Virginia Department of Environmental Quality

Commonwealth of Virginia Priority Climate Action Plan

Prepared for the U.S. EPA as a deliverable through the Climate Pollution Reduction Grants (CPRG) Program, Section 60114(a) of the Inflation Reduction Act

March 2024

Disclaimer and Acknowledgements

The Virginia Department of Environmental Quality (DEQ) developed the Commonwealth of Virginia's Priority Climate Action Plan (PCAP) to meet the requirements of the U.S. Environmental Protection Agency's (EPA) Climate Pollution Reduction Grant (CPRG) program. The CPRG program provides funding to states, local governments, tribes, and territories to develop and implement plans for reducing greenhouse gas (GHG) emissions and other harmful air pollution. The PCAP is not intended to be used outside of the context of the CPRG program.

This project has been funded wholly or in part by the United States EPA under assistance agreement number 95316001 to DEQ. The contents of this document do not necessarily reflect the views and policies of the EPA, nor does the EPA endorse trade names or recommend the use of commercial products mentioned in this document.

The purpose of the Priority Climate Action Plan is to identify all possible actions to reduce climate pollution. It is not meant to be prescriptive in any way and does not commit the Commonwealth to any specific carbon reduction strategy or path. The PCAP will be used to inform both the CPRG implementation grant and the Comprehensive Climate Action Plan (CCAP) process. However, it does not set the priorities for grant application purposes. The factors noted in the CPRG Notice of Funding Opportunity (NOFO) evaluation criteria will be the main determinants of what projects may be submitted to the competitive grant process.

The Virginia PCAP includes GHG reduction measures reflecting the Commonwealth's implementation funding opportunities through the CPRG program. The high-level PCAP measures are designed to be inclusive of projects, programs, and measures that Virginia's state government, local governments, regional planning agencies, and other stakeholders submitted to the Virginia DEQ CPRG team. Specifics of each measure (e.g., key implementers, implementation activities) are meant to be informative but are not exhaustive of all specifics of or opportunities to implement a given measure. Virginia's PCAP was developed by DEQ and its contractor with support and input from:

- **Commonwealth Agencies:** Virginia Port Authority, Virginia Energy, Virginia Department of Transportation, Virginia Department of Rail and Public Transportation, Virginia Department of Workforce Development and Advancement, Virginia Department of Housing and Community Development, Virginia Department of Agriculture and Consumer Services, Virginia Department of Conservation and Recreation, Virginia Department of Forestry, and Department of Wildlife Resources.
- **CPRG planning grantees for metropolitan statistical areas and tribes in Virginia:** Hampton Roads Planning District Commission, Metropolitan Washington Council of Governments, the Monacan Indian Nation, and PlanRVA.
- **Other stakeholders:** Metropolitan Washington Airports Authority, multiple Virginia municipalities and communities, states with common priorities for GHG reductions, citizens of Virginia, industry, non-governmental organizations, and other stakeholders.

Table of Contents

Figures

Tables

Acronyms

ADR	Audit Deferral and Repair
AFV	Alternate Fuel Vehicles
ATIIP	Active Transportation Infrastructure Investment Program
BEV	Battery-Electric Vehicles
BPAC	Bicycle and Pedestrian Advisory Committee
CCAP	Comprehensive Climate Action Plan
CCUS	Carbon Capture, Utilization, and Storage
CHP	Combined Heat and Power
CMAQ	Congestion Mitigation and Air Quality
CPRG	Climate Pollution Reduction Grant
CRP	Carbon Reduction Program
DCR	Virginia Department of Conservation and Recreation
DEQ	Virginia Department of Environmental Quality
DERA	Diesel Emissions Reduction Act
DHCD	Virginia Department of Housing and Community Development
DMV	Virginia Department of Motor Vehicles
DOE	U.S. Department of Energy
DOF	Virginia Department of Forestry
DRPT	Virginia Department of Rail and Public Transit
EECBG	Energy Efficiency and Conservation Block Grant
EJ	Environmental Justice
EPA	U.S. Environmental Protection Agency
EV	Electric Vehicles
FCEV	Fuel Cell Electric Vehicles
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FTA	Federal Transit Association
GRIP	Grid Resilience and Innovation Partnerships
GRRP	Green and Resilient Retrofit Program
GW	Gigawatt
GWP	Global Warming Potential
HDV	Heavy-Duty Vehicles
HEEHRA	High-Efficiency Electric Home Rebate
HIEE	Housing Innovations in Energy Efficiency

HTF	Housing Trust Fund
HUD	U.S. Department of Housing and Urban Development
ICEV	Internal Combustion Engine Vehicle
IIJA	Infrastructure Investment and Jobs Act
IRA	Inflation Reduction Act
LDV	Light-Duty Vehicles
LEV	Low Emission Vehicle
LIDAC	Low Income, Disadvantaged Community
LULUCF	Land Use, Land-Use Change, and Forestry
MERP	Methane Emissions Reduction Program
MHDV	Medium and Heavy-Duty Vehicle
MSA	Metropolitan Statistical Areas
MW	Megawatt
NEVI	National Electric Vehicle Infrastructure
NGO	Non-Governmental Organizations
NRI	National Risk Index
PACE	Property Assessed Clean Energy
RNG	Renewable Natural Gas
SCC	Virginia State Corporation Commission
SEP	State Energy Program
SIT	State Inventory Tool
SMR	Small Modular Nuclear Reactors
STBG	Surface Transportation Block Grant
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
VCEA	Virginia Clean Economy Act (of 2020)
VDOT	Virginia Department of Transportation
VEDP	Virginia Economic Development Partnership
VMT	Vehicle Miles Traveled
VNG	Virginia Natural Gas
VOC	Volatile Organic Compounds
VPA	Virginia Port Authority
WAP	Weatherization Assistance Program
WDR	Weatherization Deferral Repair
ZEV	Zero-Emission Vehicle

Executive Summary

This document is the Priority Climate Action Plan (PCAP) for the Commonwealth of Virginia, which is the first deliverable under the U.S. Environmental Protection Agency's (EPA) Climate Pollution Reduction Grant (CPRG) program. The PCAP is intended to be used in the context of the CPRG program.

The purpose of the PCAP is to identify all possible actions to reduce climate pollution. It is not meant to be prescriptive in any way and does not commit the Commonwealth to any specific carbon reduction strategy or path. The PCAP will be used to inform both the CPRG implementation grant and the Comprehensive Climate Action Plan (CCAP) process. However, it does not set the priorities for grant application purposes. The factors noted in the CPRG Notice of Funding Opportunity (NOFO) evaluation criteria will be the main determinants of what projects may be submitted to the competitive grant process.

The Virginia PCAP includes GHG emission reduction measures reflecting the Commonwealth's priorities as they relate to implementation funding opportunities through the CPRG program. The high-level PCAP measures are designed to be inclusive of all projects, programs, and measures that Virginia's state government, local governments, regional planning agencies, and other stakeholders submitted to the Virginia DEQ CPRG team.

The Commonwealth has a clear and vested interest in promoting cleaner air, reliable and affordable clean energy generation, and improved resilience to increased storm frequency and intensity. Many areas of Virginia and its critical infrastructure are vulnerable to changing climatic conditions. Therefore, the Commonwealth of Virginia and DEQ submitted an application, workplan, and budget to the U.S. EPA for a CPRG planning grant under the Inflation Reduction Act (IRA) to support Virginia's climate action initiatives. DEQ submitted this grant application to EPA on April 27, 2023, and received a notice of the $3 million dollar planning grant award on June 27, 2023.

The planning grant is being used to develop a statewide plan of opportunities to reduce greenhouse gas (GHG) and co-pollutant emissions in two phases:

- A PCAP to identify immediate innovative and cost-effective actions and projects targeting key source sectors to implement to reduce GHG and co-pollutant emissions in the short-term. These actions are focused on reducing high-potency GHGs, such as methane and sulfur hexafluoride (SF_6), and reducing GHGs from growing source sectors with high energy demands, such as data centers. This plan is informed by the current DEQ statewide GHG inventory, as well as public outreach and input. Particular effort has been focused on seeking input from disadvantaged communities.
- A CCAP to develop a longer-term plan and strategies to reduce GHG and co-pollutant emissions that aligns with statutory goals and requirements for reducing these emissions and increasing deployment of clean energy generation in an efficient, cost-effective, and environmentally responsible manner. This plan will cover all source sectors of the GHG

inventory and provide substantial outreach and input opportunities, particularly input from disadvantaged communities. The CCAP will be developed and submitted to the EPA no later than two years after the award of the planning grant (summer 2025).

DEQ employed the following high-level goals to guide the process through the development of this PCAP and will continue to employ the same goals for the CCAP:

- Develop short- and long-term climate action plans through the CPRG program.
- Assist localities to develop or update GHG inventories and action plans (program to be developed as part of the CCAP).
- Expedite the permitting and deployment of renewable energy and low-carbon resources in an environmentally responsible manner (ongoing).
- Develop measures to reduce GHGs from high energy demand industries.
- Accelerate the deployment of alternative and low-carbon transportation technologies and infrastructure.
- Investigate immediate measures to reduce high-potency GHG emissions.

Virginia's PCAP explores all the major economic and GHG emission generating sectors and identifies ten priority GHG reduction measures through the CPRG program as described below:

- **Measure 1:** Reduce GHG emissions from the on-road transportation sector through vehicle electrification and other zero- and low-carbon fuels.
- **Measure 2:** Support alternative modes of transportation, micro-mobility, and active transportation to reduce vehicle miles traveled (VMT).
- **Measure 3:** Reduce GHG emissions from the off-road transportation sector, including ports and airports.
- **Measure 4:** Increase residential and commercial building energy efficiency and identify and implement GHG emission reduction solutions at homes, businesses, and institutions.
- **Measure 5:** Increase industrial energy efficiency and identify and implement opportunities for GHG emission reduction solutions at industrial facilities.
- **Measure 6:** Reduce GHG emissions from the electric power sector and improve grid reliability and security.
- **Measure 7:** Deploy renewable energy, energy efficiency, energy storage, and low-carbon and resilient solutions for state and local government buildings and public fleets and transit, including infrastructure.
- **Measure 8:** Identify and implement strategies to reduce high-potency GHG emissions from industrial processes, energy production, agriculture, waste, and wastewater treatment.
- **Measure 9:** Reduce GHG emissions from manufacturing and industrial processes, materials, and products.
- **Measure 10:** Protect and restore high-carbon coastal habitats, wetlands, agricultural, forest and tribal lands.

A preliminary analysis of the estimated cumulative short- and long-term GHG emission reductions (or carbon sequestration) from these ten measures using standard EPA and other accepted modeling tools are presented in Table 1 below.

Table 1: Cumulative Estimated GHG Emissions Reductions by Measure

PCAP Measure	Cumulative Short-Term Reductions (2025-2030)	Cumulative Long-Term Reductions (2025-2050)
Measure 1	17.14 $MMTCO_2e$	278.68 $MMTCO_2e$
Measure 2	4.74 $MMTCO_2e$	60.88 $MMTCO_2e$
Measure 3	1.33 $MMTCO_2e$	23.71 $MMTCO_2e$
Measure 4	Efficiency – 14.95 $MMTCO_2e$ Other Solutions – 4.79 $MMTCO_2e$	Efficiency – 111.72 $MMTCO_2e$ Other Solutions – 46.83 $MMTCO_2e$
Measure 5	1.93 $MMTCO_2e$	45.41 $MMTCO_2e$
Measure 6	35.89 $MMTCO_2e$	321.07 $MMTCO_2e$
Measure 7	1.95 $MMTCO_2e$	9.74 $MMTCO_2e$
Measure 8	19.08 $MMTCO_2e$	87.70 $MMTCO_2e$
Measure 9	22.18 $MMTCO_2e$	125.41 $MMTCO_2e$
Measure 10	1.12 $MMTCO_{2E}$	11.36 $MMTCO_{2E}$

The estimates provided above reflect the implementation of each measure with all the identified actions included, to the extent data were available to support the analysis for this PCAP. Since a number of these measures cover the same activity sector, their impacts are not additive as they sometimes overlap with each other. Further, due to limited time for PCAP analysis, interactions between certain measures were not captured. These interactions will be captured in the GHG reduction analysis completed for the CCAP. However, it can clearly be seen that the measures and underlying actions identified have the potential to significantly reduce carbon pollution in Virginia.

It should be noted that the individual actions identified in each measure may not be feasible for all sources or activities covered by that measure. The measures identified are intended to cover a broad range of possible projects for the EPA CPRG Phase 2 competitive implementation grant process. Program and project ideas under each measure, and other ideas, may be further evaluated and possibly selected to be included in one or more applications to be submitted to the EPA CPRG Phase 2 competitive implementation grant process.

1. Introduction

The IRA, signed into law on August 16, 2022, directs federal funding to reduce carbon emissions, lower healthcare costs, fund the Internal Revenue Service (IRS), and improve taxpayer compliance. The IRA contains provisions that directly or indirectly address issues related to climate change, including reduction of GHG emissions and promotion of adaptation and resilience to impacts. The U.S. Environmental Protection Agency (EPA) Climate Pollution Reduction Grant (CPRG) program, authorized under Section 60114 of the IRA, provides $5 billion in grants to states, local governments, tribes, and territories to develop and implement plans for reducing GHG emissions and other harmful air pollution. The CPRG program consists of a planning phase and an implementation phase:

- The planning phase provides $250 million in non-competitive planning grants for state and local agencies to develop PCAPs and CCAPs aimed at reducing GHG emissions.
- The implementation phase provides $4.6 billion for competitive implementation grants to eligible applicants to implement GHG reduction measures identified in a PCAP developed under a CPRG planning grant.[1]

Definitions

- **GHG:** The air pollutants carbon dioxide, hydrofluorocarbons, methane, nitrous oxide, perfluorocarbons, and sulfur hexafluoride.
- **GHG Inventory:** A list of emission sources and sinks and the associated emissions quantified using standard methods.
- **GHG Reduction Measure:** Policies, programs, actions, or projects that reduce GHG emissions or enhance carbon removal. Measures that enhance "carbon removal" are those that increase the removal of carbon dioxide from the atmosphere through, for example, the uptake of carbon and storage in soils, vegetation, and forests.
- **Benefits:** Improvements in air quality/reduction in harmful air pollutants.
- **Co-Benefits:** Positive effects beyond the stated goal of a GHG reduction measure (e.g., improved public health outcomes, economic benefits, increased climate resilience).
- **Low Income Disadvantaged Community (LIDACs):** Communities with residents that have low incomes, limited access to resources, and disproportionate exposure to environmental or climate burdens.

The Virginia DEQ is the designated lead organization for the Commonwealth's participation in the CPRG planning phase and led the development of this PCAP. Along with DEQ, three metropolitan statistical areas (MSAs) in Virginia also received CPRG planning grants: the Washington-Arlington-Alexandria (DC-VA-MD-WV) MSA, the Richmond Metro Area, and the Virginia Beach-Norfolk-Newport News (VA-NC) MSA (see Appendix G). DEQ coordinated closely with the lead organizations for the MSA planning grants (Metropolitan Washington Council of Governments, PlanRVA, and Hampton Roads Planning District Commission, respectively) to align priorities and engage with stakeholders. Of the seven federally recognized tribes in Virginia, Monacan Indian Nation is the one

[1] US EPA. "Climate Pollution Reduction Grants." https://www.epa.gov/inflation-reduction-act/climate-pollution-reduction-grants.

tribe that received a CPRG planning grant. DEQ also coordinated with the Monacan Indian Nation for this PCAP.

DEQ conducted significant stakeholder outreach as part of this PCAP development, including soliciting project ideas from localities and feedback from the public on which source categories, actions, and benefits are most important to help identify priority climate actions for Virginia. These stakeholder outreach and engagement efforts are detailed in Section 1.2.

1.1 PCAP Purpose, Scope, and Overview

The purpose of the PCAP is to identify all possible actions to reduce climate pollution. It is not meant to be prescriptive in any way and does not commit the Commonwealth to any specific carbon reduction strategy or path. The PCAP will be used to inform both the CPRG implementation grant and the CCAP process. However, it does not set the priorities for grant application purposes. The factors noted in the CPRG NOFO evaluation criteria will be the main determinants of what projects may be submitted to the competitive grant process. This PCAP will enable Virginia and those eligible entities within the Commonwealth to apply for CPRG implementation grant funding. Table 2 summarizes the information included in this PCAP per the EPA CPRG planning guidance.[2]

Virginia's PCAP covers the entirety of the Commonwealth of Virginia.

Table 2: Overview of Virginia's PCAP

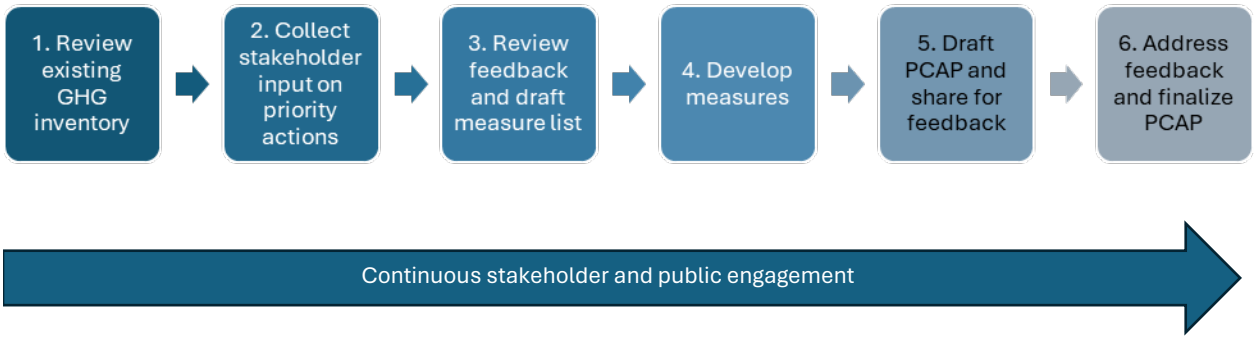
PCAP Element	PCAP Location
GHG Inventory	Section 2.1
GHG Emissions Projections	Encouraged element for the PCAP, will be addressed in the CCAP
GHG Reduction Targets	Section 2.2
Priority Quantified GHG Reduction Measures	Section 5
Benefits Analysis	Measure-specific information in Section 5
Review of Authority to Implement	Measure-specific information in Section 5
Intersection with Other Funding	Section 2.4 and measure-specific information in Section 5
Workforce Planning Analysis	Encouraged element for the PCAP, will be addressed in the CCAP
Low-Income and Disadvantaged Communities Benefits Analysis	Sections 1.2 (engagement with LIDACs), 3.1 (identification of Virginia LIDACs), 3.2 (risks to LIDACs), and 55 (LIDAC benefits for each measure)
Tribal Benefits Analysis	Sections 1.2 (engagement), 4.1 (identification of tribes), 4.2 (risks to tribes), and 5 (tribal measures actions for targeted measures)

[2] US EPA. "Climate Pollution Reduction Grants Program: Formula Grants for Planning," March 1, 2023. https://www.epa.gov/system/files/documents/2023-02/EPA%20CPRG%20Planning%20Grants%20Program%20Guidance%20for%20States-Municipalities-Air%20Agencies%2003-01-2023.pdf.

1.2 Approach to PCAP Development

DEQ used a multi-step process to develop priority GHG reductions measures identified in this PCAP and to write the PCAP, as outlined in Figure 1. DEQ conducted continuous public and stakeholder engagement throughout this process.

Figure 1: Process for Developing Virginia's PCAP



Step 1. DEQ conducted an analysis of the existing statewide GHG inventory (see Section 2.1) to determine key sectors and sources for opportunities for immediate GHG emission reduction measures.

Step 2. DEQ sought input internally, from other state agencies, local governments within and outside MSA planning regions, MSA steering and technical committee participants, communities, and other stakeholders through a survey, group meetings and discussions, one-on-one meetings, webinars, and public information via DEQ's CPRG website.[3] Within this step, DEQ sought priority project and action ideas to reduce GHG emissions in the Commonwealth. DEQ also reviewed information in existing state plans and policies.

Step 3. DEQ compiled and reviewed the ideas gathered from stakeholders and communities and existing Virginia priorities in Step 2 to group by relevant GHG inventory sector, identify themes, and ensure relevance to the CPRG program goals. DEQ then assembled similar ideas to form the broader GHG reduction measures that are presented in this PCAP. The draft measures list was shared with the Virginia MSA CPRG leads, the Monacan Indian Nation, and other engaged local governments for feedback and to ensure any alignment needed between the state's and MSA PCAPs (see Appendix G) and the Monacan Indian Nation's PCAP was done. The list of measures (which comprises existing policies and programs, voluntary actions, and work at the regional and local level) was then finalized, including the following:

- **Measure 1:** Reduce GHG emissions from the on-road transportation sector through vehicle electrification and other zero- and low-carbon fuels.
- **Measure 2:** Support alternative modes of transportation, micro-mobility, and active transportation to reduce vehicle miles traveled (VMT).

[3] DEQ. "Climate Pollution Reduction Grant." https://www.deq.virginia.gov/our-programs/air/greenhouse-gases/climate-pollution-reduction-grant

- **Measure 3:** Reduce GHG emissions from the off-road transportation sector, including ports and airports.
- **Measure 4:** Increase residential and commercial building energy efficiency and identify and implement GHG emission reduction solutions at homes, businesses, and institutions.
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- **Measure 9:** Reduce GHG emissions from manufacturing and industrial processes, materials, and products.
- **Measure 10:** Protect and restore high-carbon coastal habitats, wetlands, agricultural, forest and tribal lands.

Step 4. DEQ collaborated internally with its contractors and with other state agencies, local governments, and other stakeholders to develop the required information for each measure. In parallel, DEQ analyzed data and collected other non-measure specific information to support this PCAP, such as using EPA's EJScreen to identify LIDACs in Virginia and to understand their demographics and risks.

Step 5. DEQ prepared this PCAP using the gathered and developed information and shared the draft PCAP for feedback with other state agencies in addition to publishing the PCAP online for public comments for a two-week period February 2024.

Step 6. DEQ reviewed the feedback and comments on the draft to finalize the PCAP.

Continuous Stakeholder and Public Engagement

Throughout the development of the Virginia PCAP, DEQ continuously sought input from and shared information with different stakeholders using multiple methods. Since September 2023, DEQ has been regularly reporting on its PCAP-related engagements through monthly progress reports on their website. These progress reports are presented in Appendix A. The PCAP engagements were used to educate stakeholders and for DEQ to better understand regional and local priorities and challenges to reduce GHG emissions. DEQ prioritized this robust stakeholder and public outreach and input process to capture ideas and comments to inform the development of the PCAP. DEQ also participated in Conveners Network, EPA, and other interstate collaborative meetings to learn about and identify potential opportunities for regional collaboration and other best practices.

Website, email, and survey. DEQ established a new webpage within its website dedicated to CPRG. This houses information on the CPRG program, an educational video, DEQ's CPRG work plan, information on upcoming and past meetings, monthly DEQ CPRG progress reports, webinar recordings, and more.[4, 5] This webpage is maintained regularly with progress updates and new opportunities for engagement. It also includes a form for users to sign up to receive PCAP updates from DEQ. DEQ also established an informational email address (CPRG@DEQ.Virginia.gov) to send updates and receive correspondence about the program.

DEQ posted a general CPRG community survey on its website to gather input from stakeholders on GHG reduction priorities. The survey was a method to capture project ideas across the state to help inform PCAP measure development. The survey received 322 responses from 171 different zip codes within the Commonwealth, encompassing a diverse range of individuals, organizations, coalitions, and agencies. The results of this survey are summarized in Appendix B. Additionally, through its website, DEQ also held an informal public comment period on the draft PCAP in February 2024. The public comments received and DEQ's responses are included in Appendix C. Following on the development of the CCAP, the 2027 Status Report will include the following: the implementation status of the quantified GHG reduction measures from the CCAP; relevant updated analyses or projections supporting CCAP implementation; and next steps and future budget or staffing needs to continue CCAP implementation.

State, regional, and local government agencies (inter- and intra-agency coordination). DEQ participated in many internal, local-state, intra-agency, interagency, and regional workgroups, and meetings over the course of the PCAP development. These meetings helped to increase awareness and understanding of Virginia's statewide and regional considerations. DEQ also sat on Steering and Technical Committees for each CPRG MSA in Virginia. Several of these meetings were focused on specific considerations, such as LIDACs and community engagement. DEQ also issued a survey to local government agencies to solicit project ideas and learn about ongoing work in Virginia's communities, in alignment with the GHG sectors, to inform potential related PCAP measures. These responses, presented in Appendix D, were used to help shape the priority GHG reduction measures in the Virginia PCAP.

LIDACs and Communities. Community engagement, particularly with LIDACs was a critical component in the development of the Commonwealth's PCAP. DEQ held a series of community meetings throughout the development of the PCAP to share information about planning and gather feedback on stakeholder priorities (see Table 3). DEQ used these public meetings to solicit ideas for measures that could rapidly reduce GHG emissions in Virginia. In-person meetings were targeted in geographic areas that were identified as low-income and disadvantaged.

[4] Virginia DEQ. "Climate Pollution Reduction Grant." Virginia Department of Environmental Quality, 2023. https://www.deq.virginia.gov/our-programs/air/greenhouse-gases/climate-pollution-reduction-grant.
[5] Virginia DEQ. *Climate Pollution Reduction Grant*, 2023. https://www.youtube.com/watch?v=WVJ4M-RY9d0.

Table 3: PCAP Stakeholder Meetings for the General Public

Date	Meeting Description
September 26, 2023	Informational Webinars
October 31, 2023	Implementation Grant Webinar
December 4, 2023	Community Meeting (Abingdon)
December 5, 2023	Community Meeting (Danville)
December 7, 2023	Community Meeting (Harrisonburg)
December 12, 2023	Community Meeting (Melfa)
December 14, 2023	Community Meeting (Lawrenceville)
January 9, 2024	Statewide Virtual Community Meeting
January 22, 2024	Community Meeting (Glen Allen)
January 23, 2024	Community Meeting (Woodbridge)
January 25, 2024	Community Meeting (Virginia Beach)
February 22, 2024	Draft PCAP Webinars (2)

DEQ used multiple outreach channels including social media, the PCAP webpage, and email distribution lists both for general outreach and for environmental justice (EJ) outreach to share information about the public meetings and other PCAP progress updates. These virtual communications included email notifications about upcoming meetings and opportunities to provide feedback (e.g., through the CPRG survey), cross-posting social media updates to maximize channel shares, and through DEQ's News Release webpage. DEQ prioritized information sharing and transparency throughout the PCAP development process and will continue to develop and maintain stakeholder engagement strategies.

Tribes. DEQ met with Monacan Indian Nation and other tribes in Virginia to describe Virginia's approach and process for developing the PCAP. DEQ continued to communicate with Monacan representatives as they developed measures for the Monacan PCAP, which were shared with DEQ, to understand the tribal perspectives and priorities for climate action within the Commonwealth. These include:

- Supporting indigenous sovereignty through programs that boost energy efficiency and reduce fossil fuel reliance, promote cultural and historical land use practices, and minimize soil erosion, deforestation, and pollution (aligns with most measures, in particular Measures 4 and 10).

- Collaborating with the Monacan Indian Nation and other Tribes of Virginia in conducting a tribal-focused renewable feasibility study (aligns with Measure 6).
- Ensuring that all transportation and energy projects are available to and easily accessed by tribal citizens (aligns with Measures 1, 2, 4, and 6).
- Boosting Monacan and other interested Tribal parties' trail capacity and linkage to state trails and wildlands. Similarly, prioritize wildlife corridors and patch connectivity to boost biodiversity, improve habitat quality, and increase carbon sequestration (aligns with Measures 2 and 10).
- Fostering connections between tribal governments and state and local agencies and other stakeholders that will assist them in developing their own climate and energy plans (aligns with Measure 7).
- Assessing and monitoring major air and water quality hazards affecting tribal lands, either directly or indirectly, and support tribal needs and concerns within all land management changes and negotiations (aligns with measures that affect tribal lands).
- Assessing and monitoring all potential hazards, including mitigation and potential infrastructure needs for tribal citizens. Assist in planning and execution of any hazard mitigation plans as relevant (see Section 4.2).

Integration of Stakeholder and Public Priorities in the PCAP. Stakeholder and community input were critical in the development of the priority measures included in Virginia's PCAP. DEQ conducted the robust stakeholder and public engagement process described above to identify community needs and priorities to help inform the PCAP measures and ensure that these measures deliver benefits and outcomes that are important to Virginia's communities.

This engagement and outreach process helped DEQ better understand community climate action already underway or planned and potential barriers to action that DEQ or other implementers could help address to progress climate action.

In addition to the direct input DEQ received through the community survey, the project ideas submitted to DEQ by NGOs and local agencies further illustrated the ongoing progress and potential gaps in action. This input was critical in developing actions and other supporting information for each of the PCAP measures to accurately reflect how they could be implemented or are being implemented in Virginia.

Overall, input DEQ received in its public survey covered a few main themes:

- Industry, power, transportation, and buildings are acknowledged as the largest sources of GHG and air quality emissions. However, there is a desire for additional education around certain topics.
- Improved air quality appears to be the highest priority benefit for Virginia. Transportation improvements and community resilience also ranked high.
- Many residents are taking action to reduce emissions where possible, such as recycling and waste reduction, and energy efficient appliances. However, barriers exist – notably

limited access to public or alternate transit and high cost of energy-efficient alternatives were the main barriers to taking more action to reduce emissions. Incentives and policies were noted as attractive opportunities to address these barriers.

- Actions residents appeared to prefer to address for climate action included more renewable energy sources; more parks, trees, and greenspaces; better walkways; and more public transportation.

These observations aligned closely with the local government and state agency project ideas shared with DEQ, which addressed a range of solutions from educational clearinghouses to clean energy incentives, additional trail connections, and more.

Engaging with LIDACs, Tribes, and Stakeholders Moving Forward

With the completion of this PCAP, DEQ is moving into more comprehensive climate action planning for the CCAP. DEQ will engage with stakeholders across Virginia, including other state agencies, industry, municipalities, community organizations, other non-profits, and community members, particularly those in low-income and disadvantaged communities, through a series of facilitated workgroup sessions to develop the draft and final CCAP. Methods for seeking public input, communicating key decisions and overall progress, and information sharing may include public listening and informational sessions, request for comments on the draft CCAP, direct outreach to in-person meetings, and digital platforms (webpage, surveys, and online portal). DEQ's Office of Environmental Justice (OEJ) maintains a statewide list of environmental justice community contacts that will be used to invite and engage EJ communities.

For Tribes, DEQ will continue to work with the Monacan Indian Nation and other Tribes to:

- Assist in assessing tribal consultations and offer technical support as needed, throughout the CPRG planning process and in implementation.
- Support in tribal consultation feedback where necessary, appropriate, and requested from Tribes.
- Include Tribal concerns and feedback into all CCAP measures and continuing to collaborate with Tribes of Virginia in future iterations of the CPRG PCAP and CCAP.

2. Virginia's Climate Context

2.1 GHG Emissions Inventory

DEQ regularly produces a statewide GHG inventory using the U.S. EPA State Inventory Tool (SIT), supplemented by state-specific data and methods. For the 2020 GHG inventory (see Section 2.1), DEQ used the 11-sector-specific SIT modules and the default data for individual states within the modules for most sectors but supplemented the mobile combustion, natural gas and oil and solid waste modules. Data for these modules came from a variety of sources, including Virginia Department of Transportation (VDOT), U.S. Energy Information Administration (EIA), U.S. Office of Pipeline Safety, and DEQ.

DEQ developed economy-wide GHG emissions inventories for 2005, 2010, 2018, and 2016 through 2020. The most recent inventories (2016 through 2020) reflect updated methodologies that incorporate more state-specific GHG data to supplement the mobile combustion, natural gas and oil, industrial processes, and forest management sectors. Appendix F provides additional information on the GHG inventory data sources. Figure 2 and Table 4 summarize Virginia's GHG emissions for the years 2016 through 2020.

Figure 2: Virginia GHG Emissions by Sector 2016-2020 ($MMTCO_2e$)

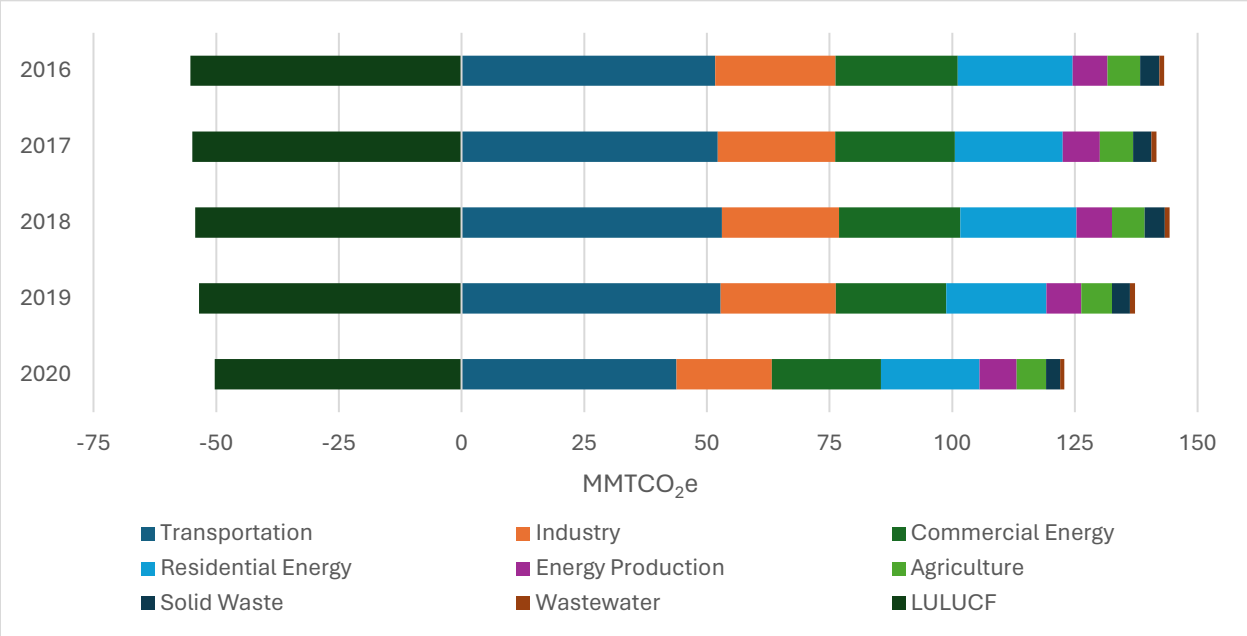


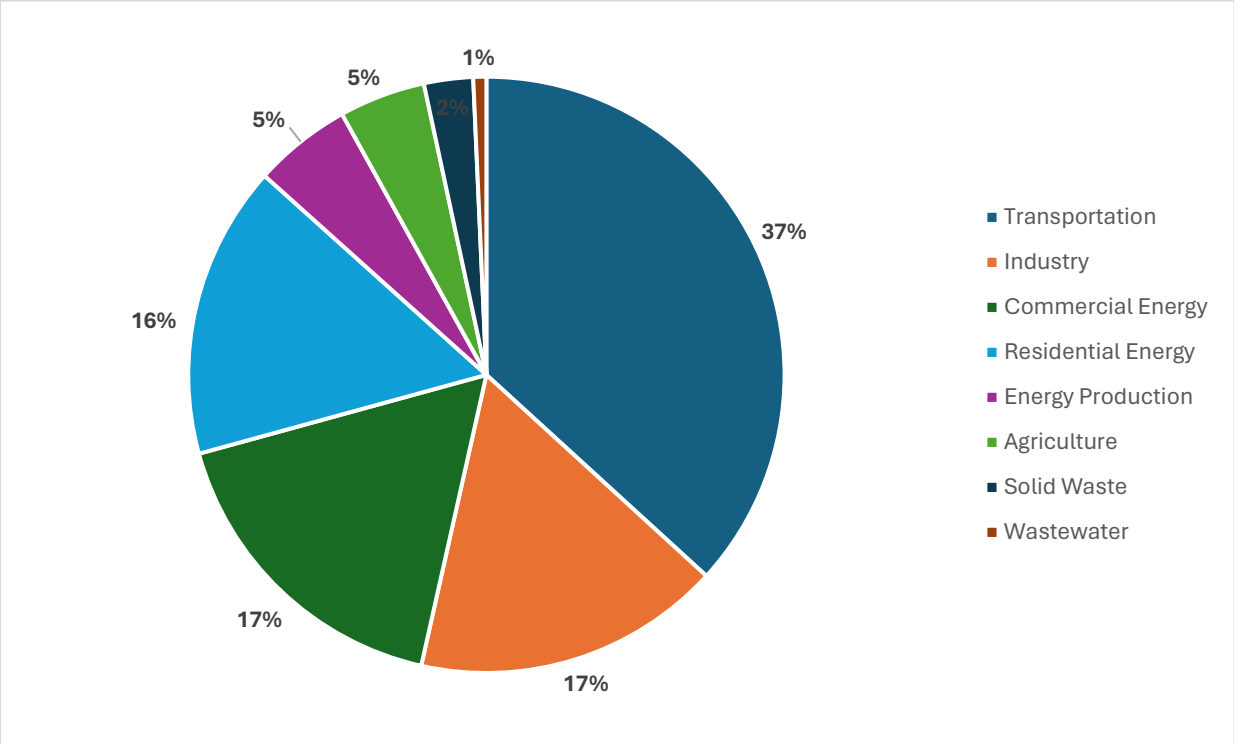
Table 4: Virginia GHG Emissions by Sector 2016-2020 ($MMTCO_2e$)

Sector	2016	2017	2018	2019	2020	% Reduction 2016-2020*
Transportation	51.7	52.2	53.1	52.8	43.8	-15%
Industry	24.5	23.9	23.9	23.4	19.5	-20%
Commercial Energy	24.9	24.4	24.7	22.5	22.2	-11%
Residential Energy	23.4	22.0	23.7	20.4	20.1	-14%
Energy Production	7.1	7.6	7.2	7.1	7.5	6%
Agriculture	6.6	6.7	6.7	6.2	6.0	-9%
Solid Waste	3.9	3.8	4.1	3.7	2.9	-26%
Wastewater	1.0	1.0	1.0	1.0	0.9	-10%
Total Gross GHG Emissions	**143.1**	**141.6**	**144.4**	**137.1**	**122.9**	-14%
LULUCF	-55.3	-54.8	-54.3	-53.5	-50.3	-9%
Total Net GHG Emissions	**87.9**	**86.8**	**90.0**	**83.8**	**72.6**	-17%

*Totals may be off due to rounding

Since 2016, gross GHG emissions have decreased by 14% and net GHG emissions have decreased by 17%. While Virginia's total emissions have decreased from 2016 to 2020, the highest emitting sectors have generally remained constant. The transportation sector has consistently been the highest emitting sector in Virginia, contributing 36–38% of Virginia emissions each year, followed by industry, commercial energy, and residential as the most significant contributors of emissions across Virginia's economy (see Figure 3).

Figure 3: Virginia GHG Emissions by Sector (2016-2020 Inventory Average)



The following section overviews data on emissions trends from each of these sectors from 2016 through 2020 in million metric tons of carbon equivalent ($MMTCO_2e$). In 2020, the COVID-19 pandemic had a significant impact on everyday activities, such as commuting; this, and other sector-specific trends that are driving these changes over time are discussed below.

Sector Trends

Transportation

The transportation sector consists of both on-road and off-road mobile source emissions and electricity consumption from transportation sources. Virginia is home to the nation's third-largest state-maintained highway system, in addition to six major interstate highways, more than a dozen railroads, several commercial airports, and a large seaport (Port of Virginia).[6] Transportation emissions have fallen in Virginia with 51.7 $MMTCO_2e$ in 2016, falling to 43.8 in 2020, a 15% decrease. This is mainly a result of the COVID-19 pandemic as the largest drop was seen between 2019 and 2020 (a 17% reduction).

Industry

The industrial sector consists of emissions from industrial processes, industrial fossil fuel combustion, and industrial electricity consumption. Virginia's industrial sector is comprised of several significant manufacturing sectors, including food and beverage, transportation equipment, chemicals, computer and electronic products, and pulp and paper manufacturing, among other industries. The industrial sector accounts for roughly 17% of Virginia emissions each year between 2016 and 2020. Emissions from the industrial sector have been reduced from 24.5 $MMTCO_2e$ in 2016 to 19.5 $MMTCO_2e$ in 2020, a 20% decrease. This is due to a decrease in total energy consumption, and specifically energy consumption from coal and petroleum products, for Virginia's industrial sector from 2016 to 2020.[7] Additionally, during this same period, Virginia's manufacturing sector increased its total output from $42 billion to $49 billion. Energy efficiency improvements, combined heat and power generation, and process improvements likely contributed to this decrease in total energy consumption.

Commercial Energy

The commercial energy sector consists of emissions from commercial electricity consumption and fossil fuel and stationary combustion. Commercial energy emissions are near the same level as the industrial sector, with emissions comprising between 16 and 18% of Virginia emissions each year between 2016 and 2020. Commercial energy emissions fell from 24.9 $MMTCO_2e$ in 2016 to 22.2 $MMTCO_2e$ in 2020, an 11% decrease, resulting from continued carbon intensity reductions through increased energy efficiency and additional sources of clean power.

[6] U.S. Energy Information Administration. Virginia State Energy Profile. https://www.eia.gov/state/print.php?sid=VA#15.
[7] EIA. "Industrial Sector Energy Consumption Estimates, 1960-2021, Virginia," 2021. https://www.eia.gov/state/seds/data.php?incfile=/state/seds/sep_use/ind/use_ind_VA.html&sid=VA.

Residential Energy

The residential energy sector consists of emissions from residential electricity consumption and residential fossil fuel and stationary combustion. Residential energy emissions comprised 15–16% of Virginia emissions each year in 2016–2019. Residential energy emissions have fallen from 23.4 $MMTCO_2e$ in 2016 to 20.1 $MMTCO_2e$ in 2020, a 14% decrease. This decrease is also a result of increased energy efficiency, and continued carbon intensity reductions.

Energy Production

The energy production sector consists of emissions from coal mining and the production, transmission, and distribution of natural gas and oil. Energy production accounted for 6% of Virginia emissions each year between 2016 and 2020. Emissions from energy production increased from 7.1 $MMTCO_2e$ in 2016 to 7.5 $MMTCO_2e$ in 2020. This increase of 6% emissions in energy production emissions is primarily due to the coal and natural gas industries. Though coal, oil, and natural gas production has decreased in Virginia from 2016 to 2020, the increase in energy production emissions from 2016 to 2020 is likely due to increased methane emissions from abandoned coal mines and fugitive emissions from abandoned gas wells, in addition to emissions from active coal mines and natural gas production, transmission, and distribution.[8]

Agriculture

The agriculture sector consists of emissions stemming from several agricultural practices, including enteric fermentation, soil management, and fertilization, accounted for 5% of Virginia emissions each year between 2016 and 2020. Agriculture emissions decreased 9% from 6.6 $MMTCO_2e$ in 2016 to 6.0 $MMTCO_2e$ in 2020. Agriculture emissions fell primarily due to decreases in emissions from enteric fermentation, manure management, soil management, and liming.

Solid Waste

The solid waste sector emissions from landfills and waste combustion accounted for roughly 3% of Virginia emissions each year from 2016 to 2020. Solid waste emissions fell 26% from 3.9 $MMTCO_2e$ in 2016 to 2.9 MMT CO_2e in 2020. This decrease is primarily due to increased flaring and landfill gas energy projects that have contributed to a 23% decrease in total methane emissions in the solid waste sector from 2016 to 2020.

Wastewater

The wastewater sector emissions from municipal and industrial facilities accounted for 1% of emissions in Virginia each year from 2016 to 2019. The majority of wastewater emissions come from municipal facilities. Wastewater emissions fell 15% from 1.0 in 2016 to 0.9 $MMTCO_2e$ in 2020. This decrease is likely due to methane reduction upgrades to wastewater treatment plants, such as anerobic digesters, which are some of the most effective ways to reduce wastewater sector emissions.

[8] EIA. "Primary Energy Production Estimates in Trillion Btu, Virginia, 1960-2021." EIA, 2021. https://www.eia.gov/state/seds/sep_prod/pdf/PT2_VA.pdf.

Land Use, Land-Use Change, and Forestry

Land Use, Land-Use Change, and Forestry (LULUCF) represents the net carbon flux from vegetation and other land use. Sequestration of carbon from these sources offsets emissions from other sectors, reducing net emissions in Virginia each year. Land-use changes have reduced the capacity for sequestration from 55.3 $MMTCO_2e$ in 2016 to 50.3 $MMTCO_2e$ in 2020. In 2016, sequestration from land use reduced gross emissions by 39%, and in 2020, 41% of gross emissions were sequestered due to emissions falling faster than the reduction in sequestration capacity.

2.2 GHG Reduction Targets

Virginia enacted Senate Bill 94 (SB 94) in 2020.[9] This bill establishes GHG emissions reduction goals across Virginia's economy sufficient to reach net-zero emissions by 2045. It also includes other aspects addressing climate change and the health, welfare, and safety of Virginians, including energy efficiency, distributed energy, mitigating the negative impacts of climate change and the energy transition on disadvantaged communities and prioritizing investment in these communities, ensuring reliability, among other topics.

2.3 Current Goals, Programs, Plans, and Policies

Virginia has a clear and vested interest in promoting cleaner air, reliable and affordable clean energy generation, and improved resilience to increasing storm frequency and intensity. Many regions and communities of Virginia and key infrastructure assets are vulnerable to changing climatic conditions. The 2022 Virginia Energy Plan assesses the current state of the Commonwealth's energy economy and provides a series of recommendations for policymakers and industry participants to reduce GHG emissions from the power sector.[10] In addition to SB 94, many climate-related goals and policies have been codified through legislation, such as the Virginia Clean Economy Act of 2020 (VCEA) (House Bill 1526 of 2020), which among other provisions created the state's first mandatory clean energy standard and sets renewable energy and energy resource targets for utilities (requiring a transition to a 100% clean electric grid by 2050), and defines specific levels of solar, offshore wind, and long-duration battery storage as in the public interest.[11] The 2022 Plan found that Virginia has had a dramatic shift in electricity generation over the last ten years and is continuing to strive to reduce GHG emissions from the electric power sector as demonstrated by the state's 2019 energy production targets and strategies to meet the targets outlined in VCEA.[12] Virginia has also passed a number of recent bills to support climate actions, including the Clean Cars Act (House Bill 1965 of 2021).[13, 14]

[9] Virginia's Legislative Information System. "SB 94 Virginia Energy Plan; Climate Change Pressing Challenge," 2020. https://lis.virginia.gov/cgi-bin/legp604.exe?201+sum+SB94.
[10] Virginia DOE. 2022. 2022 Energy Plan. https://energy.virginia.gov/energy-efficiency/documents/2022_Virginia_Energy_Plan.pdf
[11] Virginia's Legislative Information System. "HB 1526 Electric Utility Regulation; Environmental Goals," 2020. https://lis.virginia.gov/cgi-bin/legp604.exe?201+sum+HB1526.
[12] Virginia's Legislative Information System. 2020. HB 1526 electric utility regulation; environmental goals. https://lis.virginia.gov/cgi-bin/legp604.exe?201+sum+HB1526.
[13] Virginia DEQ. "Clean Vehicles." Virginia Department of Environmental Quality," 2024. https://www.deq.virginia.gov/our-programs/air/clean-vehicles.
[14] Virginia's Legislative Information System. "Code of Virginia Code - Article 12. Virginia Environmental Justice Act," 2020. https://law.lis.virginia.gov/vacodefull/title2.2/chapter2/article12/.

In addition, various actions have been taken to plan for and fund increased climate resilience investments, including the following:

- Virginia Coastal Resilience Master Plan[15]
- Virginia Department of Conservation and Recreation: Guidance for Local Floodplain Ordinances[16]
- Virginia Strategy for Safeguarding Species of Greatest Conservation Need from the Effects of Climate Change[17]
- Funding mechanisms such as the Community Flood Preparedness Fund and the Resilient Virginia Revolving Fund[18]

Local and regional bodies have also developed climate action and related planning and funding initiatives, especially in the Northern Virginia and Tidewater regions.

2.4 Funding Sources for Climate Action in Virginia

Virginia currently provides policy and funding support for several climate actions through existing policies and programs, including those authorized under VCEA. VCEA is a significant policy directive to reduce emissions in the state as it enables renewable power investments and requires utilities to achieve energy efficiency goals by offering customer incentive programs. In addition to state-level funding sources for climate action, Virginia is currently tapping into and planning to seek funds across a range of federal funding sources to implement GHG reduction measures. Some of these funds could be used to support priority GHG reduction measures identified in the PCAP. Table 5 maps identified potential federal funding sources to the related GHG inventory sectors. This list of funding opportunities is not exhaustive but is instead meant to be informative.

Table 5: Summary of Federal Funding Sources for Climate Action

Program/Grant Name	Funding Source	Related Inventory Sector(s)
FHWA Active Transportation Infrastructure Investment Program	Federal – Competitive	On-road Transportation
DOE Assistance for Latest and Zero Building Energy Code Adoption	Federal – Formula	Residential, Commercial, and Industrial Energy

[15] Commonwealth of Virginia. "Virginia Coastal Resilience Master Plan Phase 1," December 2021. https://www.dcr.virginia.gov/crmp/plan.
[16] Virginia DCR. "Floodplain Management Regulations and Ordinances." Virginia Department of Conservation and Recreation, 2023. https://www.dcr.virginia.gov/dam-safety-and-floodplains/fpordnce.
[17] Virginia DWR. "Virginia's Strategy for Safeguarding Species of Greatest Conservation Need from the Effects of Climate Change." Virginia Department of Wildlife Resources, 2024. https://dwr.virginia.gov/wildlife/wildlife-action-plan/safeguarding-species-from-climate-change/.
[18] Virginia DCR. "Community Flood Preparedness Fund Grants and Loans." Virginia Department of Conservation and Recreation, 2024. https://www.dcr.virginia.gov/dam-safety-and-floodplains/dsfpm-cfpf.

Program/Grant Name	Funding Source	Related Inventory Sector(s)
DOE Industrial Efficiency and Decarbonization Funding Opportunity Announcement	Federal – Competitive	Industrial Energy
FHWA Carbon Reduction Program	Federal – Formula	On-road Transportation
USDOT Charging and Fueling Infrastructure	Federal – Competitive	On-road Transportation
EPA Clean Diesel Grant Program/Diesel Emissions Reduction Act	Federal – Competitive	On-road Transportation and Off-road Transportation
EPA Clean Heavy-Duty Vehicles Program	Federal – Competitive	On-road Transportation
EPA Clean Ports Program	Federal – Competitive	Off-road Transportation
EPA Clean School Bus Program	Federal – Competitive	On-road Transportation
USDA Empowering Rural America Program	Federal – Competitive	Residential, Commercial, and Industrial Energy
DOE Energy Efficiency and Conservation Block Grant	Federal – Formula	Residential, Commercial, and Industrial Energy
DOE Energy Efficiency Revolving Loan Fund Capitalization Grant Program	Federal – Formula	Residential, Commercial, and Industrial Energy
HUD Green and Resilient Retrofit Program	Federal – Competitive	Residential and Commercial Energy
EPA Greenhouse Gas Reduction Fund	Federal – Competitive	Residential, Commercial, and Industrial Energy
DOE High Efficiency Electric Home Rebate Program	Federal – Formula Rebates Administered by States	Residential and Commercial Energy
DOE Home Energy Performance-Based, Whole-House Rebate Program	Federal – Formula Rebates Administered by States	Residential Energy
EPA Methane Emissions Reduction Program	Federal – Competitive	Energy Production
USDOT National Electric Vehicle Infrastructure Program	Federal – Formula	On-road Transportation
USDA Powering Affordable Clean Energy	Federal – Competitive	Residential, Commercial, and Industrial Energy
DOE Renew America's Schools Program	Federal – Competitive	Commercial Energy

Program/Grant Name	Funding Source	Related Inventory Sector(s)
USDA Rural Energy for America Program	Federal – Competitive	Residential and Commercial Energy
DOE State Energy Program	Federal – Formula	Residential, Commercial, and Industrial Energy, On-road Transportation
USDOT Surface Transportation Block Grant Program	Federal – Formula Grants Administered by States	On-road Transportation
EPA National Clean Investment fund and the Clean Communities Investment Accelerator Fund	Federal – Competitive	Residential and Commercial Energy
USDA Urban and Community Forestry Grants	Federal – Competitive	Land Use and Forestry
DOE Weatherization Assistance Program	Federal – Formula	Residential Energy
Zero Emission Technologies Grant Program	Federal – Competitive	Residential, Commercial, and Industrial Energy
DOE Grid Resilience and Innovation Partnerships Program	Federal – Competitive	Industrial Processes, Residential, Commercial, and Industrial Energy
DOE Grid Resilience State and Tribal Formula Grant	Federal – Formula	Industrial Processes, Residential, Commercial, and Industrial Energy

The significant rebate and grant opportunities from the IRA and the Infrastructure Investment and Jobs Act (IIJA), including CPRG implementation funding, will help to support Virginia's actions to reduce GHG emissions and provide benefits to communities across the state. Despite these funding sources, including those identified above, gaps in funding needs for climate action in Virginia still exist. As Virginia continues to evaluate the specific activities identified for each measure, key state and local agencies and partners that are administrators of formula funding or eligible applicants for competitive grant programs will continue to evaluate funding opportunities that are applicable for Virginia's climate actions. DEQ, and other state agencies, are actively evaluating these federal funding opportunities to support Virginia's climate initiatives and emissions reduction efforts. For formula funded programs, Virginia's designated lead agencies are developing plans and seeking input from stakeholders and other agencies to identify priority actions, similar to the PCAP development process. As Virginia continues to identify and implement climate actions, DEQ will coordinate with other agencies to identify and share available funding opportunities, incentives, and other rebates available to Virginians.

Virginia businesses, residents, and local governments are also eligible for federal tax incentives, primarily in the form of income and investment tax credits for various clean energy and emissions reduction technologies. These typically reduce tax liability based on a percentage of project cost, up to defined dollar limits. Local governments can obtain payments from the IRS for such projects, equal to but in lieu of credits taken by taxable entities. In such cases, tax incentives reduce the after-tax cost of projects; Virginia's PCAP strategy is to complement such incentives such that market adoption of eligible technologies is accelerated. However, some funding gaps remain, particularly for the industrial and commercial sectors, for specific reduction strategies for high-potency GHG emissions, and in land use sectors. DEQ will continue to coordinate with other state agencies and stakeholders to evaluate and leverage existing funding opportunities and identify funding gaps for key actions.

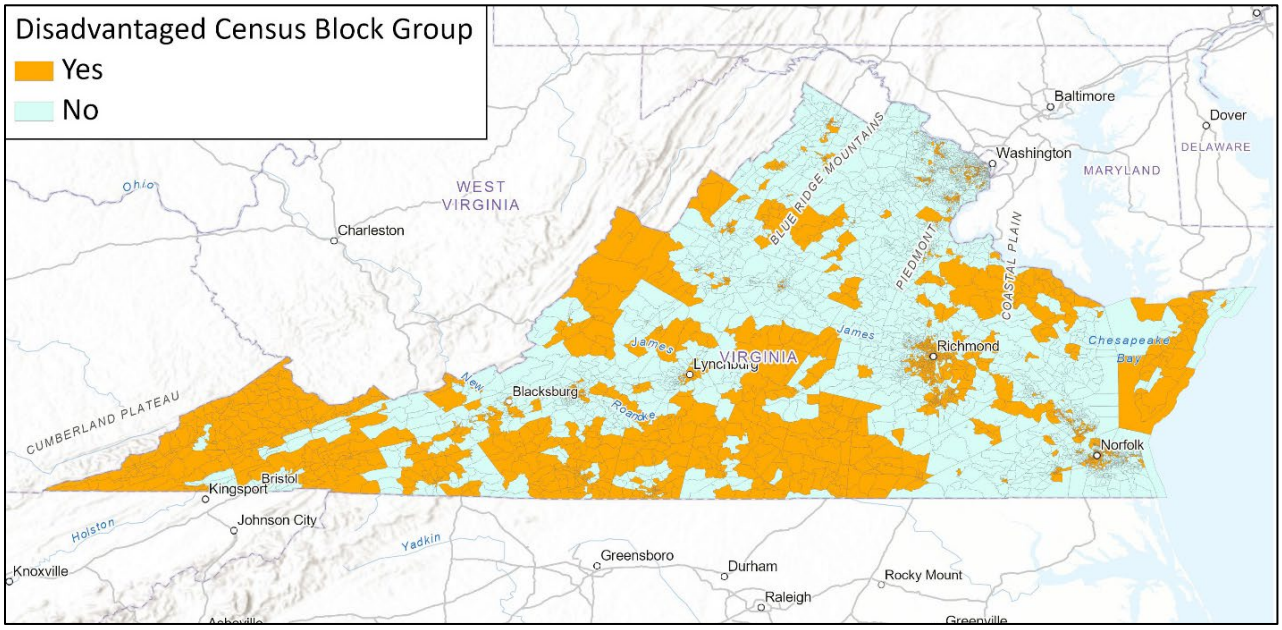
3. Virginia's Low-Income and Disadvantaged Communities

The CPRG program emphasizes engaging with, understanding, and providing benefits to LIDACs. A summary of how DEQ has and is planning to engage with LIDACs for climate action is presented above in Section 1.2. This section presents the identified LIDACs in Virginia and risks climate change presents to these communities. The benefits of Virginia's priority GHG reduction measures for LIDACs are presented for each measure in Section 5.

3.1 Identification of LIDACs

Virginia utilized EPA's EJScreen to identify and visualize Census Block Groups that the EPA designates as low-income, disadvantaged in Virginia.[19] The results of this analysis are shown in Figure 4. See Appendix E, for the full list of Census Block Group IDs identified as low-income and disadvantaged in Virginia.

Figure 4: Virginia LIDACs identified through EPA EJScreen



EPA's EJScreen identifies 36% of Virginia's total population as disadvantaged. The regions with the highest concentration of disadvantaged communities in Virginia are Richmond, Fairfax County, Henrico County, Norfolk, and Chesterfield County. Smyth County, Buchanan County, and Lee County all also have significant populations of disadvantage communities.

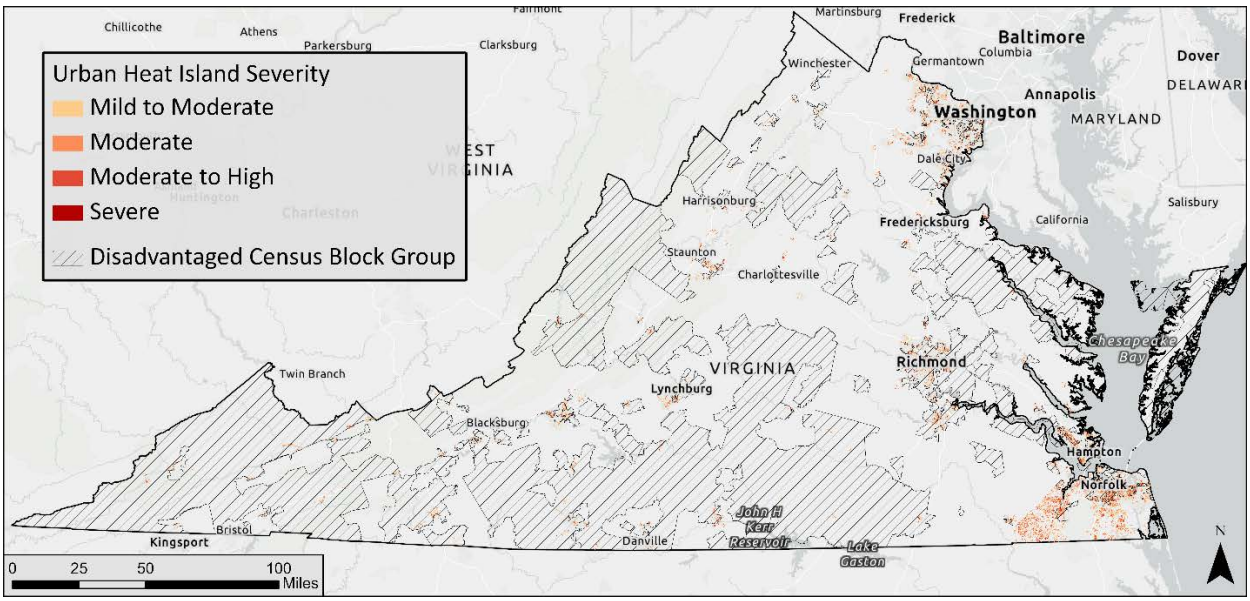
[19] The EPA defines a disadvantaged community in the following manner: 1) if it is disadvantaged according to the Climate and Economic Justice Screening Tool (CEJST); 2) if the census block is at or above the 90th percentile for any of EJScreen's Supplemental Indexes compared to the nation or state; 3) any geographic area within Tribal lands and indigenous areas as included in EJScreen.
U.S. EPA Office of Air and Radiation. "Climate Pollution Reduction Grants Program: Technical Reference Document for States, Municipalities and Air Pollution Control Agencies. Benefits Analyses: Low-Income and Disadvantaged Communities," April 27, 2023. https://www.epa.gov/system/files/documents/2023-05/LIDAC%20Technical%20Guidance%20-%20Final_2.pdf.

3.2 Risks to Virginia's LIDACs

LIDACs are particularly vulnerable to risks and impacts from climate change. The biggest risks facing Virginians are extreme heat, drought, extreme precipitation, and sea level rise, in addition to harmful air pollution from the transportation, industrial, and building sectors. Average temperatures in Virginia have already risen over 1.5° F since the beginning of the 20th century. Warming trends are also reflected in summer average temperatures, which in the 2005–2020 period exceeded those in the early 1930s (the prior peak of very hot days and very warm nights).[20]

Older adults, young children, people of color, outdoor workers, those with poorer health, and low-income individuals are more at risk of heat-related death. Impacts from increasing temperatures may be even more significant in urban areas where urban heat islands form as structures such as buildings, roads and other infrastructure absorb and re-emit heat more than natural landscapes.[21] As an example of this, Figure 5 illustrates the overlap of disadvantaged census block groups with areas of urban heat island severity from the Trust for Public Land.[22]

Figure 5: Urban Heat Island Severity in Virginia



Public cooling centers, which provide an option to avoid intense heat and avoid heat-related illnesses, tend to be in urban areas; rural areas, where people also experience higher energy burdens, often lack sufficient cooling centers. A 2022 study found that while 65% of Virginians have convenient access to a cooling center, less than 7% of Virginians living below the federal poverty

[20] NOAA. 2022. State Climate Summaries 2022: Virginia. NCICS. https://statesummaries.ncics.org/chapter/va/
[21] U.S. EPA. Heat Island Effect. https://www.epa.gov/heatislands.
[22] Trust for Public Land. Urban heat island severity for U.S. cities. https://www.arcgis.com/home/webmap/viewer.html?webmap=339c93a11b7d4cf7b222d60768d32ae5.

level do. Locations of cooling centers highlight the disparities between wealthier, urban areas and lower-income, rural areas.[23]

Lower-income and minority groups will be at greater risk for heat-related illnesses due to decreased access to healthcare and cooling centers and be more disproportionately impacted by increased cooling costs during heat waves. Extreme heat can also trigger asthma attacks, which will disproportionately target Black and low-income populations. In Virginia, 11.4% of Black adults have asthma, while only 8.4% of white adults. Adults in households with an income less than $15,000 have an asthma prevalence rate of 14.4%, while those in households with an income of $75,000 or more have a rate of 6.9%.[24]

Climate change may also impact Virginia's agricultural and fisheries economies. Hotter, drier conditions will also contribute to increased water scarcity and drought. Half of Virginia's counties face higher risks of water shortage by mid-century; these same counties are responsible for a large portion of Virginia's agricultural production (roughly $472 million in crops).[25] Climate change is also threatening marine living conditions in Chesapeake Bay. Blue crabs and oysters generate tens of millions of dollars annually in economic impacts in Virginia; this industry could decline or even disappear with increasing ocean temperatures and salinity. This disruption will severely impact the livelihoods of coastal communities.[26]

Tropical storms and hurricanes have become more intense during the past 20 years, and extreme rain events will likely increase in frequency and intensity throughout the century. Since 2000, average annual precipitation in Virginia has increased slightly. Summer precipitation was above average during the 2015–2020 period. Annual precipitation is projected to increase across Virginia by 5–10%, as is the frequency and intensity of extreme precipitation events (defined as days with two or more inches of precipitation).[27] Extreme precipitation events have already been increasing throughout the state; in the past 60 years, there has been a 33% increase in heavy rainstorms and snowstorms and an 11% increase in precipitation from the largest storms.[28] Impacts from these storms will continue to be felt most significantly in densely populated areas along tidal rivers. Flooding can also impact human health by increasing mold production and exposure to waterborne diseases.

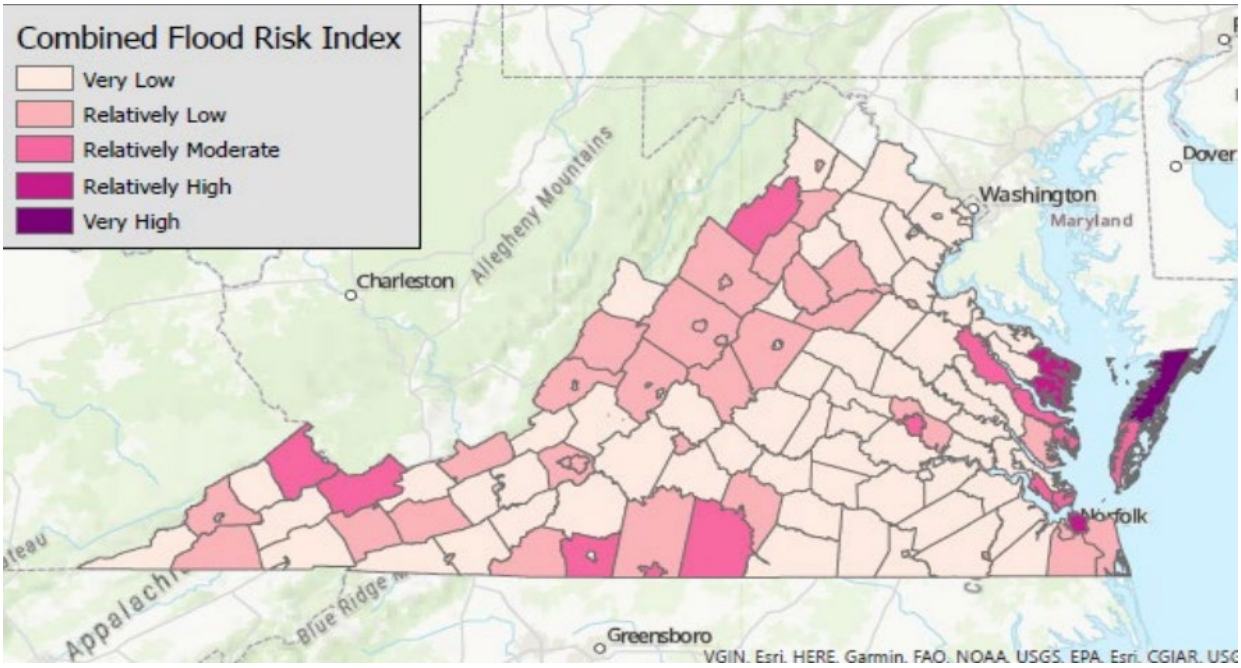
Sea level rise is happening more rapidly along Virginia's coast than in most coastal areas because the land is sinking. Since 1927, the sea level has risen 17 inches along the Virginia coast, causing an increase in tidal floods associated with nuisance-level impacts.[29] By the end of the century, tidal

[23] Allen M, Hoffman J, Whytlaw JL, Hutton N. Assessing Virginia cooling centers as a heat mitigation strategy. J Emerg Manag. 2022 May-Jun;20(3):205-224. doi: 10.5055/jem.0671. PMID: 35792811.
[24] Virginia Department of Health. 2018. Virginia 2018: Asthma Burden Report. https://www.vdh.virginia.gov/content/uploads/sites/94/2018/11/Asthma-Burden-Report_Final_10232018-1.pdf
[25] Georgetown Climate Center. 2020. Understanding Virginia's Vulnerability to Climate Change. MOST Center. https://mostcenter.umd.edu/sites/default/files/2020-08/understanding-virginias-vulnerability-to-climate-change.pdf
[26] Georgetown Climate Center. 2020.
[27] NOAA. 2022.
[28] Georgetown Climate Center. 2020.
[29] NOAA. 2022.

flooding is projected to occur nearly every day of the year under an intermediate scenario.[30] Over 400,000 homes in Virginia are at risk for storm surge (most of which are in identified disadvantaged communities in the Hampton Roads region).[31] In rural coastal Virginia, flood-exposed residents are more likely to be elderly, disabled, and experience various types of socioeconomic stress. Roughly 15% of the region's flood-exposed residents live below the poverty line. Presently, about 47,000 residents in Virginia are exposed to chronic flooding; by 2080, this number could skyrocket to 360,000 residents.[32] Coastal flooding impacts jeopardize health and safety, disrupt schools and businesses, and damage infrastructure and public facilities.

LIDACs in Virginia are at higher flood risk, as seen in Figure 6. This figure displays areas of very low to very high flood risk across the state using the U.S Federal Emergency Management Agency's (FEMA) National Risk Index (NRI) tool.[33] The combined flood risk index in Figure 6 is based on a combination of expected annual losses to buildings, population, and agriculture from flooding and that value by social vulnerability and dividing by community resilience.[34]

Figure 6: FEMA NRI Combined Flood Risk Index (FEMA Nov. 2021 NRI data)

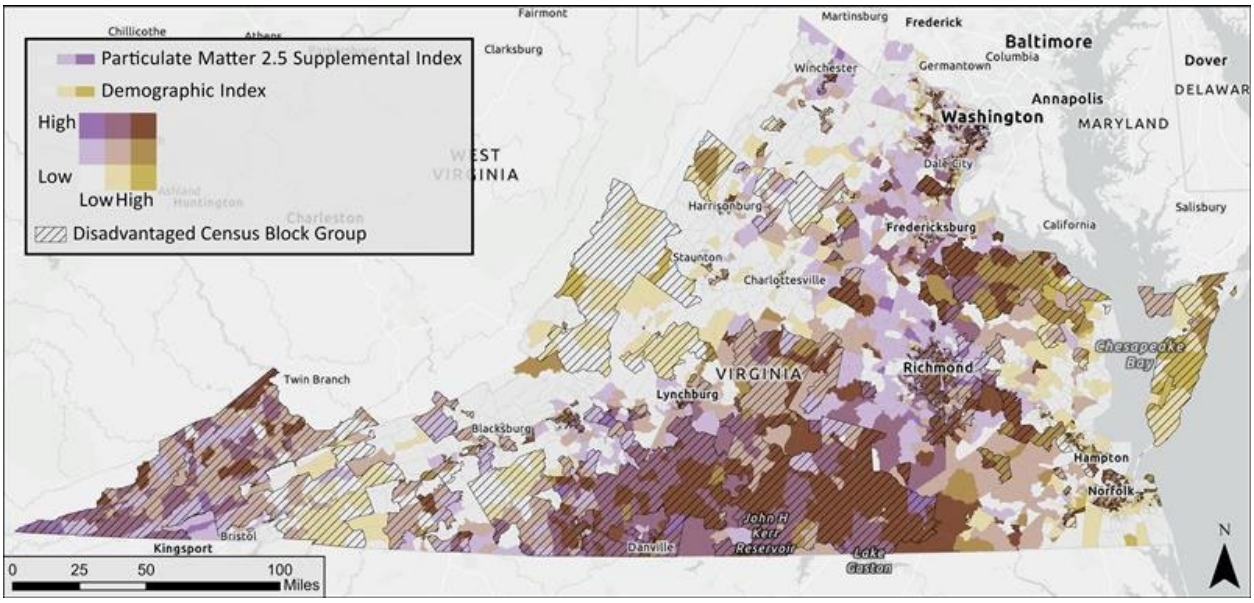


The risks of air pollution, particularly near industrial centers, are also a significant human health risk. Figure 7 illustrates the areas of particulate matter 2.5 ($PM_{2.5}$) exposure and disadvantaged census communities. The adverse health effects associated with prolonged exposure to $PM_{2.5}$, including

[30] An "intermediate scenario" refers to one falling under the SSP2 – or "middle of the road" – set of pathways. Under an SSP2 scenario, social, economic, and technological trends largely resemble historical patterns. Development and income growth are uneven across the world. Despite environmental degradation, there is some slow progress towards achieving sustainable development goals.
[31] Georgetown Climate Center. 2020.
[32] DCR. 2021. Virginia Coastal Resilience Master Plan. virginiacoastalresiliencemasterplan.pdf
[33] National Risk Index for Natural Hazards | FEMA.gov
[34] Report of the Secretary of Natural and Historic Resources. 2023. "The Status of Flood Resilience in the Commonwealth." https://rga.lis.virginia.gov/Published/2024/RD12/PDF

respiratory issues and cardiovascular diseases, are exacerbated in these communities, where access to healthcare and other resources may already be limited.[35]

Figure 7: EJScreen $PM_{2.5}$ Exposure and Demographic Index in Virginia



LIDACs in Virginia will face the burden of these hazards and risks more than other groups. These potential impacts to LIDACs were a key consideration in the development of the priority measures in the PCAP.

[35] EPA. 2023. Health and Environmental Effects of Particulate Matter (PM). https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm

4. Virginia's Tribes

4.1 Tribes

There are seven federally recognized tribes in Virginia: Chickahominy Indian Tribe, Chickahominy Indians Eastern Division, Monacan Indian Nation, Nansemond Indian Nation, Pamunkey Indian Tribe, Rappahannock Tribe, and Upper Mattaponi Indian Tribe. There are four additional tribes that are state recognized: Mattaponi Indian Tribe, Nansemond Indian Tribe, Nottoway Indian Tribe, and Patawomeck Indians. Through the CPRG program tribes are a targeted group for engagement and benefits, and some tribes are eligible to receive CPRG planning grants and compete for CPRG funding. In Virginia, the Monacan Indian Nation is participating as a planning grantee in the CPRG program.

4.2 Risks to Virginia's Tribes

Rooted in ancestral lands long predating English settlement at Jamestown, Virginia's tribes played a crucial role in the survival of newcomers during the colony's early years. Over the ensuing four centuries, these native communities have made substantial contributions to Virginia's vitality and the nation at large.[36]

However, Virginia's tribes face pressing challenges, particularly regarding water issues and climate change, jeopardizing traditional resources. Increasing water temperatures and recurrent droughts threaten water quality and ecosystem health and limited financial resources hamper tribes' ability to address these concerns. Tribes that have achieved federal recognition can establish independent environmental management offices, while others continue prolonged efforts for recognition, enduring waits that can extend over three decades. Four of the seven federally recognized tribes have identified Special Flood Hazard Areas: Pamunkey Indian Tribe, Upper Mattaponi Indian Tribe, Nansemond Indian Nation, and Monacan Indian Nation. Three of these, not including the Monacan Indian Nation, are impacted by coastal flooding.

DEQ will continue to engage with the Monacan Indian Nation and other Tribes to help assess and monitor all potential hazards, including mitigation and potential infrastructure needs for tribal citizens, and assist in planning and execution of any hazard mitigation plans as relevant.

[36] Secretary of the Commonwealth. Virginia Indians. https://www.commonwealth.virginia.gov/virginia-indians/

5. Priority GHG Reduction Measures

Virginia has identified ten priority implementation-ready measures that will reduce GHG emissions in the short- and long-term, while providing air quality and other community benefits across the Commonwealth. The PCAP measures, and the relevant Virginia GHG inventory sectors for each, are identified in Table 6. The following section describes each priority measure in detail.

The GHG reduction measures included in the PCAP reflect priorities for potential CPRG funding across the Commonwealth that align with the objectives and evaluation criteria for the relevant Notice of Funding Opportunity. They are not reflective of all potential opportunities or priorities to reduce GHG emissions in Virginia. These measures were developed through the process outlined in Section 1.2. A list of CPRG project and program ideas submitted to DEQ is included in Appendix D, though this list is not comprehensive of all potential projects and programs that may be pursued under a measure. A more comprehensive look at these opportunities and longer-term project and program ideas will be addressed in the CCAP.

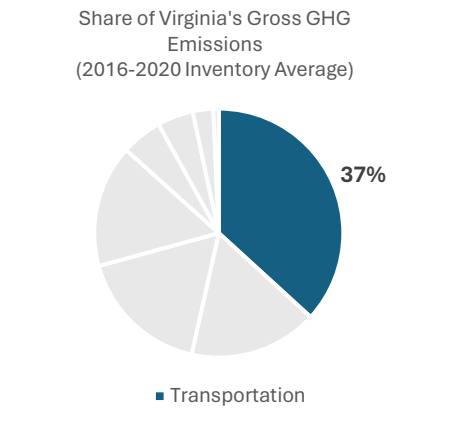
Table 6: Summary of PCAP Measures and Related GHG Inventory Sector(s)

PCAP Measure	Sector(s)
Measure 1: Reduce GHG emissions from the on-road transportation sector through vehicle electrification and other zero- and low-carbon fuels.	Transportation
Measure 2: Support alternative modes of transportation, micro-mobility, and active transportation to reduce vehicle miles traveled (VMT).	Transportation
Measure 3: Reduce GHG emissions from the off-road transportation sector, including ports and airports.	Transportation, Agriculture
Measure 4: Increase residential and commercial building energy efficiency and identify and implement GHG emission reduction solutions at homes, businesses, and institutions.	Residential Energy, Commercial Energy
Measure 5: Increase industrial energy efficiency and identify and implement opportunities for GHG emission reduction solutions at industrial facilities.	Industrial Energy
Measure 6: Reduce GHG emissions from the electric power sector and improve grid reliability and security.	Industrial Energy, Commercial Energy, Residential Energy, Transportation, Energy/Electricity Production
Measure 7: Deploy renewable energy, energy efficiency, energy storage, and low-carbon and resilient solutions for state and local government buildings and public fleets and transit, including infrastructure.	Commercial Energy, Transportation, Energy/Electricity Production
Measure 8: Identify and implement strategies to reduce high-potency GHG emissions from industrial processes, energy production, agriculture, waste, and wastewater treatment.	Industrial Processes, Energy Production, Agriculture, Waste & Wastewater
Measure 9: Reduce GHG emissions from manufacturing and industrial processes, materials, and products.	Industrial Processes
Measure 10: Protect and restore high-carbon coastal habitats, wetlands, agricultural, forest and tribal lands.	LULUCF, Agriculture

Measure 1: Reduce GHG emissions from the on-road transportation sector through vehicle electrification and other zero- and low-carbon fuels.

On-road transportation is the largest source of GHG emissions in Virginia. To reduce these emissions, this measure focuses on the sales and use of electric and alternative fuel light-duty, medium-duty, and heavy-duty vehicles across the Commonwealth. [37] It includes incentive and assistance programs, workforce development, and other activities to encourage adoption of electric vehicles (EVs) and vehicles that rely on low-carbon-intensity fuels (e.g., hydrogen, biofuels, and renewable gas). Where appropriate and feasible, state agencies and localities could also electrify or use low carbon fuels in their municipal fleets and equipment, such as school buses, public works trucks, and department vehicles (see also Measure 7). This measure includes the planning and deployment of EV charging infrastructure and expanded markets for and access to zero- and low-carbon fuels for vehicle types that are harder to electrify.

Relevant GHG inventory sectors:



Cumulative GHG Reductions from 2025–2030*:

17.14 $MMTCO_2e$

Cumulative GHG Reductions from 2025-2050*:

278.68 $MMTCO_2e$

**See Appendix F for a summary of methods, data, and assumptions.*

Potential Implementing Agencies and Partners

Potential implementers and examples of their current, future, or potential roles in this measure include:

- **VDOT:** Responsible for developing the state's EV deployment plan and Commonwealth transportation planning and programs. [38]
- **Virginia Energy:** Supports state alternative fuels/vehicles initiatives. [39]
- **Virginia Department of Motor Vehicles (DMV):** Established the 2022 Electric Vehicle Rebate Program, which offers rebates of $2,500 for people who purchase EVs from participating dealers. [40]
- **DEQ:** Operates several programs to monitor and reduce vehicle emissions, such as the Air Check Virginia program. [41]

[37] Electric vehicle adoption may also impact GHG emissions in the residential and commercial energy sectors depending on how chargers are tied to the built environment.
[38] VDOT. 2023. Virginia Electric Vehicle Infrastructure Deployment. https://publicinput.com/VirginiaNEVI
[39] Virginia Clean Cities. 2024. CMAQ Vehicle Fuel Conversion Incentive Program. https://vacleancities.org/reports-2/cmaq-incentive-program/
[40] Code of Virginia. 2021. Article 8. Electric Vehicle Rebate Program. § 45.2-1726. https://law.lis.virginia.gov/vacodefull/title45.2/chapter17/article8/
[41] Virginia DEQ. "Clean Vehicles." https://www.deq.virginia.gov/our-programs/air/clean-vehicles

- **Virginia Clean Cities Coalition:** Advances air quality improvement, economic opportunity, and energy security through deployment of alternative fuel vehicles and infrastructure, education programs, and other petroleum reduction activities.
- **Localities, school districts, and municipal governments:** Plans and procures to reduce GHG emissions from their own fleets of vehicles and equipment and site or provide access to public charging and fueling infrastructure.
- **Utilities:** Offers EV charging station rebates, and opportunities for other partnerships and action are possible.
- **Companies and consumers:** Take advantage of incentives, federal tax credits, and buy/use EV and alternative fuel vehicles.

Progress to Date and Future Activities and Milestones

The Clean Cars Act (HB1965) of 2021 aims to reduce tailpipe pollution through the sale of EVs and other clean vehicle technologies.[42] The legislation directs DEQ to develop, and the State Air Pollution Control Board to adopt, a low emissions vehicle (LEV) and zero-emission vehicle (ZEV) program for motor vehicles beginning with model year 2025.

Virginia provides several incentives to residents and public agencies related to EVs and alternative fuels. The Congestion Mitigation and Air Quality Improvement (CMAQ) program offers up to $10,000 to state agencies and local governments for the incremental cost of new or converted alternate fuel vehicles (AFVs).[43] These funds are currently available through September 2024. For residents, the Virginia DMV established an Electric Vehicle Rebate Program in 2022 effective until 2027 that offers rebates of $2,500 for people who purchase EVs, new or used, from participating dealers.[44] However, the program has not been funded by the General Assembly.[45] There are a number of credits and exemptions that support biofuel production and use, as well as charging station rebates offered by several utilities serving Virginia.[46]

Drive Electric Virginia is a statewide initiative to advance electric vehicle adoption.[47] This initiative, led by Virginia Clean Cities Coalition and partnering organizations, engages stakeholders to address EV adoption barriers and accelerating plug-in EV use throughout the state. It is part of the Drive Electric USA initiative sponsored by U.S. Department of Energy (DOE), and project goals include expanding EV availability, awareness, and infrastructure, and supporting EV policy.

Virginia is also investing in its EV infrastructure, a key factor in widespread EV adoption, with significant funding through the National Electric Vehicle Infrastructure (NEVI) Program. Virginia's Electric Vehicle Infrastructure Deployment Plan was approved by the Federal Highway

[42] State Air Pollution Control Board. 2021. HB 1965. "Low-emissions and zero-emissions vehicle program", https://lis.virginia.gov/cgi-bin/legp604.exe?ses=212&typ=bil&val=hb1965
[43] Virginia Clean Cities. 2024. CMAQ Vehicle Fuel Conversion Incentive Program. https://vacleancities.org/reports-2/cmaq-incentive-program/
[44] Code of Virginia. 2021. Article 8. Electric Vehicle Rebate Program. § 45.2-1726. https://law.lis.virginia.gov/vacodefull/title45.2/chapter17/article8/
[45] Virginia Energy. Sustainable Transportation. Virginia DOE. https://energy.virginia.gov/renewable-energy/Transportation.shtml
[46] Alternative Fuels Data Center. Virginia Laws and Incentives. U.S. DOE. https://afdc.energy.gov/laws/all?state=VA
[47] Drive Electric Virginia. About. Virginia Clean Cities. https://driveelectricva.org/about/

Administration (FHWA) in October 2023 and will be updated annually.[48] To meet the federal requirements of the NEVI Program, the initial phase of public charging stations will be located within one mile of Virginia's federally designated Alternative Fuel Corridors.

In addition to continuing the activities described above, example actions for Measure 1 implementation are outlined in Table 7. These actions are illustrative and not intended to be exhaustive of all actions that could be used to implement this measure.

Table 7: Example Actions for Measure 1

Example Actions	Status
Use emission standards to bolster use of LEVs and ZEVs.	Ongoing
Design and employ programs, credits, and exemptions to incentivize use of AFVs.	Ongoing
Address EV adoption barriers through programs such as Drive Electric Virginia.	Ongoing
Make investments in EV infrastructure through NEVI program.	Ongoing
Provide and use incentives to electrify and/or use low carbon fuels in public-owned/ public fleets.	Potential
Provide and use EV rebates (e.g., to fund state mandate).	Potential
Expand electric vehicle charging and other fueling infrastructure.	Potential
Identify and promote other clean transportation technologies using advanced biofuels, hydrogen, and others (particularly MD/HD).	Potential
Facilitate the transition to electric vehicles including charging stations including expanding electric vehicle supply equipment access and financial assistance programs.	Potential
Ensure that all transportation and energy projects are available to and easily accessed by tribal citizens.	Potential

Authority to Implement

The actions taken under this measure would be predominantly voluntary incentives and actions. The Clean Cars Act (HB 1965) of 2021 authorizes a wide range of incentives under its mandate, and the existing and planned incentives described above are implemented under existing federal and state authorities; the actions taken under this measure would use similar authorities. Owners of personal vehicles and vehicle fleets would have the authority to participate in voluntary incentive programs at their discretion.

Geographic Coverage

The actions within this measure apply across Virginia.

Funding Sources

Federal funding sources identified to date for actions under this measure include the following:

[48] VDOT. 2023. Virginia Electric Vehicle Infrastructure Deployment. https://publicinput.com/VirginiaNEVI

- **U.S. DOT NEVI**: Virginia has plans to invest approximately $100 million received through NEVI over the next several years to install public EV charging infrastructure.[49] The expansion of charging infrastructure is necessary for widespread adoption of EVs.
- **FHWA Carbon Reduction Program (CRP):** Virginia will receive approximately $165 million in CRP funding over the next several years for projects to reduce transportation emissions, including investing in transportation choice, efficiency and alternative fuels, and low emissions construction and equipment.[50]
- **U.S. DOT Congestion Mitigation and Air Quality Improvement (CMAQ):** This grant offers up to $10,000 to state agencies and local governments for the incremental cost of new or converted AFVs.[51] These funds are currently available through September 2024.
- **FHWA Charging and Fueling Infrastructure (CFI) Grant:** This competitive grant program aims to strategically deploy publicly accessible electric vehicle charging and alternative fueling infrastructure in the places people live and work—urban and rural areas alike—in addition to along designated Alternative Fuel Corridors. In 2023, Virginia received one CFI grant for approximately $1.5M for charging infrastructure in Henrico County.[52]
- **EPA Clean School Bus Rebate Program:** Various school districts in Virginia have received funding through this program.
- **EPA Clean Heavy-Duty Vehicles Program:** This program will distribute $1 billion in funding for clean HDVs from 2024 to 2031. This will be provided as grants and rebates to replace existing HDVs with ZEVs, as well as funds for zero-emission vehicle infrastructure, workforce development and training, and planning and technical activities.[53]
- **EPA Clean Diesel Grant Program/Diesel Emissions Reduction Act (DERA):** The DERA program funds grants and rebates that protect human health and improve air quality by reducing harmful emissions from diesel engines.[54]
- **DOE State Energy Program (SEP):** SEP provides funding and technical assistance to states to enhance energy security, advance state-led energy, and transportation initiatives, accelerate alternative fuels, and increase energy affordability. Virginia has received $10.7 million from SEP since 2015.[55]
- **IRA Federal Tax Credits:** includes Clean Vehicle Tax Credit, Previously Owned Vehicle Tax Credit, Clean Commercial Vehicle Tax Credit, Alternative Fuel Vehicle Refueling Property Tax Credit.

[49] VDOT. 2023. Virginia Electric Vehicle Infrastructure Deployment. https://publicinput.com/VirginiaNEVI
[50] VDOT. 2024. VDOT Carbon Reduction Program. https://www.ctb.virginia.gov/resources/springmeeting2023/statewide_displays/syip_crp_poster_revised.pdf
[51] Virginia Clean Cities. 2024. CMAQ Vehicle Fuel Conversion Incentive Program. https://vacleancities.org/reports-2/cmaq-incentive-program/
[52] https://www.fhwa.dot.gov/environment/cfi/grant_recipients/
[53] EPA. 2024. Clean Heavy-Duty Vehicle Program. https://www.epa.gov/inflation-reduction-act/clean-heavy-duty-vehicle-program
[54] EPA. 2024. Diesel Emissions Reduction Act (DERA) Funding. https://www.epa.gov/dera
[55] U.S. DOE. "State and Community Energy Programs Project Map – Virginia." Energy.gov, 2024. https://www.energy.gov/scep/articles/state-and-community-energy-programs-project-map-virginia.

Benefits

This measure will improve air quality through reduced emissions of nitrogen oxides (NOx), volatile organic compounds (VOCs), fine particle pollution (PM2.5), and sulfur dioxide (SO_2) because of the transition away from fossil-fuel based internal combustion engines. When EVs are charged with electricity generated by clean and renewable resources, air pollution benefits will be amplified. According to a study from the American Lung Association, potential improvements in air quality because of the Advanced Clean Cars Act and a non-combustion power grid could result in health benefits of $25 billion, 2,340 avoided premature deaths, 60,600 avoided asthma attacks, and 299,00 avoided lost days of work.[56]

LIDAC Benefits and Co-Benefits

Benefits for LIDACs in Virginia may include improved air quality and health benefits resulting from potential reductions in vehicular emissions, as well as potential reductions in new asthma cases, hospital admissions, and emergency department visits; reduced noise pollution; and reduction in fuel use by disadvantaged communities. This is particularly true for LIDACs that are highway-adjacent.

Cost barriers to accessing EVs and ZEVs still exist for LIDACs, so programs and incentives may need to be expanded or designed to help overcome these barriers. It is particularly important to consider the right incentive levels to make EVs or alternative vehicles cost-competitive so they are accessible for lower income households.

In addition, smaller businesses, including family and minority owned businesses, and smaller municipalities and counties may face greater strains in reducing GHG emissions from their fleets from a cost, workforce training, and operational perspective. This could be addressed through, for example, programs that provide targeted incentives, workforce training or cooperative purchasing programs. Job training programs may be targeted at LIDACs to support the deployment of new charging and fueling infrastructure and maintenance; but existing jobs for internal combustion engine maintenance may start to dissipate.

Metrics

Potential metrics to measure progress under this measure could include the following:

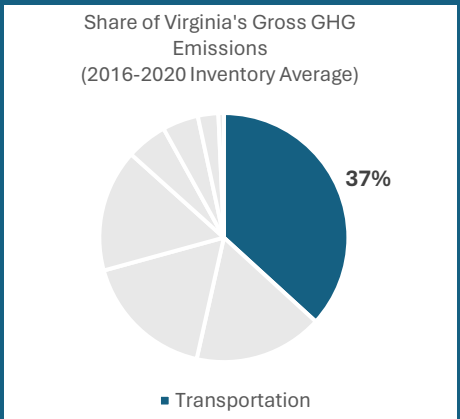
- Number of EVs and LEVs registered in the state, purchased, or procured
- Number of publicly accessible installed charging stations by type (e.g., Level 2 or DC Fast Chargers), across the Commonwealth and in LIDACs
- Uptime hours for public charging
- Number of maintenance/repair workers trained
- Number of EV or ZEV rebate program participants (including number of LIDAC resident participants)

[56] American Lung Association. "Driving to Clean Air: Health Benefits of Zero-Emission Cars and Electricity." June 2023. https://www.lung.org/getmedia/9e9947ea-d4a6-476c-9c78-cccf7d49ffe2/ala-driving-to-clean-air-report.pdf

Measure 2: Support alternative modes of transportation, micro-mobility, and active transportation to reduce vehicle miles traveled (VMT).

Incentivizing and expanding public and active transportation opportunities and infrastructure can reduce single-occupancy vehicle travel and reduce VMT, leading to reductions in the largest GHG emitting sector, transportation, in the Commonwealth. This measure involves encouraging accessible and efficient alternatives to single-occupancy vehicles travel by making changes to expand micro-mobility options (e.g., bike sharing) and active transportation infrastructure (e.g., sidewalks and bike lanes). To make micro-mobility options more accessible, it also includes land-use and development changes. This measure also includes improved public transportation options, such as more expanded and frequent bus routes and stops. Telework and telehealth options may also be incentivized or used to reduce VMT and provide more flexibility. Underserved areas with lower rates of car ownership could be prioritized to increase the effectiveness of this measure.

Relevant GHG inventory sectors:



Cumulative GHG Reductions from 2025–2030*:

4.74 $MMTCO_2e$

Cumulative GHG Reductions from 2025-2050*:

60.88 $MMTCO_2e$

**See Appendix F for a summary of methods, data, and assumptions.*

Potential Implementing Agencies and Partners

Potential implementers and examples of their current, future, or potential roles in this measure include:

- **VDOT:** Developed several policies related to bicycle and pedestrian planning and is responsible for improvements in bicycle and pedestrian accommodations.
- **Virginia Department of Rail and Public Transit (DRPT):** Responsible for its visions of a connected Commonwealth supported by an integrated multimodal network that serves every person, every business, and every need. Responsible for multiple grant programs to promote VMT reduction.
- **Localities and municipal governments:** Develops plans and implements active transportation and micro-mobility improvements.
- **Micro-mobility partners:** Partners with public agencies to expand the accessibility of these transportation alternatives.
- **Regional planning organizations and commissions.** Plans for, evaluates, and in some cases, fund transportation infrastructure investments and programs. This includes regional planning agencies across the Commonwealth, including those that are and are not CPRG MSA planning grantees.

- **Private sector partners:** Play a key role in development decisions and design that affect the viability of using alternatives to driving (e.g., landowners, private companies). Private rail companies (e.g., Amtrak) are also essential players in connecting Virginia. Business and healthcare providers can also implement telecommuting and telehealth policies that help manage travel demand.

Progress to Date and Future Activities and Milestones

This measure is consistent with Virginia's Statewide Transportation Plan (Vtrans 2040).[57] Goal B of this plan is Accessible and Connected Places: increase the opportunities for people and businesses to efficiently access jobs, services, activity centers, and distribution hubs. The objectives aligned with this goal are to reduce average peak-period travel times in metropolitan areas, reduce average daily trip lengths in metropolitan areas, and increase the accessibility to jobs via transit, walking and driving in metropolitan areas. This measure is also consistent with Goal E, Healthy Communities and Sustainable Transportation Communities: support a variety of community types promoting local economies and healthy lifestyles that provide travel options, while preserving agricultural, natural, historic, and cultural resources. The objectives of this goal are to reduce per-capita VMT, reduce transportation related NO_X, VOC, $PM_{2.5}$, and carbon monoxide (CO) emissions, and increase the number of trips traveled by active transportation (bicycling and walking).

In 2004, Virginia adopted a Policy for Integrating Bicycle and Pedestrian Accommodations, which provides a framework for VDOT to accommodate bicyclists and pedestrians in the planning, funding, design, construction, operation, and maintenance of Virginia's transportation network.[58] VDOT also developed a Bicycle Policy Plan in 2011 and Pedestrian Policy Plan in 2014 to advance these elements from the 2004 policy.[59, 60] These are supported by implementation guidance for design and construction of active infrastructure, as well as annual reports that track improvements in bicycle and pedestrian accommodations.[61]

VDOT established a Bicycle Advisory Committee in 1989 that reconvened in 2013 as the Bicycle and Pedestrian Advisory Committee (BPAC). BPAC meets quarterly to discuss VDOT policies, standards and practices that affect the bicycling and walking community. Virginia will continue to engage stakeholders through BPAC and other infrastructure planning processes to identify key areas for bicycle and pedestrian infrastructure investments or improvements.

DRPT has conducted multiple studies and plans on transit modernization, connectedness, road needs, rural micro-transit, rail connectivity, transit equity, and more.[62] These studies and plans can

[57] VDOT. "VTrans2040 Vision, Goals & Objectives, and Guiding Principles." https://www.vtrans.org/resources/VTrans2040-Vision.pdf
[58] VDOT. 2004. Policy for Integrating Bicycle and Pedestrian Accommodations. https://www.vdot.virginia.gov/media/vdotvirginiagov/about/programs/biking-and-pedestrian/bike_ped_policy.pdf
[59] VDOT. 2011. State Bicycle Policy Plan. https://www.vdot.virginia.gov/media/vdotvirginiagov/about/programs/biking-and-pedestrian/bike_ped_policy.pdf
[60] VDOT. 2014. State Pedestrian Policy Plan. https://www.vdot.virginia.gov/media/vdotvirginiagov/about/programs/biking-and-pedestrian/SPPP_FINAL_OnLine_LowRes.pdf
[61] VDOT. 2024. Bicycle and Pedestrian Accommodations. https://www.vdot.virginia.gov/doing-business/technical-guidance-and-support/transportation-and-mobility-planning/bicycle-and-pedestrian-accommodations/
[62] Virginia DRPT. "All DRPT Studies & Reports – DRPT." Virginia Department of Rail and Public Transportation, 2024. https://drpt.virginia.gov/studies-and-reports/.

be leveraged to implement this measure. DRPT also offers several grant programs to reduce VMT across the Commonwealth,[63] such as the Commuter Assistance Program, a statewide grant program for programs and projects that are both efficient and effective at increasing ridership on transit, vanpools, and carpooling.[64]

DRPT also offers Virginia Breeze, a program which operates four routes and provides a critical connection between rural Virginia communities and the national bus network. The program is funded through the Federal Transit Administration's Intercity Bus Program as well as ticket revenues. The four routes are the Valley Flyer (Blacksburg-Washington), Highlands Rhythm (Bristol-Washington), Piedmont Express (Danville-Washington), and Capital Connector (Martinsville-Richmond-Washington).[65]

In addition to continuing the activities described above, the example actions for Measure 2 implementation are outlined in Table 8. These actions are illustrative and not intended to be exhaustive of all actions that could be used to implement this measure.

Table 8: Example Actions for Measure 2

Example Actions	Status
Improve and expand bicycle and pedestrian infrastructure.	Ongoing
Provide and use grant, education, and assistance programs to promote VMT reductions.	Ongoing
Deploy projects that improve pedestrian and bike infrastructure and better connect residents to public transit.	Planned
Provide and use electric bike rebate programs.	Potential
Improve and expand bus routes, stops, bike share options, and rail connectivity with priority for low car ownership, underserved areas and/or rural areas.	Potential
Provide and use incentives for telecommuting.	Potential
Expand and extend trails and trail networks. Boost Monacan and other interested Tribal parties' trail capacity and linkage to state trails and wildlands.	Potential
Ensure that all transportation and energy projects are available to and easily accessed by tribal citizens.	Potential

Authority to Implement

VDOT and DRPT have policy and planning authorities which are sufficient to authorize efforts under this measure. Local governments would conduct individual projects under their existing land-use and transportation authorities within their respective jurisdiction.

[63] Virginia DRPT. "Our Grant Programs." Virginia Department of Rail and Public Transportation, 2024. https://drpt.virginia.gov/our-grant-programs/.
[64] Virginia DRPT. "CAP (Commuter Assistance Program)." Virginia Department of Rail and Public Transportation, 2024. https://drpt.virginia.gov/our-grant-programs/cap-commuter-assistance-program/.
[65] Virginia DRPT. "Virginia Breeze." Virginia Department of Rail and Public Transportation, 2024. https://drpt.virginia.gov/work/virginia-breeze/.

Geographic Coverage

The actions within this measure apply across Virginia, but different tactics may be used in rural versus urban versus suburban areas.

Funding Sources

Federal funding sources identified to date for actions under this measure include the following:

- **FHWA CRP:** Virginia will receive approximately $165 million in CRP funding over the next several years for projects to reduce transportation emissions, including investing in bike lanes, sidewalks and crosswalks, and trails.[66]
- **U.S. DOT Active Transportation Infrastructure Investment Program (ATIIP):** The ATIIP is a competitive grant program for projects that provide safe and connected active transportation facilities in active transportation networks or active transportation spines.[67]
- **FHWA Surface Transportation Block Grant Program (STBG):** The STBG program provides flexible funding that may be used by states and localities for projects to preserve and improve the conditions and performance on any Federal-aid highway, bridge and tunnel projects on any public road, pedestrian and bicycle infrastructure, and transit capital projects, including intercity bus terminals.[68]
- **Federal Transit Administration (FTA) Grants for Buses and Bus Facilities Program:** In June 2023, FTA announced $1.69 billion for projects that replace, rehabilitate and purchase buses and related equipment, and to construct bus-related facilities, including technological changes or innovations to modify low or no emission vehicles or facilities.[69]
- **FTA Capital Investment Grants Program:** This FTA discretionary grant program funds transit capital investments, including heavy rail, commuter rail, light rail, streetcars, and bus rapid transit.[70]
- **DRPT grant programs:** DRPT has several grant programs that reduce VMT, including the Commuter Assistance Program (for projects that increase ridership on transit, vanpools, and carpooling)[71] and Making Efficient and Responsible Investments in Transit (provides financial assistance to support public transportation services).[72]

Benefits

This measure would offer the same type of air quality benefits as Measure 1: improved air quality through reduced emissions NOx, VOCs, $PM_{2.5}$, and SO_2.

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[66] VDOT. 2023. VDOT Carbon Reduction Program. https://www.ctb.virginia.gov/resources/springmeeting2023/statewide_displays/syip_crp_poster_revised.pdf
[67] FHWA. 2024. Active Transportation Infrastructure Investment Program (ATIIP). https://www.fhwa.dot.gov/environment/bicycle_pedestrian/atiip/
[68] FHWA. 2024. Surface Transportation Block Grant Program (STBG). https://www.fhwa.dot.gov/specialfunding/stp/
[69] FTA. 2024. Grants for Buses and Bus Facilities Program. https://www.transit.dot.gov/bus-program
[70] FTA. 2024. Capital Investment Grants Program. https://www.transit.dot.gov/CIG
[71] DRPT. 2024. CAP (Commuter Assistance Program). https://drpt.virginia.gov/our-grant-programs/cap-commuter-assistance-program/
[72] DRPT. 2024. Making Efficient and Responsible Investments in Transit (MERIT). https://drpt.virginia.gov/our-grant-programs/making-efficient-and-responsible-investments-in-transit-merit/

LIDAC Benefits and Co-Benefits

Benefits for LIDACs in Virginia may include improved air quality and health benefits resulting from potential reductions in vehicular emissions, as well as potential reductions in new asthma cases, hospital admissions, and emergency department visits. Additional benefits may include reduced noise pollution due to less vehicle traffic, improved access to services and amenities, increased access to more reliable and resilient transportation alternatives, and reduced transportation expenses with more mass transit and shared mobility. Benefits from this measure may also include social and physical health, such as greater solidarity and social inclusion, including in sharing, local, and circular economies and increased access to social and cultural activities and promotion of exercise when engaging in active transportation.

Because of the varied nature of connectivity in LIDACs across Virginia, with urban, suburban, and rural areas, opportunities for reducing VMT may face some limitations (e.g., if there a lack of public transit options in rural areas). However, innovative strategies, such as car sharing and last mile destination targeted programs, may help alleviate some of these potential barriers.

Metrics

VDOT already tracks improvements in bicycle and pedestrian accommodations through the following metrics:[73]

- Improvements in curb ramps
- Completed project count and length of the following:
  - Shared use paths
  - Sidewalks
  - Bike lanes
  - Paved shoulder
  - Paved/unpaved roads
  - Other bike/pedestrian facilities
  - Bike/pedestrian design features

Potential additional metrics to measure progress under this measure could include the following:

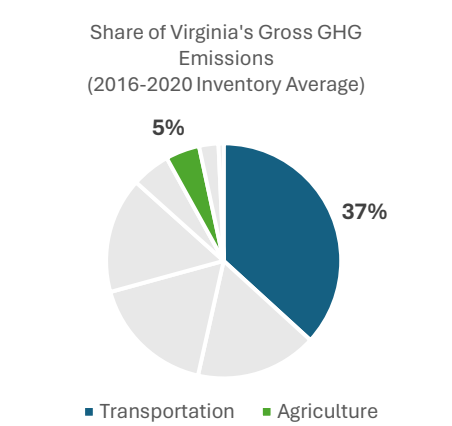
- Transit ridership
- Additional miles of bicycle or pedestrian lanes added, across the Commonwealth and connecting within and to LIDACs

[73] VDOT. 2020. Fiscal Year 2018 and 2019 Bicycle and Pedestrian Metric Report. https://www.vdot.virginia.gov/media/vdotvirginiagov/doing-business/technical-guidance-and-support/transportation-and-mobility/bicycle-and-pedestrian/Fiscal-Year-2018-2019-Bicycle-and-Pedestrian-Metric.pdf

Measure 3: Reduce GHG emissions from the off-road transportation sector, including ports and airports.

This measure focuses on reducing off-road transportation GHG emissions primarily through actions to reduce GHG emissions from operations and electrify ports, rail, airport operations, and agricultural and landscaping equipment. On the shoreline of ports, the measure could involve deploying shore power (electric power supplied to docked ships to reduce idling), installing renewable energy, or switching to electric forklifts and other cargo handling equipment, among other activities. Reducing GHG emissions at airports could include implementing or increasing use of sustainable aviation fuels, deploying renewable energy, or electrifying airport vehicles and equipment. Opportunities also exist to reduce GHG emissions from rail operations, an essential aspect of moving goods across the Commonwealth. This measure also aims to identify opportunities to reduce GHG emissions from agricultural and landscaping equipment.

Relevant GHG inventory sectors:



Cumulative GHG Reductions from 2025-2030*:

1.33 $MMTCO_2e$

Cumulative GHG Reductions from 2025-2050*:

23.71 $MMTCO_2e$

**See Appendix F for a summary of methods, data, and assumptions. The majority of off-road GHG emissions in Virginia come from aircrafts. These GHG emissions were not addressed in this GHG calculation but will be considered in the CCAP.*

Potential Implementing Agencies and Partners

Potential implementers and examples of their current, future, or potential roles in this measure include:

- **Virginia Port Authority (VPA):** Operates four general cargo facilities Norfolk International Terminals, Portsmouth Marine Terminal, Newport News Marine Terminal, and the Virginia Inland Port in Warren County.
- **DRPT:** Responsible for railways moving people and cargo across Virginia.
- **Virginia Department of Aviation:** An executive branch agency, reporting to the Virginia Secretary of Transportation.
- **Metropolitan Washington Airports Authority:** Plans, provides access, and actively manages Reagan National and Dulles International airports.
- **Utilities:** Plays a role in helping to connect and manage load and renewable energy opportunities for port, rail, and airport operations.

Progress to Date and Future Activities and Milestones

In 2013, EPA awarded $750,000 to the VPA to replace diesel cargo handling equipment with hybrid diesel-electric equipment.[74] The port replaced three Tier 1 shuttle carriers with Tier IV diesel-electric carriers three to five years ahead of schedule. The updated shuttles are more fuel-efficient, are cleaner and quieter, and save on costs. VPA announced their commitment to become net zero by 2040, and in 2022 released a sustainability report detailing their progress and future GHG reduction targets.[75] This includes a goal to source all their energy from clean sources by 2024. VPA has replaced diesel carrier shuttles with hybrid shuttles and plans to electrify yard tractors, develop an offshore wind energy hub, and implement a living shoreline project

VPA, in partnership with the Virginia Clean Cities Coalition, also offers regional Congestion Mitigation and Air Quality (CMAQ) Improvement first come, first serve funds to retire aging drayage trucks and replace them with modern clean diesel vehicles. This program provides 50% of the cost to purchase new clean diesel drayage trucks, up to $30,000.[76]

In 2016, the Virginia Department of Aviation and Federal Aviation Administration commissioned the Virginia Airports Sustainability Management Plan, which provides a voluntary framework for the 66 public-use airports in Virginia to undertake tailored sustainability planning to meet their local priorities, needs, and abilities.[77] The plan provides a menu of sustainability initiatives for airport managers and specific resources and tools related to integrating airport sustainability into all aspects of business. For rail, DRPT's 2022 Virginia Statewide Rail Plan discusses opportunities for changing locomotives from electric to diesel (e.g., for passenger cars) and implementing plans to relieve critical capacity bottlenecks to reduce emissions.[78]

In addition to continuing the activities described above, the example actions for Measure 3 implementation are outlined in Table 9. These actions are illustrative and not intended to be exhaustive of all actions that could be used to implement this measure.

Table 9: Example Actions for Measure 3

Example Actions	Status
Source clean energy for Port of Virginia operations.	Completed
Fund port equipment transitions to lower emissions models.	Ongoing
Convert rail from diesel.	Planned

[74] EPA. 2023. Virginia Port Authority Hybrid Shuttle Carriers Reduce Costs and Air Emissions. https://www.epa.gov/ports-initiative/virginia-port-authority-hybrid-shuttle-carriers-reduce-costs-and-air-emissions
[75] The Port of Virginia. 2022. Sustainability Report: Net-Zero by 2040. https://www.portofvirginia.com/wp-content/uploads/2023/09/Port-of-VA-Sustainability-Report_2023_12pgs.pdf
[76] The Port of Virginia. "Green Operator Program – Dray Truck Upgrades for Clean Air." The Port of Virginia, 2021. https://www.greenoperator.org/.
[77] Virginia Department of Aviation. 2016. Virginia Airports Sustainability Plan. https://doav.virginia.gov/resources/forms-and-reports/studies-guides-and-reports/virginia-airports-sustainability-management-plan-2016/
[78] DRPT. "2022 Virginia Statewide Rail Plan." January 2023. https://storymaps.arcgis.com/collections/f83c1618157b45388bc794dde93d0f81

Example Actions	Status
Develop plans to relieve critical capacity bottlenecks for both freight and passenger rail to generate time savings and GHG emissions reductions.	Planned
Design, deploy and use programs and incentives to reduce GHG emissions from ports/port electrification.	Potential
Provide and use incentives for port cargo handling equipment and airport ground support equipment (lawn, forklifts, etc.).	Potential
Provide and use education and assistance programs for electrified agricultural, landscaping, and other off-road equipment, such as tractors, mowers, chain saws, and trimmers.	Potential

Authority to Implement

VPA and the Virginia Department of Aviation, in coordination with regional authorities such as the Metropolitan Washington Airports Authority, have the authority to modify their infrastructure and acquire low-emission equipment and systems used within their facilities as described under this measure. DRPT also has authority and oversight for Virginia's rail system. For broader incentives that would encourage reducing emissions from farming or landscaping equipment, those programs would be implemented under the authority of designated state and/or local agencies.

Geographic Coverage

The actions within this measure are focused on the Commonwealth of Virginia, and the areas near and around ports and public-use airports and railways.

Funding Sources

Federal funding sources identified to date for actions under this measure include the following:

- **EPA DERA:** The VPA's hybrid shuttle carriers program has received funding from the EPA through DERA. This program provides incentive funding for projects focused on reducing diesel emissions from old heavy-duty diesel engines that do not meet the latest highway and nonroad engine emission standards.
- **EPA Clean Ports Program:** This program provides $3 billion to fund zero-emission port equipment and technology and to help ports develop climate action plans to reduce air pollutants.
- **U.S. DOT Rebuilding American Infrastructure with Sustainability and Equity (RAISE):** This federal grant program also offers $1.5 billion in funding for projects at the state and local levels. The eligibility requirements of RAISE allow project sponsors to obtain funding for projects that may be harder to support through other U.S. DOT grant programs.

Benefits

Shifting away from diesel will reduce emissions of NOx, $PM_{2.5}$, CO, and other air toxins. Reduction in ground-level ozone will also be realized.[79]

LIDAC Benefits and Co-Benefits

Within Virginia, as with many parts of the country, there is overlap between locations of ports, airports, and railways and the location of LIDACs. Through implementing this measure, benefits for these LIDACs in Virginia will include improved air quality and health benefits resulting from potential reductions in off-road emissions, as well as potential reductions in new asthma cases, hospital admissions, emergency department visits, and other health related issues. This may result in lower healthcare costs and an overall improved quality of life. Communities near or adjacent to ports and airports will also benefit from reduced light and noise pollution.[80]

Metrics

For the Port of Virginia, VPA is already tracking the following metrics:[81]

- Tons of CO_2e per 10,000 20-foot equivalent unit (TEU)
- Fuel gallons per 10,000 TEU
- Percent electric equipment
- Virginia International Gateway turn-time
- Norfolk International Terminals turn-time

Potential additional metrics for airports include the following:

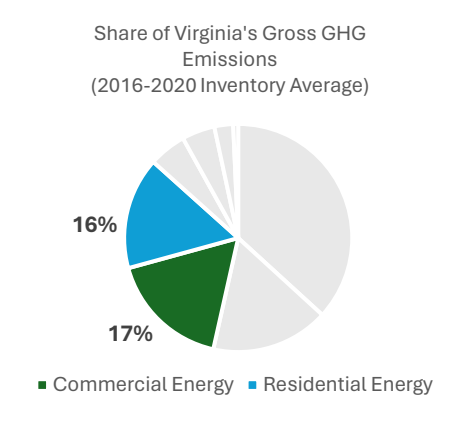
- Percent electric equipment at airports throughout Virginia
- Percent of planes using sustainable aviation fuels
- Number of electric rails cars commissioned/number of diesel rail cars decommissioned
- Number or dollar value of incentives taken for electric equipment

[79] EPA. "Learn About Impacts of Diesel Exhaust and the Diesel Emissions Reduction Act." https://www.epa.gov/dera/learn-about-impacts-diesel-exhaust-and-diesel-emissions-reduction-act-dera
[80] US EPA. "Environmental Justice Primer for Ports: Impacts of Port Operations and Goods Movement." Overviews and Factsheets, July 31, 2019. https://www.epa.gov/community-port-collaboration/environmental-justice-primer-ports-impacts-port-operations-and-goods.
[81] The Port of Virginia. 2022. Sustainability Report: Net-Zero by 2040. https://www.portofvirginia.com/wp-content/uploads/2023/09/Port-of-VA-Sustainability-Report_2023_12pgs.pdf

Measure 4: Increase residential and commercial building energy efficiency and identify and implement GHG emission reduction solutions at homes, businesses, and institutions.

Commercial and residential building energy use, which includes electricity, oil, propane, and natural gas usage, accounts for a substantial portion of Virginia's annual GHG emissions. This measure focuses on identifying and implementing actions to decrease emissions in Virginia's residential and commercial building sectors through energy efficiency and other options to reduce GHG emissions. Virginia has several existing programs to reduce energy-related emissions in homes and businesses and is focused on further expanding these efforts through this measure.

Relevant GHG inventory sectors:



Cumulative GHG Reductions from High Energy Efficiency 2025-2030*:

14.95 $MMTCO_2e$

Cumulative GHG Reductions from High Energy Efficiency 2025-2050*:

111.72 $MMTCO_2e$

Cumulative GHG Reductions from Other Solutions 2025-2030*:

4.79 $MMTCO_2e$

Cumulative GHG Reductions from Other Solutions 2025-2050*:

46.83 $MMTCO_2e$

**See Appendix F for a summary of methods, data, and assumptions.*

Potential Implementing Agencies and Partners

Potential implementers and examples of their current, future, or potential roles in this measure include:

- **Virginia Energy:** Coordinates state energy efficiency programs and administers state programs and funding, and federal funding such as the Home Energy Rebates program.
- **Virginia Department of Housing and Community Development (DHCD):** Administers Housing Innovations in Energy Efficiency (HIEE), Weatherization Assistance Program (WAP), and Weatherization Deferral Repair Program (WDR) funding.
- **Virginia Property Assessed Clean Energy (PACE) Authority:** Administers the Commercial Property Assessed Clean Energy (C-PACE) financing program.
- **State universities**: Manage university facilities and associated energy systems, power plants, and utilities.
- **Utilities:** Provide energy savings and other distributed energy resource programs.
- **Local governments.** Operate voluntary programs to support efficiency and other GHG reduction options.
- **Building owners, residents, and developers:** Make decisions about building upgrades, retrofits, and construction.

Progress to Date and Future Activities and Milestones

Virginia is making strides to reduce GHG emissions from the built environment through legislative, regulatory, and programmatic actions.

VCEA set new energy savings targets for investor-owned utilities Dominion Energy and Appalachian Power. Under the State Corporation Commission's (SCC) regulatory authority, these companies have ramped up their customer incentive programs accordingly. Dominion hosts numerous weatherization and energy efficiency programs, as well as various incentives and rebates offered to residential and business customers for purchasing energy-efficient products.[82] For example, residential customers may avail themselves of rebates on products such as smart thermostats, and property-specific checkup, rebates, and discounts. Among other sectors, the Agriculture Program offers rebate incentives to eligible customers for installing high efficiency agricultural equipment and lighting, while the Small Business Improvement Enhanced Program provides customers with on-site energy assessments.

Virginia enacted the High-Performance Buildings Act in 2021 to drive more efficient, resilient, and future-proof buildings.[83] The law updated the building performance standards for state/public buildings by adding electric vehicle charging and infrastructure and utility metering requirements and created new building performance standards for local governments. In the residential sector, Virginia administers federal WAP funding to reduce low-income household energy use through the installation of energy savings measures, which also improve resident health and safety.[84] The Virginia WDR funds repairs for deferred homes to enable clients to receive energy efficiency and health and safety measures through WAP.[85]

The IRA Home Energy Performance-Based, Whole-House Rebate (HOMES) program and High-Efficiency Electric Home Rebate (HEEHRA) program provide direct funding to the Commonwealth to implement this measure.[86] HOMES funding will provide rebates that discount the price of energy-saving retrofits in single-family and multifamily buildings while HEEHRA funding will provide rebates for high-efficiency electric products and equipment. Virginia Energy applied for and is expected to begin administering these funds to further home energy improvement initiatives in Virginia this year.

Virginia also has several state programs supporting activities under this measure. The HIEE fund, administered by DHCD, provides capital for energy efficiency upgrades to both new and existing housing.[87] HIEE funding is available as the lesser of $2,000,000 or 10% of development costs for affordable housing developments which demonstrate that they are designed to meet both a third-party green building certification standard (e.g., EarthCraft Gold) and energy performance criteria

[82] Dominion Energy. 2021. Annual Report: Energy Conservation. https://www.dominionenergy.com/-/media/pdfs/virginia/save-energy/energy-conservation-annual-report.pdf?la=en&rev=7be7e0a699e14a67be8b865c60348e8f&hash=9F349F07BC46BA77BFAC10FB351F353D.
[83] Code of Virginia. 2012. § 2.2-1183. Article 8. High Performance Buildings Act. § 2.2-1182. Definitions. https://law.lis.virginia.gov/vacodefull/title2.2/chapter11/article8/
[84] Virginia DHCD. Weatherization Assistance Program. Virginia DOE. https://www.dhcd.virginia.gov/wx
[85] Virginia DHCD. Weatherization Deferral Repair. Virginia DOE. https://dhcd.virginia.gov/wdr
[86] U.S. DOE. "Home Energy Rebates Programs." Energy.gov, 2024. https://www.energy.gov/scep/home-energy-rebates-programs.
[87] Virginia DHCD. Housing Innovations in Energy Efficiency. Virginia DOE. https://www.dhcd.virginia.gov/hiee

(e.g., Zero Energy Ready Homes certification or achieving an applicable Home Energy Rating System (HERS) score).

Virginia's C-PACE program finances energy efficiency upgrades, disaster resiliency improvements, water conservation measures and renewable energy installations at commercial and multifamily buildings with no upfront cost to property owners.[88] The Virginia Energy Demand Response Program is a Virginia Energy initiative that pays state facilities to reduce energy load during times of peak grid demand.[89] A contract partner aggregates state facility electric load reductions to participate in the regional grid operator Pennsylvania-New Jersey-Maryland Interconnection (PJM) demand response program.

In addition to continuing the activities described above, the example actions for Measure 4 implementation are outlined in Table 10. These actions are illustrative and not intended to be exhaustive of all actions that could be used to implement this measure.

Table 10: Example Actions for Measure 4

Example Actions	Status
Provide and use residential weatherization and efficiency subsidies, grants and incentives to low-income households and LIDAC-focused programs, including affordable housing.	Ongoing
Incentivize energy efficiency and clean energy power generation at commercial facilities, including data centers.	Planned
Provide and use incentives for retrofits of residential and commercial buildings to reduce energy use and GHG emissions, supported by concierge services including outreach and marketing, technical assistance, transaction support, and workforce development.	Planned
Conduct supporting activities for incentive programs, such as outreach and marketing, technical assistance, transaction support, and workforce development to enable effective market impacts.	Planned
Identify gaps between state programs, federal buildings programs and tax incentives, and develop additional programs where needed.	Planned
Provide support for advanced new building construction.	Planned
Offer/complement energy audits offered by Virginia Energy for small businesses, and to moderate-income households with incomes between weatherization qualifying levels and 100% AMI. DHCD would offer a complementary program modeled after WDR to address key household repairs preventing the installation of further energy efficiency measures, called Audit Deferral and Repair (ADR).	Planned
Convert state university fossil fuel-fired power plants to low- and zero-carbon fuels.	Potential
Support indigenous sovereignty through programs that boost energy efficiency and reduce fossil fuel reliance in Tribal buildings and homes.	Potential

[88] Virginia Energy, C-PACE Program. Virginia DOE. https://www.energy.virginia.gov/energy-efficiency/PACE.shtml
[89] Virginia Energy. Demand Response. Virginia DOE. https://www.energy.virginia.gov/energy-efficiency/demand-response.shtml

Example Actions	Status
Ensure that all buildings-related energy projects are available to and easily accessed by tribal citizens.	Potential

Authority to Implement

Incentive programs for upgrades to existing buildings would fall under the existing authority for Virginia Energy and DHCD to implement programs under their charters. Private building owners would agree to participate in programs under program rules and conditions.

Geographic Coverage

The actions within this measure would apply across Virginia.

Funding Sources

Federal funding sources identified to date for actions under this measure include the following:

- **DOE SEP:** This DOE formula grant program provides basic operating support for Virginia Energy. Supplemental SEP funding under the Bipartisan Infrastructure Law enables the Agency to add program activities it proposes to DOE.
- **DOE Renew America's Schools Program:** This competitive award focuses on funding clean energy infrastructure upgrades at K-12 public school facilities, prioritizing high-need school communities.
- **USDA Rural Utilities Service Empowering Rural America Program:** This program provides funding to make energy efficiency improvements to eligible rural generation and transmission systems, to purchase, build, or deploy renewable energy, zero-emission systems, carbon capture storage systems, or to purchase renewable energy.
- **DOE Assistance for Latest and Zero Building Energy Code Adoption:** Virginia has been allocated $7,401,939 for this program to adopt and implement building energy codes that reduce utility bills, increase efficiency, and lower GHG emissions.[90]
- **DOE HOMES and HEEHRA**: Virginia has been allocated a total of $188,524,540 for the Home Energy Rebate Programs: $94,537,110 for Home Efficiency Rebates and $93,987,430 for Home Electrification and Appliance Rebates.[91] These funds will be available in Virginia by 2025.
- **DOE Weatherization Assistance and WDR Programs**: Virginia receives annual federal formula funding to reduce low-income household energy use through the installation of energy savings measures. Since 2015 Virginia has received $42.5 million from WAP.[92]

[90] U.S. DOE. "Assistance for Latest and Zero Building Energy Code Adoption (Sec. 50131)," September 19, 2023. https://www.energy.gov/sites/default/files/2023-11/IRA-Codes-Program-ALRD_11-17-23_Mod0002.pdf.
[91] Virginia Energy. "Inflation Reduction Act Rebates and Tax Credits." Virginia Energy, 2024. https://energy.virginia.gov/energy-efficiency/Inflation-Reduction-Act-FAQ.shtml.
[92] U.S. DOE. "State and Community Energy Programs Project Map – Virginia." Energy.gov, 2024. https://www.energy.gov/scep/articles/state-and-community-energy-programs-project-map-virginia.

- **EPA Greenhouse Gas Reduction Fund:** The GHG reduction fund is a $27 billion investment to mobilize financing and private capital to reduce GHG emissions. The fund will be implemented via three grant competitions the $14 billion National Clean Investment Fund, the $6 billion Clean Communities Investment Accelerator, and the $7 billion Solar for All competition.
- **DOE Energy Efficiency Revolving Loan Fund:** This funding will provide capitalization grants to States to establish a revolving loan fund under which the state shall provide loans and grants for energy efficiency audits, upgrades, and retrofits to increase energy efficiency and improve the comfort of buildings.
- **DOE Energy Efficiency and Conservation Block Grant (EECBG):** EECBG funding provides assistance to local governments, states, and tribes to implement strategies to increase energy efficiency and reduce energy usage and fossil fuel emissions. Larger localities are eligible for a direct formula allocation from DOE; Virginia Energy will receive additional EECBG funding, of which at least 60% must go to smaller localities that are not eligible for formula funding. Approximately $8M is expected to be provided to communities not eligible for formula funding through a competitive DOE process.[93]
- **HUD Green and Resilient Retrofit Program:** The U.S. Department of Housing and Urban Development (HUD) runs the Green and Resilient Retrofit Program (GRRP), which provides owners of HUD-assisted multifamily housing with funding to reduce carbon emissions, improve utility efficiency, incorporate renewable energy sources, and make properties more resilient to climate hazards.
- **Federal tax credits:** These include residential and commercial tax incentives for a variety of energy efficiency and other low-emission technologies.

Benefits

Reduced use of combustion fuels on site (e.g., natural gas and propane) will have localized indoor and outdoor air quality benefits (e.g., reduced emissions of $PM_{2.5}$, CO, SO_2, and NO_X). Transitioning to electric equipment may result in increased emissions from electricity generation (e.g., $PM_{2.5}$, CO, SO_2, NO_X, VOCs, ozone), but this may be offset with clean and renewable generating resources.

LIDAC Benefits and Co-Benefits

Increasing energy efficiency reduces electric grid load and combustion of other energy sources, thereby reducing associated air pollution, leading to public health benefits. [94] Additional benefits for LIDACs within Virginia may include using less energy which results in energy costs savings and can help alleviate energy burden (percent of household income spent on home energy bills); increased indoor comfort during cold and warm seasons; increased resilience to homes and small businesses;

[93] VAEEC. "EECBG Toolkit." Virginia Energy Efficiency Council, 2024. https://vaeec.org/federal-funding-opportunities/eecbg-toolkit/.
[94] U.S. EPA. "Quantifying the Multiple Benefits of Energy Efficiency and Renewable Energy, A Guide for State and Local Governments." 2018. https://www.epa.gov/sites/default/files/2018-07/documents/epa_slb_multiple_benefits_508.pdf.

and job creation through the designing, producing, installing, and maintaining energy-efficient equipment and appliances, and other energy-efficient measures/products.

It Is important to note that intentional engagement and planning is essential to provide LIDACs with meaningful benefits. Failure in program design and mechanisms may lead to significant challenges within LIDACs, including capital cost barriers, renter/owner dynamics, or potentially greater energy burden as a result of increased costs associated with technology transitions. [95]

Metrics

Potential metrics to measure progress under this measure could include the following:

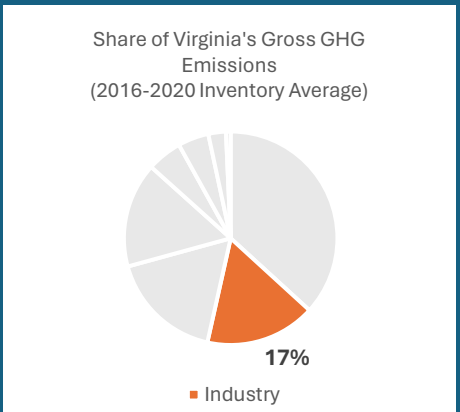
- Number of residential units retrofitted across the Commonwealth and in LIDACs
- Amount of commercial square footage retrofitted across the Commonwealth and in LIDACs
- Energy savings for projects
- Dollar amount of used incentives or rebates

[95] World Resources Institute. "Achieving Social Equity in Climate Action: Untapped Opportunities and Building Blocks for Leaving No One Behind." 2021. https://www.wri.org/research/achieving-social-equity-climate-action.

Measure 5: Increase industrial energy efficiency and identify and implement opportunities for GHG emission reduction solutions at industrial facilities.

This measure focuses on reducing emissions in Virginia's industrial sector through increasing industrial energy efficiency, cleaner technologies, and other emission reduction solutions and facilitating the transition of energy intensive sectors toward less carbon intensive production methods. This measure aims to support cost-effective new and existing initiatives for industrial energy efficiency and clean and alternative fuels initiatives. Large point sources of industrial GHG emissions in Virginia include chemicals, minerals, and metals manufacturing and pulp and paper production. These industries vary significantly in overall energy needs and manufacturing processes, thermal needs of process equipment, on-demand energy, and other specialized factors. For these reasons, alternative fuels are not feasible for all industrial operations.

Relevant GHG inventory sectors:



Cumulative GHG Reductions from 2025-2030*:

1.93 $MMTCO_2e$

Cumulative GHG Reductions from 2025-2050*:

45.41 $MMTCO_2e$

**See Appendix F for a summary of methods, data, and assumptions.*

Potential Implementing Agencies and Partners

Potential implementers and examples of their current, future, or potential roles in this measure include:

- **Virginia Energy:** Coordinates several state energy efficiency programs.
- **Virginia PACE Authority:** Administers the C-PACE financing program.
- **Utilities:** Several utilities already support energy efficiency initiatives, and opportunities for other partnerships are possible.
- **Private sector:** Set corporate commitments and make business decisions to support a low-carbon industrial economy.

Progress to Date and Future Activities and Milestones

The State's C-PACE is an innovative clean energy financing tool that provides 100% upfront capital to property owners who want to upgrade their buildings with energy efficiency, renewable energy, and water management systems.[96] While designed primarily for commercial buildings, C-PACE could be applied to industrial facilities. The 2022 Virginia Energy Plan also highlights the state's commitment to investing in emerging low-carbon fuel alternatives and technologies such as long-duration battery storage, hydrogen, small modular nuclear reactors, and carbon capture, utilization, and storage (CCUS).[97] Although the energy plan focuses on utilizing these technologies for clean

[96] Virginia Energy, C-PACE Program. Virginia DOE. https://www.energy.virginia.gov/energy-efficiency/PACE.shtml
[97] Virginia DOE. 2022. 2022 Energy Plan. https://energy.virginia.gov/energy-efficiency/documents/2022_Virginia_Energy_Plan.pdf

energy generation and to reduce GHG emissions from powerplants, hydrogen and CCUS technologies can be explored to mitigate emissions at industrial manufacturing facilities as well.

VCEA created an Energy Efficiency Resource Standard that requires utilities to implement programs designed to achieve energy savings relative to 2019 electricity sales.[98] The legislation provides that the utilities can invest in new Combined Heat and Power (CHP) and Waste Heat to Power facilities to reach these energy efficiency goals under certain conditions.

The CHP Technology Roadmap published in 2020 outlines opportunities to achieve CHP goals laid out by the previous 2018 Virginia Energy Plan.[99] The CHP roadmap highlights the potential for additional capacity from CHP installations of 4,308 megawatts (MW) across 7,291 potential existing sites in Virginia, with most of that potential consisting of commercial and institutional facilities. Energy efficiency can be dramatically improved by utilizing CHP systems that can achieve combined efficiencies of 60–80% for producing electricity and thermal energy while the efficiency of fossil-fueled power plants in the United States is typically half that range. HB 1899 ended the Coal Employment and Production Incentive Tax Credit and Coalfield Employment Enhancement Tax Credit after tax year 2021 and prohibited the allocation of such credits on and after January 1, 2022.[100]

The Renewable Energy Pilot Program (REPP), created and implemented by the Virginia SCC, allows large commercial and industrial customers to contract for renewable energy under power purchase agreements.[101] Under a purchase power agreement, a non-utility developer installs a solar or wind generating facility on a customers' property and then sells the electricity generated by them back to that customer. Three Virginia utility companies have pilot programs—Appalachian Power Company, Dominion Energy Virginia, and Kentucky Utilities/Old Dominion Power. After approval from the SCC for a power purchase agreement, the utility at hand will work with the third-party energy supplier and the customer to interconnect to the distribution grid and to install any necessary metering. This program may provide clean energy options for big-box retailers, data centers, and other industrial production and manufacturing companies, many of which have around the clock electricity needs that still require utility power generation and power delivery infrastructure.

In addition to continuing the activities described above, the example actions for Measure 5 implementation are outlined in Table 11. These actions are illustrative and not intended to be exhaustive of all actions that could be used to implement this measure.

[98] Virginia's Legislative Information System. 2020. HB 1526 Electric utility regulation; environmental goals. https://lis.virginia.gov/cgi-bin/legp604.exe?201+sum+HB1526
[99] DMME. 2020. Combined Heat and Power Technology Roadmap for Virginia. https://www.energy.virginia.gov/energy-efficiency/documents/CHP%20Roadmap-20201106.pdf
[100] Virginia's Legislative Information System. 2021. HB 1899 Coal tax credits; sunset date. https://lis.virginia.gov/cgi-bin/legp604.exe?212+sum+HB1899S
[101] Virginia SCC. "Renewable Energy Pilot Program." 2024. https://scc.virginia.gov/pages/Renewable-Energy-Pilot-Program.

Table 11: Example Actions for Measure 5

Example Actions	Status
Provide financing (such as C-PACE) to help property owners upgrade facilities with energy efficiency, renewable energy, and water management systems.	Potential
Support emission reduction options including electrification of common end uses, electrification of industrial processes, and use of low-carbon fuels (e.g., hydrogen, RNG or other lower carbon gases) for hard-to-electrify processes.	Piloted
Expand incentive programs to encourage energy efficiency through financial incentives as well as services such as energy audits and related site assessments and project development services.	Potential

Authority to Implement

Virginia Energy has the authority to implement various energy efficiency and other clean energy programs under its existing charter. Utilities are authorized to implement similar programs subject to regulatory review and approval; new state efforts would be designed to complement those implemented under utility authority. Private commercial and industrial businesses that own or operate facilities receiving support under this measure would use their existing authority to install and operate projects.

Geographic Coverage

The actions within this measure are focused on areas in Virginia that have a higher concentration of industrial activity than others.

Funding Sources

Federal funding sources identified to date for actions under this measure include the following:

- **C-PACE Program:** Virginia's C-PACE Program is authorized by the Virginia PACE Authority C-PACE provides 100% upfront capital to property owners who want to upgrade their buildings with energy efficiency, renewable energy, and water management systems.[102] C-PACE can be used for industrial facilities in some cases.
- **DOE Industrial Efficiency and Decarbonization Funding Opportunity:** DOE announced $135 million in funding for 40 projects that will reduce the carbon footprint of the industrial sector and move the U.S. toward a net-zero emissions economy by 2050.[103] The University of Virginia received $2,195,281 to research how to reduce the energy and emissions impact of styrene production (a common chemical used to produce latex, synthetic rubber, and insulation) by eliminating the need to produce the energy intensive, intermediate chemicals. This project will scale the two new processes for styrene production, which could reduce

[102] Virginia Energy. C-PACE Program. Virginia DOE. https://www.energy.virginia.gov/energy-efficiency/PACE.shtml
[103] Industrial Efficiency and Decarbonization Office. Industrial Efficiency and Decarbonization Funding Opportunity Announcement. Energy.Gov. https://www.energy.gov/eere/iedo/industrial-efficiency-and-decarbonization-funding-opportunity-announcement

process complexity, carbon emissions, and energy consumption by 50-75% compared to traditional styrene production.[104]

- **EPA National Clean Investment fund and the Clean Communities Investment Accelerator:** This funding will provide competitive grants to non-profit organizations to provide accessible, affordable financing for clean technology projects across the country, particularly for LIDAC communities.

Benefits

Reduced use of combustion fuels on site (e.g., natural gas and propane) will have localized indoor and outdoor air quality benefits (e.g., reduced emissions of $PM_{2.5}$, CO, SO_2, and NO_X). Transitioning to electric equipment may result in increased emissions from electricity generation (e.g., $PM_{2.5}$, CO, SO_2, NO_X, VOCs, and ozone), but this may be offset by using clean and renewable generating resources.

LIDAC Benefits and Co-Benefits

Benefits for LIDACs in Virginia may include improved air quality, and therefore health benefits, resulting from potential reductions in industrial pollution emissions. Implementing this measure will also lead to reductions in health issues (e.g., asthma cases in children) for surrounding communities and potential reduced health care costs. An additional benefit from this measure could be potential for new or higher paying job opportunities through training programs targeted at LIDAC residents and businesses.[105]

Metrics

Potential metrics to measure progress under this measure could include the following:

- Changes in carbon intensity per unit output/product produced
- Financing/incentives used
- GHG emissions of large point sources over time (e.g., are reported through the EPA Greenhouse Gas Reporting Program)

[104] U.S. DOE. "Funding Selections: Industrial Efficiency and Decarbonization FOA." Energy.gov, 2024. https://www.energy.gov/eere/iedo/funding-selections-industrial-efficiency-and-decarbonization-foa-0.
[105] U.S. EPA. "Quantifying the Multiple Benefits of Energy Efficiency and Renewable Energy, A Guide for State and Local Governments." 2018. https://www.epa.gov/statelocalenergy/quantifying-multiple-benefits-energy-efficiency-and-renewable-energy-guide-state

Measure 6: Reduce GHG emissions from the electric power sector and improve grid reliability and security.

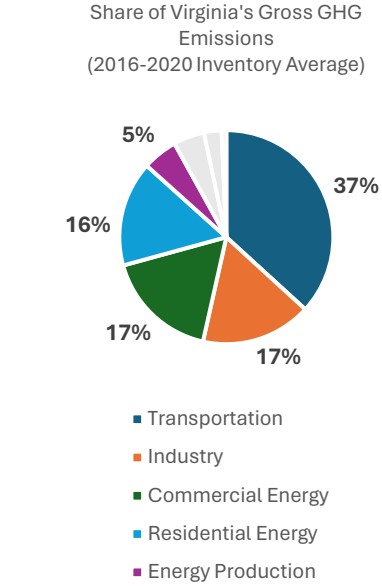
This measure focuses on reducing GHG emissions from Virginia's electric power sector and improving grid reliability and security through the deployment of clean and renewable energy resources and investments in grid infrastructure. Actions under this measure may include support for renewable energy purchasing and investment in infrastructure for clean energy expansion, including enhancing infrastructure resilience and reliability. The 2022 Virginia Energy Plan assesses the current state of the Commonwealth's energy economy and a provides a series of recommendations for policymakers and industry participants to reduce GHG emissions from the power sector.[106] The 2022 Plan found that Virginia has had a dramatic shift in electricity generation over the last ten years and is continuing to strive to reduce GHG emissions from the electric power sector as demonstrated by the state's 2019 energy production targets and strategies to meet these targets outlined in VCEA.[107]

Potential Implementing Agencies and Partners

Potential implementers and examples of their current, future, or potential roles in this measure include:

- **Utilities:** Provide or procure cleaner generation resources and related assets. Comply with various legislative requirements and goals that have been codified.
- **Virginia SCC:** Leads the REPP and regulates the development of new generating facilities and the provisions affecting utilities in VCEA.
- **Virginia Energy:** Administers federal funding programs and develops state energy plans. Also delivers programs, such as SolSmart, to develop distributed renewable energy resources across the Commonwealth.[108]

Relevant GHG inventory sectors:



This measure addresses electricity sources, which will result in GHG reductions from end use electricity consumption across the sectors shown in the figure above.

Cumulative GHG Reductions from 2025–2030*:

35.89 $MMTCO_2e$

Cumulative GHG Reductions from 2025–2050*:

321.07 $MMTCO_2e$

**See Appendix F for a summary of methods, data, and assumptions.*

[106] Virginia DOE. 2022. 2022 Energy Plan. https://energy.virginia.gov/energy-efficiency/documents/2022_Virginia_Energy_Plan.pdf
[107] Virginia's Legislative Information System. 2020. HB 1526 electric utility regulation; environmental goals. https://lis.virginia.gov/cgi-bin/legp604.exe?201+sum+HB1526
[108] Virginia Energy. "SolSmart." Virginia Department of Energy. https://www.energy.virginia.gov/renewable-energy/SolSmart.shtml.

- **Virginia Solar Energy Development and Energy Storage Authority:** Leads the development of solar energy development and storage projects in Virginia.
- **Virginia Offshore Wind Development Authority:** Lead the development of offshore wind projects in Virginia waters.
- **Virginia Nuclear Energy Consortium Authority:** Lead the development of nuclear energy production in Virginia.

Progress to Date and Future Activities and Milestones

In 2020, Virginia passed the Virginia Clean Economy Act (VCEA), which builds on previous state-level energy policy goals including the Grid Transformation and Security Act of 2018 and the Executive Order 43 of 2019 and established the following mandates and targets:

- By 2030, 30% of Virginia's electric system will be powered by renewable energy resources.
- By 2035, Virginia will deploy 3.1 GWs of energy storage systems to support a clean and reliable grid.
- By 2045, 100% of Virginia's electricity will be produced from carbon-free sources, such as wind, solar, and nuclear.

Virginia has already undertaken several key actions to work toward achieving these goals. As part of DEQ's efforts to ensure access to clean air and reliable energy, the agency issues permits for renewable energy projects with a generation capacity of 5 to 150 MW under Virginia's "Permit by Rule" (PBR) statute.[109] Applicants can obtain authorization from DEQ by agreeing to comply with construction and operating requirements. Virginia established the Clean Energy Advisory Board in 2019 to establish a solar loan and rebate pilot program and fund for disbursing loans or rebates for the installation of solar energy infrastructure in low-income and moderate-income households. Virginia also established a shared solar program in 2020, which provides customers of Dominion Energy Virginia (approximately two-thirds of Virginians) the opportunity to participate in shared solar projects.[110] Virginia additionally launched SolSmart, a no-cost technical partner program, with support from The Solar Foundation to bring solar-specific resources and technical assistance to localities across Virginia.[111]

The Energy Information Administration's Preliminary Monthly Electric Generator Inventory Report for January 2024 reported that Virginia has 3,630.1 MW of installed solar capacity.[112] These low-cost, intermittent sources comprise 3% of the Commonwealth's power capacity. Most of the Commonwealth's capacity is comprised of baseload generation sources, such as natural gas (50%) and nuclear (14%). Comparatively, the total capacity mix of PJM includes significantly more coal at

[109] Code of Virginia. 2022. 9VAC15-100-100. Permit by rule change of ownership, project modifications, reporting, and permit termination. https://law.lis.virginia.gov/admincode/title9/agency15/chapter100/section100/
[110] U.S. Energy Information Administration, 2022 Annual Electric Power Industry Report, https://www.eia.gov/electricity/data/eia861/.
[111] Virginia Energy. SolSmart. Virginia DOE. https://www.energy.virginia.gov/renewable-energy/SolSmart.shtml
[112] U.S. Energy Information Administration, January 2024 Preliminary Monthly Electric Generator Inventory Report. https://www.eia.gov/electricity/data/eia860M/.

27% (compared to Virginia's 11%), similar levels of nuclear (17%) and intermittent sources (2%) as Virginia, and lower amounts of natural gas (44%) .

The 2022 Virginia Energy Plan advocates for exploratory investments to capitalize on the long-term opportunities of other clean energy generation technologies, such as small modular nuclear reactors (SMR) and hydrogen, as well as CCUS advancements. The plan especially emphasizes the need to invest in SMR technologies and supports funding to initiate the goal of deploying a commercial SMR. Virginia also developed the Virginia Energy Security Plan to identify methods to strengthen the physical and cyber security of Virginia's energy infrastructure and mitigate the risk of energy supply disruptions. Virginia submitted their State Energy Security Plan to the DOE in September 2023 to receive SEP funding.

In October 2022, Governor Glenn Youngkin announced a plan to allocate $10 million to establish the Virginia Power Innovation Fund. This fund will support research and development in innovative energy technologies such as nuclear, hydrogen, carbon capture, and long-duration battery storage. Five million dollars of this funding will contribute to the growth of Virginia's nuclear energy industry, including the establishment of a Virginia Nuclear Innovation Hub. The proposal also includes grants for higher education institutions to study Small Modular Nuclear Reactor technology, funding for nuclear workforce development and financial support for exploring potential SMR sites.

Virginia has also made significant progress in accelerating the deployment of offshore wind technology. The Virginia Offshore Wind Development Authority was created by 2010 legislation—Title 45.2, Chapter 18, Code of Virginia with the mission to facilitate, coordinate and support development of the offshore wind energy industry, offshore wind energy projects and supply chain vendors. [113] Virginia is now home to the largest offshore wind project that is still in active development, Dominion's Coastal Virginia Offshore Wind (CVOW) commercial project. [114] The Department of the Interior announced the approval of the construction and operation of the CVOW project in October 2023. This is a 2.6-gigawatt wind farm that will consist of 176 wind turbines. Construction is scheduled to begin in 2024 and be completed in 2026.

The Virginia Grid Reliability Improvement Program was established to enhance the resilience of the electric grid against disruptive events with specific objectives to reduce grid disruptions through investing in the modernization of the grid infrastructure through technologies such as innovative technologies such as long-duration battery storage to provide consumers access to reliable, affordable, and clean energy. [115]

HB 1919 of 2021 authorized Virginia localities to establish local green banks to promote the investment in clean energy technologies and provide financing for clean energy technologies. [116]

[113] Code of Virginia. 2021. Title 45.2. Mines, Minerals, and Energy. https://law.lis.virginia.gov/vacode/title45.2/chapter18/
[114] Dominion Energy. Coastal Virginia Offshore Wind. https://coastalvawind.com/about-offshore-wind.aspx
[115] Virginia Energy. Virginia Grid Reliability Improvement Program. Virginia DOE. https://www.energy.virginia.gov/energy-efficiency/VGRIP.shtml
[116] Virginia's Legislative Information System. 2021. HB 1919 Local green banks; authorizes a locality, by ordinance, to establish. https://lis.virginia.gov/cgi-bin/legp604.exe?211+sum+HB1919

In addition to continuing the activities described above, the example actions for Measure 6 implementation are outlined in Table 12. These actions are illustrative and not intended to be exhaustive of all actions that could be used to implement this measure.

Table 12: Example Actions for Measure 6

Example Actions	Status
Accelerate the development of offshore wind, onshore wind, solar, and nuclear energy.	Ongoing
Increase support for DEQ small to medium renewable energy PBR program, working with Virginia Energy and the SCC to promote both large-scale and community-based clean energy projects.	Ongoing
Expedite approvals of transmission line projects.	Planned
Expand existing solar programs such as through the Solar for All program funded by EPA's Greenhouse Gas Reduction Fund, to increase solar deployment for low- and moderate-income households.	Ongoing/ Planned
Provide funding and programs for microgrids, with renewable power generation and long-duration battery storage (e.g., to community-based organizations particularly in frontline communities).	Planned
Expedite renewable energy siting on brownfields, mine lands, other disturbed lands.	Planned
Make strategic investments in innovative, emerging technologies, including hydrogen, CCUS, and SMR.	Planned
Collaborate with the Monacan Indian Nation and other Tribes of Virginia in conducting a tribal-focused renewable feasibility study.	Potential
Ensure that all power sector projects are available to and easily accessed by tribal citizens.	Potential

Authority to Implement

The SCC, State Air Pollution Control Board, Virginia Energy, and the state's utilities have existing authorities, described earlier in this section, under which they can implement the kinds of actions described under this measure.

Geographic Coverage

The actions within this measure apply across Virginia.

Funding Sources

Federal funding sources identified to date for actions under this measure include the following:

- **DOE Grid Resilience and Innovation Partnerships (GRIP) program:** As part of BIL, the DOE's Grid Deployment Office is administering a $10.5 billion GRIP program to enhance grid flexibility and improve the resilience of the power system against growing threats of extreme weather and climate change. In 2023, Virginia Electric and Power Company (Dominion Energy Virginia) received $33,654,095 in Smart Grid Grant funding, a subset of GRIP funding, to help expand the critical grid management capabilities needed to steward the energy

transition responsibly and effectively.[117] Rappahannock Electric also received a GRIP grant of $38,162,015 to deploy a distributed energy resources management system, coupled with an advanced metering upgrade and a fiber utility network connecting various nodes and devices throughout REC's service territory.[118]

- **DOE Grid Resilience State and Tribal Formula Grant (BIL Section 40101(d)):** Managed by the DOE's Grid Deployment Office, the Grid Resilience State and Tribal Formula Grants provide non-competitive funding to states to improve the resilience of their electric grids. Administered by the National Energy Technology Laboratory and falling under BIL provision 40101(d), the program is designed to strengthen and modernize America's power grid against wildfires, extreme weather, and other natural disasters that are exacerbated by the climate crisis. Virginia was allocated $6,438,397 in funds for the program for fiscal year 2024.[119]
- **DOE SEP:** This DOE formula grant program provides basic operating support for Virginia Energy. Supplemental SEP funding under the Bipartisan Infrastructure Law enables the Agency to add program activities it proposes to DOE.
- **DOE EECBG:** EECBG funding provides assistance to local governments, states, and tribes to implement strategies to increase energy efficiency and reduce energy usage and fossil fuel emissions. Larger localities are eligible for a direct formula allocation from DOE and Virginia Energy will receive an additional $2.6M for EECBGs; at least 60% must go to localities that are not eligible for formula funding. Approximately $8M will be provided to communities not eligible for formula funding through a competitive DOE process.[120]
- **EPA Greenhouse Gas Reduction Fund:** The GHG reduction fund is a $27 billion investment to mobilize financing and private capital to reduce greenhouse gas emissions. The fund will be implemented via three grant competitions, including the Solar for All competition.
- **EPA Solar for All:** Part of the GHG Reduction Fund, this funding will help expand the number of LIDACs primed for residential solar investment—enabling millions of low-income households to access affordable, resilient, and clean solar energy.
- **EPA National Clean Investment fund and Clean Communities Investment Accelerator:** This funding will provide competitive grants to non-profit organizations to provide accessible, affordable financing for clean technology projects across the country, particularly for LIDAC communities.
- **HUD Green and Resilient Retrofit Program (GRRP):** The U.S. Department of HUD runs the GRRP, which provides owners of HUD-assisted multifamily housing with funding to reduce

[117] U.S. DOE Grid Deployment Office. "MODERNIZING INFRASTRUCTURE TO SUPPORT GRID MANAGEMENT AND DECARBONIZATION." Grid Deployment Office, October 2023. https://www.energy.gov/sites/default/files/2023-11/DOE_GRIP_2038_Virginia%20Electric%20and%20Power%20Co.%20%28Dominion%20Energy%20Virginia%29_v4_RELEASE_508.pdf
[118] https://www.energy.gov/sites/default/files/2023-10/DOE-GRIP-Rappahannock-Electric-Cooperative.pdf
[119] U.S. DOE Grid Deployment Office. "Allocation of Funds." National Energy Technology Laboratory, December 2023. https://netl.doe.gov/sites/default/files/2023-12/FY24%20Allocations%20Table.pdf.
[120] VAEEC. "EECBG Toolkit." Virginia Energy Efficiency Council, 2024. https://vaeec.org/federal-funding-opportunities/eecbg-toolkit/.

carbon emissions, improve utility efficiency, incorporate renewable energy sources, and make properties more resilient to climate hazards.

- **Other State Programs:** Other state funding programs include The Virginia Grid Reliability Improvement Program that provides up to $10,402,496 in total amount of funding available to enhance the resilience of the electric grid against disruptive events, the Virginia Power Innovation Fund, Virginia community solar programs, and potential future loan programs from green banks established via HB 1919.[121, 122]

Benefits

Reducing GHG emissions from the electric grid will lead to reduced emissions of CO, NOx, SO_2, $PM_{2.5}$, and other air toxics and pollutants, such as ozone.

LIDAC Benefits and Co-Benefits

Reducing GHG emissions from electricity generation will reduce criteria pollutant emissions such as NOx, SO_2, $PM_{2.5}$, and VOCs that are ground-level ozone precursors, resulting in public health outcomes related to air pollution and air quality will improve, resulting also in reduced health care costs. This is particularly relevant for LIDACs, as they have been historically disadvantaged by the siting of energy projects that produce environmental hazards and significant public and environmental health impacts.

This measure also will lead to the creation of new jobs in construction, operation, and maintenance of these clean energy facilities – these jobs could be targeted at LIDACs. In addition, there is a need for workers in the power sector to enable updates to transmission and distribution.

Precedent exists for developing solar projects on the brownfield sites. Doing so can increase nearby home property values and maintain the tax base of the area.

Grid reliability, and increased resilience creating fewer economic disruptions that could impact lives, businesses, and critical services within LIDACs and across the Commonwealth, can be achieved through a diverse mix of energy resources, such as renewables, SMR, and combustion with CCUS.

Metrics

Potential metrics to measure progress under this measure could include the following:

- MW of wind, solar, and other renewable energy systems deployed (grid-scale and distributed)
- MW of clean energy systems deployed (e.g., hydrogen and combustion with CCUS)
- Number of hydrogen or CCUS projects
- Carbon intensity of megawatt hour (MWh) of power generated in Virginia over time

[121] Virginia Energy. Virginia Grid Reliability Improvement Program. Virginia DOE. https://www.energy.virginia.gov/energy-efficiency/VGRIP.shtml
[122] Virginia's Legislative Information System. 2021. HB 1919 Local green banks; authorizes a locality, by ordinance, to establish. https://lis.virginia.gov/cgi-bin/legp604.exe?211+sum+HB1919

Measure 7: Deploy renewable energy, energy efficiency, energy storage, and low-carbon and resilient solutions for state and local government buildings and public fleets and transit, including infrastructure.

This measure focuses on deploying low-carbon and resilient solutions for state, local, and public institutional facilities, and operations. This measure applies to state, municipal, and school buildings, operations, and fleets, among other public and institutional facilities. It includes energy efficiency, and other actions to help facilitate reduction of GHG emissions from government buildings and operations. Actions in this measure will reduce energy costs and provide resilience. They will also provide opportunities to lead by example and learn from others across the Commonwealth.

Potential Implementing Agencies and Partners

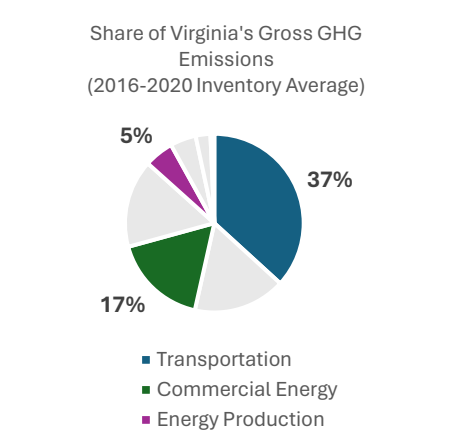
Potential implementers and examples of their current, future, or potential roles in this measure include:

- **State agencies, local governments, public schools, and universities:** Set goals and develop plans and policies, make climate-friendly procurement decisions.
- **Virginia Department of General Services:** Update procurement policies and guidance.

Progress to Date and Future Activities and Milestones

Virginia has begun to reduce GHG emissions from state buildings through the High-Performance Buildings Act, passed in 2021.[123] The act sets energy requirements for new and renovated state-owned buildings, which must comply with Virginia Energy Conservation and Environmental Standards, have ZEV infrastructure, and be able to monitor building energy consumption and associated carbon emissions. In addition, some buildings must incorporate resilience and distributed energy features. This act took effect for some types of state-owned buildings in 2021 and for all state-owned buildings in 2023.

Relevant GHG inventory sectors:



Cumulative GHG Reductions from 2025–2030*:

1.95 $MMTCO_2e$

Cumulative GHG Reductions from 2025–2050*:

9.74 $MMTCO_2e$

**See Appendix F for a summary of methods, data, and assumptions.*

The GHG reductions presented here represent an example of potential GHG reductions for state-owned office facilities. Due to current timing and data limitations, additional reductions from other state and all local government buildings and all state and local government and school operations could not be estimated but will be for the CCAP. The GHG reductions presented here likely overlap with the GHG reductions presented for Measures 1, 3, 4, and 8.

[123] Code of Virginia. 2021. Article 8. High Performance Buildings Act." https://law.lis.virginia.gov/vacodefull/title2.2/chapter11/article8/

Virginia has also supported energy efficiency efforts at state agencies and other public facilities through Virginia Energy's Energy Savings Performance Contracting Program, which allows state agencies and local government entities to enter contracts with energy service companies to reduce energy costs through efficiency measures.[124] In June 2021, the program celebrated over $1 billion in cumulative energy savings across the Commonwealth.

Local governments are also implementing efforts to increase energy efficiency and use renewable energy in government buildings to achieve carbon neutrality. For example, the City of Charlottesville plans to use onsite solar, equipment upgrades, and changes in operations to reduce their emissions in 2030 to 55% of their 2011 emissions level. Several municipalities across the state are also transitioning streetlights to LEDs to reduce energy use.

Virginia has encouraged schools to adopt renewable energy. Solar energy installation is one avenue for new or renovated public school buildings to meet the requirements of §22.1-141.1 in the Code of Virginia which mandates that such buildings generate more energy than they consume.[125] The VCEA and §56-589.1 of the Code of Virginia allows schools that choose to generate solar energy to contract to sell excess energy to utility providers and thereby offset costs associated with purchasing solar panels.[126, 127] Several Virginia public schools have installed solar energy systems.

Federal, state, and private investment have supported existing efforts to convert publicly owned fleets to lower-carbon fuel sources. Electric school bus deployment has been a major achievement to date, with over 300 electric buses in service or on order.

Another key initiative for public agencies to implement low-carbon solutions for their operations is through recycled materials and waste reduction. Virginia has established a legal mandate, outlined in §10.1-1425.6, requiring public institutions of higher education and state agencies, including the General Assembly, to develop recycling programs. These programs are designed to promote the use of recycled materials and facilitate the collection of recyclable items, such as motor oil, glass, aluminum, office paper, and corrugated paper. The Department of Waste Management is designated as the lead agency for the Commonwealth's recycling efforts and is responsible for developing relevant programs and plans. To implement these recycling initiatives, each Commonwealth agency must establish procedures for the collection and storage of recyclable materials, the disposal of such materials to buyers, and the reduction of waste generated by the agency.

In addition to continuing the activities described above, Table 13 outlines the example actions for Measure 7 implementation. These actions are illustrative and not intended to be exhaustive of all actions that could be used to implement this measure.

[124] Virginia Energy. Energy Savings Performance Contract. Virginia DOE. https://www.energy.virginia.gov/energy-efficiency/PerformanceContracting.shtml
[125] Code of Virginia. 2019. Article 3. Public School Building and Facilities Modernization. § 22.1-141.1. Standards for buildings and facilities. https://law.lis.virginia.gov/vacodefull/title22.1/chapter9/article3/
[126] VA State Legislature. 2020. HB 1526. Virginia Clean Economy Act. LegiScan. https://legiscan.com/VA/bill/HB1526/2020
[127] Code of Virginia. 2019. § 56-589.1. Energy generation by public school buildings and facilities. https://law.lis.virginia.gov/vacode/title56/chapter23/section56-589.1/.

Table 13: Example Actions for Measure 7

Example Actions	Status
Transition state and municipal-owned buildings to renewable energy (e.g., through onsite solar, power purchase agreements).	Ongoing
Replace state and municipal-owned fleets with EVs.	Ongoing
Roll out electric school buses and ZEV infrastructure to school systems across Virginia.	Ongoing
Conduct energy audits and provide support to implement energy efficiency upgrades in state, municipal, and school/university buildings.	Ongoing/Potential
Identify and fund opportunities for renewable energy retrofits for school buildings.	Ongoing/Potential
Transition all streetlights to LED.	Ongoing
Support deployment of renewable energy and storage systems for local government buildings to reduce energy costs and provide resilience in case of an electric grid outage. This support will include additional incentives to complement newly available "direct pay" options for local governments to receive energy tax credits and technical assistance for such projects.	Potential
Foster connections between tribal governments and state and local agencies and other stakeholders that will assist them in developing their own climate and energy plans.	Potential

Authority to Implement

Virginia Energy and other cognizant state entities have the authority within their charters to offer incentives and support services for the actions described under this measure. Individual agencies can often make their own procurement and operating decisions, but also need to consider alignment with requirements from general services departments. Local and regional authorities that own and operate the subject facilities and fleets have the authority to undertake the subject projects and to apply for other funding or internally raise funds for the balance of project costs.

Geographic Coverage

The actions within this measure apply across Virginia.

Funding Sources

Federal funding sources for this measure significantly overlap with the funding opportunities identified for Measures 1, 4, and 6 (e.g., EECBG, EPA Greenhouse Gas Reduction Fund, IRA tax credits), and include other funding opportunities, such as the Federal Emergency Management Agency Building Resilient Infrastructure and Communities grant program.

Potential Program Implementation Schedule

If CPRG funds were to be used to support the deployment of renewable energy and storage systems for local government buildings, a potential implementation schedule could be:

- **October 2024**: Award received from EPA
- **End of 2024:** Third-party administrator selected
- **Early 2025:** Local governments apply for and receive funding
- **Late 2025:** Projects installed
- **Early 2026:** Projects placed in service

Benefits

The potential air quality benefits of this measure are the same as outlined for Measures 1, 4, and 6.

LIDAC Benefits and Co-Benefits

The potential benefits and co-benefits of this measure for LIDACs are like those outlined for Measures 1, 4, and 6.

Actions under this measure would be open and applicable to all communities in the Commonwealth but could be prioritized to LIDAC areas in the state. This would provide additional community benefits (e.g., opportunities to serve as local community resilience hubs). Further, implementation of this measure will reduce local government energy costs allowing these agencies to divert funding they were spending on energy to provide additional services to communities. Implementing this measure will reduce emissions of pollutants from power plants, resulting in improved health outcomes. Because LIDAC communities frequently bear a disproportionate burden of environmental harms and adverse health outcomes from pollution, such communities will receive the greatest health benefits from implementation of this measure.

Because this measure also focuses on schools, additional benefits to children in LIDACs may be realized. According to the EPA, pollution from diesel buses contributes to 3,700 heart attacks, 8,800 deaths, and $100 billion in health damages each year.[128] EVs have no tailpipe emissions and can significantly reduce air pollution in comparison to diesel buses.

Metrics

Potential metrics to measure progress under this measure could include the following:

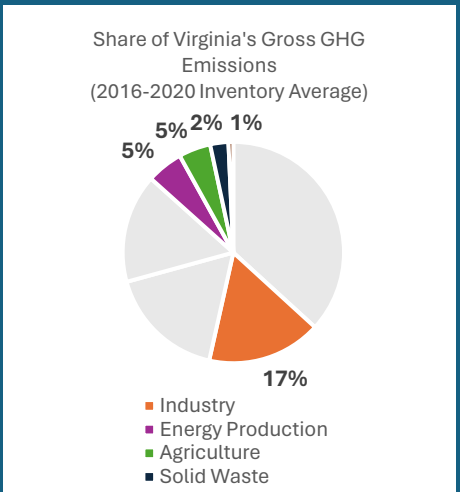
- Energy use intensity of government-owned buildings
- Number of installed or implemented projects
- Share of state or municipal fleets that are EVs or ZEVs
- Number of facilities installing renewable energy and storage
- Number of kilowatts of installed renewable energy
- Number of kilowatts of long-duration battery power installed
- Number of kilowatt hours long-duration battery capacity installed
- Number of performance years to quantify lifetime pollution reductions

[128] Clean Air Task Force. "New CATF tool maps the staggering U.S. health and economic damages caused by diesel emissions." https://www.catf.us/2022/01/new-catf-tool-maps-staggering-health-economic-damages-caused-diesel-emissions/

Measure 8: Identify and implement strategies to reduce high-potency GHG emissions from industrial processes, energy production, agriculture, waste, and wastewater treatment.

This measure focuses on actions to reduce high-potency GHG emissions from sources across the Commonwealth, particularly fluorinated GHGs (F-GHG) and methane emissions. The primary emission sources related to this measure are industry (e.g., semiconductor manufacturing, electric power systems, coolants), energy production (i.e., coal mining, oil and gas systems), agriculture, wastewater plants, and landfills.

Relevant GHG inventory sectors:



Cumulative GHG Reductions from 2025-2030*:

19.08 $MMTCO_2e$

Cumulative GHG Reductions from 2025-2050*:

87.70 $MMTCO_2e$

**See Appendix F for a summary of methods, data, and assumptions.*

Potential Implementing Agencies and Partners

Potential implementers and examples of their current, future, or potential roles in this measure include:

- **DEQ:** Ensures compliance with regulations to control emissions, while assessing the feasibility of methane reduction goals and implementing organics recycling and oil and gas emission reduction initiatives.
- **Virginia Energy:** Supports renewable natural gas projects and oil and gas emission reduction efforts.
- **Virginia Department of Agriculture and Consumer Services (VDACS):** Implements sustainable agricultural practices and waste reduction measures to decrease methane emissions, supporting organics recycling programs and methane reduction initiatives.
- **VDOT:** Supports infrastructure enhancements, including methane mitigation and fugitive emission controls.
- **DCR:** Implements methane reduction initiatives and sustainable practices, supporting organics recycling efforts and collaborating with stakeholders.
- **Facility owners and operators:** Owners or operators of solid waste disposal facilities with some exceptions, implement a gas management plan in accordance with the gas control requirements to protect the landfill cap and prevent the migration of landfill gas into structures or beyond the facility boundary.

Progress to Date and Future Activities and Milestones

High-potency GHGs, which are GHGs with a high global warming potential (GWP), absorb more energy per ton emitted than gases with a lower GWP and can therefore have a significant impact on the climate and are critical to address. Virginia has taken steps to address high-potency GHG

emissions, particularly methane and SF_6 emissions from a range of sectors. Virginia's manufacturing sector is a significant component of its economy, including manufacturing of food products, microchips and other computer and electronic equipment, chemicals, and other products that contribute to emissions of high-potency GHGs. Virginia's manufacturers and utilities are key stakeholders in the development of strategies to reduce high-potency GHGs.

Virginia regulation 9VAC25-790-550 (2008) outlines requirements for the design, operation, and maintenance of anaerobic digesters in Virginia. It emphasizes optimizing microbial degradation of organic matter, ensuring effective separation and removal of liquid, and maximizing methane gas production.[129] Virginia also passed legislation to require facilities to have landfill gas management plans addressing the control of decomposition gas requirements, as outlined in 9 VAC 20-81-200 of the Virginia Solid Waste Management Regulations. Per the requirements, the design of landfill gas monitoring and control systems shall be implemented to prevent migration of landfill gas into structures or beyond the facility boundary and protect the landfill cap.[130]

There have been several recent significant pilot and innovation projects to reduce and beneficially use methane emissions in the Commonwealth. In May of 2022, the Western Virginia Water Authority and Roanoke Gas broke ground on an innovative biogas project. The two entities entered into a cooperative agreement to produce commercial quality renewable natural gas, or RNG, from biogas produced at the Roanoke Regional Water Pollution Control Plant.[131] In January 2023, the SCC approved a project to produce commercial quality RNG from biogas produced at the Roanoke Regional Water Pollution Control Plant using an anaerobic digester.[132] Virginia Natural Gas (VNG) has initiated a five-year pilot program to promote RNG production facilities within its service territory, recently approved by the Virginia SCC. This program, part of VNG's Sustainable Gas Program, allows for the integration of RNG into its natural gas distribution system. VNG is the first local distribution company in Virginia to establish a Commission-approved tariff enabling interconnection between RNG production facilities and its distribution system.[133]

Organics diversion programs, including composting, waste reduction, and diverting tonnage to anaerobic digesters, are another key strategy to reduce methane emissions from landfills. Some Virginia localities already run and may continue to evaluate the expansion and addition of new organics diversion programs.

[129] Virginia Administrative Code. "9VAC25-790-550. Anaerobic digestion." 2008. https://law.lis.virginia.gov/admincode/title9/agency25/chapter790/section550/
[130] Virginia DEQ. "Clarification of Landfill Gas Regulatory Requirements." 2017.
[131] Virginia Resources Authority. "Innovative Biogas Project Details." 2022. https://townhall.virginia.gov/L/ViewGDoc.cfm?gdid=6251 https://www.virginiaresources.gov/portfolio/projects/41/innovative-biogas-project
[132] Tasha Durrett. "SCC Approves First Biogas Project under New Law." Southern Environmental Law Center, February 2, 2024. https://www.southernenvironment.org/press-release/scc-approves-first-biogas-project-under-new-law/.
[133] Virginia Natural Gas. "Virginia Natural Gas receives approval from Virginia State Corporation Commission for renewable natural gas pilot program." 2023. https://www.virginianaturalgas.com/news/sustainability/pursuing-a-clean-energy-future-through-environmentally-responsible-solutions-like-renewable-natural-gas.html

In addition to continuing the activities described above, the example actions for Measure 8 implementation are outlined in Table 14. These actions are illustrative and not intended to be exhaustive of all actions that could be used to implement this measure.

Table 14: Example Actions for Measure 8

Example Actions	Status
Deploy and use state and local government waste reduction and recycling programs, including food waste reduction.	Ongoing
Encourage reduction and composting of green food waste and other organics.	Ongoing
Provide tax credits for the acquisition of machinery and equipment specifically designed for processing recyclable materials.	Ongoing
Provide incentives and programmatic support for initiatives to reduce methane emissions from energy production activities, including methane capture and leak detection and repair.	Planned
Incentivize anaerobic digesters and climate-smart agricultural practices.	Planned
Incentivize reducing or capturing and beneficially reusing methane emissions from mines (coal methane abandoned or closed mines), landfills, and wastewater treatment facilities.	Planned
Encourage SF_6 reductions at microchip manufacturers.	Planned
Capture and reuse methane to achieve greatest GHG emission reductions.	Planned
Incentivize RNG development, distribution, and usage.	Planned
Incentivize high-GWP refrigerant substitution.	Planned

Authority to Implement

The identified key implementing agencies for this measure, including local governments and regional authorities, would use their existing authorities to implement source reduction, composting, new technologies, and other programmatic activities under this measure. State agencies and local and regional entities would use existing authorities to provide incentives and other services.

Geographic Coverage

The actions within this measure are focused on the state of Virginia and are not meant to encompass a broader or smaller geographic area.

Funding Sources

Federal funding sources identified to date for actions under this measure include the following:

- **EPA MERP:** Virginia Energy has been awarded $2,643,702 which will help the state support industry efforts to cut methane emissions from wells on nonfederal lands and support environmental restoration of well sites.[134]

[134] EPA. 2023. Biden-Harris Administration Announces $350 Million to 14 States to Reduce Methane Emissions from Oil and Gas Sector as Part of Investing in America Agenda. https://www.epa.gov/newsreleases/biden-harris-administration-announces-350-million-14-states-reduce-methane-emissions.

- **Additional funding opportunities for utilities:** The US Department of Agriculture (USDA) Rural Development—Electric Program and USDA Rural Energy Savings Program may provide funding for electric power utilities to achieve SF_6 emission reductions.[135]

Benefits

Implementing this measure may result in substantial localized air quality improvements through reductions in potential toxic chemicals (e.g., from landfills), VOCs, carbon monoxide, lead, $PM_{2.5}$, ozone, and other pollutants.

LIDAC Benefits and Co-Benefits

Health impacts of leakage of VOCs and other possible air toxics from oil and gas production have the greatest impact on people living near production facilities. Minimizing leakage of methane from these facilities will also minimize the leakage of VOCs that are a portion of natural gas. Thus, reduced methane leakage from oil and gas production improves environmental equity by minimizing health damages to people living close to production facilities.

Addressing methane emissions from landfills, which can be located in LIDACs, creates local benefits. Improving methane capture also better controls for emissions of hazardous air pollutants, smog-forming compounds, and odors, while reducing explosion hazards. This improves air quality, safety, public health, and quality of life for communities near landfills. Expanding landfill methane monitoring and using opportunities for RNG development can also create local jobs that could be targeted for LIDACs.

Metrics

Potential metrics to measure progress under this measure could include the following:

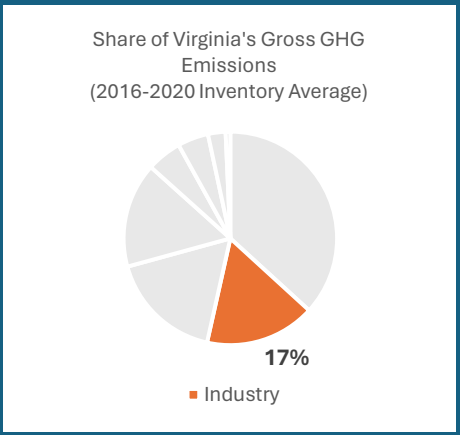
- Number of projects or pilots to capture or reuse methane
- Number of composting/organics diversion programs implemented
- Tons of organic waste diverted through organics collection programs

[135] EPA. 2023. Funding Opportunities for Electric Utilities. https://www.epa.gov/eps-partnership/funding-opportunities-electric-utilities.

Measure 9: Reduce GHG emissions from manufacturing and industrial processes, materials, and products.

This measure focuses on reducing GHG emissions from manufacturing and industrial processes and throughout the production supply chain. This measure focuses on process emissions from industry, whereas Measure 5 addresses energy use and combustion-related industrial emissions. This measure could include the deployment of carbon capture, hydrogen technologies, and other low carbon alternatives where feasible. The two measures and the actions within them will have interrelated effects on emission reductions in the industrial sector.

Relevant GHG inventory sectors:



Cumulative GHG Reductions from 2025-2030*:

22.18 $MMTCO_2e$

Cumulative GHG Reductions from 2025-2050*:

125.41 $MMTCO_2e$

**See Appendix F for a summary of methods, data, and assumptions. Emission reductions for Measure 9 overlap with some high GWP emission reductions also presented in Measure 8.*

Potential Implementing Agencies and Partners

Potential implementers and examples of their current, future, or potential roles in this measure include:

- **DEQ:** Responsible for producing guidance and programming on reducing GHG emissions from manufacturing and industrial processes. The Recyclable Materials Processing Equipment Tax Credit is an example of a program supported by DEQ.
- **Virginia Economic Development Partnership (VEDP):** Aids businesses in programming, resources, and financing opportunities that support reducing GHG emissions.
- **Virginia PACE Authority:** Administers the Virginia C-PACE financing program.
- **Local economic development authorities:** Aids businesses in programming, resources, and financing opportunities that support reducing GHG emissions.
- **Utilities and Businesses:** Implement changes to materials and infrastructure that reduce emissions in operations.

Progress to Date and Future Activities and Milestones

In addition to the industrial high-potency emission reduction actions identified in Measure 8, Virginia has several policies and programs that aid the industrial and manufacturing sector with reducing GHG emissions. Executive Order 17 (2022) directed DEQ to produce a report that identified opportunities to attract companies using post-consumer recycled materials as raw materials to the

Commonwealth. [136] The report, published in 2023, identified waste stream requirements for companies using these materials, incentives that could be offered to these companies, and geographical locations to focus on new clean technology business development. [137] Using recyclable material has significant potential to reduce GHG gas emissions from industrial processing and end waste.

DEQ offers guidance on various recycling topics and programs, actively monitoring and reporting Virginia's recycling efforts. The agency focuses on promoting awareness and enhancing the overall recycling network in the state. To incentivize businesses, DEQ provides tax credits for the acquisition of machinery and equipment specifically designed for processing recyclable materials. DEQ collaborates closely with local agencies and solid waste planning units, ensuring that recycling programs at the local level not only comply with but also surpass the state's mandated recycling rates. The agency publishes these rates annually. [138]

Senate Bill 218 (2018) mandates the Virginia DEQ to produce a report focused on recycling rates and suggestions for enhancing the dependability of recycled material supplies. [139] In response to this directive, DEQ has proactively engaged with various stakeholders, including solid waste planning units, locality recycling coordinators, recycling organizations, and other relevant parties. DEQ aims to gather diverse perspectives and insights to inform the report accurately.

In addition to continuing the activities described above, the example actions for Measure 9 implementation are outlined in Table 15. These actions are illustrative and not intended to be exhaustive of all actions that could be used to implement this measure.

Table 15: Example Actions for Measure 9

Example Actions	Status
Identify opportunities to attract companies using post-consumer recycled materials as raw materials to the Commonwealth.	Ongoing
Continue to use the Waste Diversion and Recycling Task Force.	Ongoing
Support funding for carbon and methane capture, utilization, and storage projects at commercial and industrial facilities.	Potential
Build carbon and methane recovery and capture technologies in new and existing facilities.	Potential
Redesign certain products that pose an opportunity to minimize embodied carbon.	Potential
Reinvent certain industrial processes that pose an opportunity to reduce GHG emissions.	Potential

[136] Commonwealth of Virginia, Office of the Governor. 2022. Recognizing the Value of Recycling and Waste Reduction. https://www.governor.virginia.gov/media/governorvirginiagov/governor-of-virginia/pdf/eo/EO-17-Recognizing-The-Value-of-Recycling-and-Waste-Reduction.pdf.
[137] Virginia DEQ. 2023. Opportunities for Attracting Post-Consumer Recycling Product Business Entities to the Commonwealth. https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.deq.virginia.gov%2Fhome%2Fshowpublisheddocument%2F22218%2F638409984846300000&wdOrigin=BROWSELINK.
[138] Virginia DEQ. Recycling. https://www.deq.virginia.gov/our-programs/land-waste/recycling.
[139] Virginia DEQ. Statewide Recycling Programs. https://www.deq.virginia.gov/our-programs/land-waste/recycling/statewide-recycling-programs.

Authority to Implement

DEQ and state economic development and financing agencies, such as the VEDP and VPA, have the authority to implement programming that supports reducing GHG emissions from manufacturing and industrial processes. Private commercial and industrial businesses such as utilities are authorized to implement similar programs and reduce GHG emissions in their own practices.

Geographic Coverage

The actions within this measure apply across Virginia.

Funding Sources

Federal funding sources identified to date for actions under this measure include the following:

- **Recyclable Materials Processing Equipment and Alternative Tax Credit:** This Virginia tax credit program is eligible to manufactures who purchase certified equipment and machinery to process recyclable materials. All machinery and equipment must meet DEQ certification requirements.
- **Manufacturing Sales and Use Tax Exemption:** Virginia offers a retail sale and use tax exemption for equipment that is directly reused in other manufacturing, research, or development operations.
- **Commercial Property Assessed Clean Energy (C-PACE) Program:** Virginia's C-PACE Program is authorized by the Virginia PACE Authority. C-PACE provides 100% upfront capital to property owners who want to upgrade their buildings with energy efficiency, renewable energy, and water management systems.
- **DOE Industrial Efficiency and Decarbonization Funding Opportunity Announcement:** A competitive grant opportunity that advances applied research, development, and demonstration projects that reduce GHG emissions in the industrial and manufacturing sector.

Benefits

Depending on the industry, reducing GHG emissions from manufacturing operations may reduce various types of air pollution. For example, process adjustments in cement manufacturing may further reduce NOx, SO_2, and CO.

LIDAC Benefits and Co-Benefits

Benefits LIDACs in Virginia may include improved air quality, and therefore health benefits, resulting from potential reductions in industrial pollution emissions. This measure brings potential for new or higher paying job opportunities through training programs targeted at LIDAC residents and businesses.

Metrics

Potential metrics to measure progress under this measure could include the following:

- Number of facilities using post-consumer recycled materials in the Commonwealth
- Total GHG emissions in commercial and industrial facilities
- GHG reductions from carbon and methane capture technologies
- Number of funding opportunities to support lower carbon material production and processing

Measure 10: Protect and restore high-carbon coastal habitats, wetlands, agricultural, forest and tribal lands.

Relevant GHG inventory sectors:

LULUCF, Agriculture

Cumulative Additional GHG Sequestration/Reductions from 2025-2030*:

1.12 $MMTCO_2e$

Cumulative Additional GHG Sequestration/Reductions from 2025-2050*:

11.36 $MMTCO_2e$

**See Appendix F for a summary of methods, data, and assumptions.*

The GHG inventory sectors relevant to this measure are agriculture and land use, land-use change and forestry (LULUCF). The LULUCF sector accounts for sequestration of carbon by vegetation and other land uses. This sequestration of carbon offsets emissions from other sectors. The average total CO_2e sequestered by the LULUCF sector is -53.63 $MMTCO_2e$. Maintaining Virginia's natural lands and habitats is essential to support critical ecosystem services such as cleaning air and water resources. In addition, natural lands have the potential to sequester carbon, further reducing atmospheric carbon.

This measure focuses on increasing carbon sequestration through policies, practices, and programs, and reducing other emissions due to different agricultural practices. Actions included in this measure range from educational opportunities to land management practices and tracking emission reductions from programming. Implementing carbon sequestration strategies on natural and working lands will significantly reduce Virginia's total GHG emissions.

Potential Implementing Agencies and Partners

Potential implementers and examples of their current, future, or potential roles in this measure include:

- **DEQ:** Provides programming, funding opportunities, and technical assistance in conservation and maintenance of natural and working lands.
- **Virginia Department of Forestry (DOF):** Provides programming, funding opportunities, and technical assistance for forest conservation.
- **Virginia Department of Wildlife Resources (DWR):** Provides policy expertise, programming, resource management, and technical assistance to conserve and protect wildlife habitat from loss and degradation.
- **Office of the Secretary of Natural & Historic Resources:** Provides programming and resources to preserve natural lands with historical and cultural significance.
- **Virginia Department of Conservation and Recreation (DCR):** Provides programming, funding opportunities, and technical assistance in conservation and maintenance for Virginia's state parks and natural area preserves.
- **Local Universities:** Studies on carbon reductions from natural sequestration and capture can support funding and potential programming.

- **Local governments and municipalities.** Operates land and conservation programming and policies within their jurisdictions.
- **Local non-governmental environmental organizations:** The Nature Conservancy, Chesapeake Bay Foundation, Virginia Forestry Association, and other NGOs provide programming, funding opportunities, and technical assistance in conservation and maintenance of natural and working lands.
- **Landowners:** Make decisions about land use and easements.

Progress to Date and Future Activities and Milestones

Virginia has made significant progress in increasing opportunities for carbon capture sequestration in restored and preserved natural lands. Chapter 504 of the 2021 Special Session Virginia Acts of Assembly directed the Secretary of Natural and Historic Resources, and the Secretaries of Agriculture and Forestry to convene a task force to analyze to analyze the feasibility and potential of carbon sequestration in Virginia. The Task Force was created in 2021 and included various governmental, academic, non-governmental, and private stakeholders. This effort identified existing programming with sequestrating co-benefits and proposed new ideas such as carbon markets and tax credits.

The Virginia Natural Heritage Program in the Department of Conservation and Recreation has developed a network of natural lands for Virginia named the Virginia Natural Landscape Assessment. [140] This assessment provides a landscape-scale geospatial analysis for identifying, prioritizing, and linking natural lands in Virginia using land cover data from satellite imagery to identify patches of natural land with at least one hundred acres of interior cover (or core area). The Virginia Natural Landscape Assessment has many potential applications, including identifying targets for protection activities such as conservation land purchases or easements, guiding comprehensive planning efforts by localities, and helping target lands for habitat restoration. This planning approach can help to identify and prioritize large core areas for carbon sequestration potential.

A new Chesapeake Bay agreement was signed in June 2014. The agreement included new commitments for partnership, including a new Wetlands Outcome under the Vital Habitats Goal. The Wetlands Outcome was to continually increase the capacity of wetlands to provide water quality and habitat benefits throughout the watershed, create or reestablish 85,000 acres of tidal and non-tidal wetlands, and enhance the function of an additional 150,000 acres of degraded wetlands by 2025. These activities may occur in any land use (including urban), but primarily occur in agricultural or natural landscapes. Virginia has agreed to the Major Desired Outcome for Wetlands (Chesapeake Bay 2000 Agreement, Subsection 2.3) to "(i) achieve no net loss of existing wetland acreage and function through regulatory programs; (ii) achieve net wetland resource gain through wetland restoration; and (iii) assist local governments and community groups with development of wetland preservation plans as part of integrated locally based watershed planning." Under the 2010

[140] Virginia Department of Conservation and Recreation. Virginia Natural Landscape Assessment. https://www.dcr.virginia.gov/natural-heritage/vaconvisvnla.

Agreement, Virginia committed to restoring 6,000 new acres of wetlands by 2010 within Virginia's portion of the Chesapeake Bay. In addition, Virginia has set a goal of restoring 4,000 acres outside of the Bay drainage, for a total of 10,000 new acres statewide.

As part of the Chesapeake Bay Phase III Watershed Implementation Plan, DEQ quantified carbon sequestration co-benefits of best management practices using the Department of Agriculture's Carbon Management & Emissions tool. Verified 2020 land BMPs covering 1.1 million acres resulted in an estimated 482,000 tons of CO_2e sequestration. Potential benefits from the implementation plan could see 2.9 million acres of BMPs resulting in approximately 2 million tons of CO_2e sequestration.[141] BMPs cover both natural (e.g., tree and forest practices) and working land areas (e.g., tilling and grazing) in both rural and urban settings.

In addition to continuing the activities described above, the example actions for Measure 10 implementation are outlined in Table 16. These actions are illustrative and not intended to be exhaustive of all actions that could be used to implement this measure.

Table 16: Example Actions for Measure 10

Example Actions	Status
Establish Carbon Sequestration Task Force to inform strategies and actions.	Ongoing
Create reforestation and afforestation programs/projects on natural and working lands.	Ongoing
Enhance carbon stocks in wetlands, coastal lands, and coastal estuaries.	Ongoing
Identify reforestation opportunities on degraded lands (e.g., brownfields, mine reclamation) to enhance carbon sequestration.	Ongoing
Increase support for existing programs with carbon sequestration co-benefits.	Ongoing
Explore new programs, such as carbon markets or tax credits.	Ongoing
Protect and restore high-carbon tidal and non-tidal wetlands and adjacent forested buffers, forested stream buffers, wetlands, and forest lands.	Potential
Support indigenous sovereignty through programs that boost energy efficiency and reduce fossil fuel reliance, promote cultural and historical land use practices, and minimize soil erosion, deforestation, and pollution.	Potential
Boost Monacan and other interested Tribal parties' trail capacity and linkage to state trails and wildlands. Similarly, prioritize wildlife corridors and patch connectivity to boost biodiversity, improve habitat quality, and increase carbon sequestration.	Potential

Authority to Implement

Virginia's DEQ, DWR, and DOF have the authority to support policy and programming aimed at reducing carbon through sequestration and other capture efforts. Local governments and organizations identified earlier in this section are also able to implement programming and practices to support this measure.

[141] Virginia Carbon Sequestration Task Force. 2022. Natural Carbon Sequestration in the Commonwealth. https://rga.lis.virginia.gov/Published/2022/RD77/PDF.

Geographic Coverage

The actions within this measure apply across Virginia.

Funding Sources

Federal funding sources identified to date for actions under this measure include the following:

- **USDA Forest Service Urban and Community Forestry Grants:** This federal competitive grant invests $1.5 billion in increasing equitable access to tree cover and green spaces in urban, suburban, and urban communities.
- **USDA Agricultural Conservation Easement Program:** This program, administered by USDA's Natural Resources Conservation Service, helps to protect agricultural lands, and restore wetlands previously degraded due to agricultural use.
- **Virginia DCR Agricultural Cost-Share Program:** Virginia offers federal and state funding to support the cost of conservation best management practices that also protect water quality.

Benefits

Protection and restoration of natural and working forest lands will improve air and water quality of the surrounding areas.

LIDAC Benefits and Co-Benefits

Benefits for urban LIDACs in Virginia may include increased green space to reduce heat island effect in urban areas, and overall improved air quality in communities. This directly leads to health benefits, and therefore cost savings. There is also potential for new job opportunities in ecosystem services through this measure.

Metrics

Potential metrics to measure progress under this measure could include the following:

- Tons of CO_2e sequestered from baseline
- Acreage of planned implemented best management practices
- Acres of tidal and non-tidal wetlands restored
- Acres of forestry lands restored
- Number of trees planted, in rural and urban areas, and in LIDACs
- Percent of green space in restored and preserved natural lands

6. Moving Forward

DEQ, other executive branch-level agencies, offices, and departments in Virginia, and municipalities and tribes in Virginia are eligible to participate in the general competition for CPRG implementation grants, competing against other entities nationally for up to $4.6 billion in funding.[142] Implementation grant applications are due April 1, 2024, with awards anticipated in 2024.

As the lead organization for CPRG planning deliverables, DEQ is also responsible for developing a CCAP by mid-2025 and a Status Report on CCAP progress in 2027.

The 2025 CCAP will include the following:

- An updated GHG inventory for Virginia.
- BAU GHG emissions projections and an economy-wide GHG emissions reduction scenario.
- GHG reduction targets for Virginia (short and long-term).
- A comprehensive list of GHG reduction measures that address economy-wide emissions. Building on the PCAP, this will include the following for each measure:
  - Quantified estimates of GHG reduction and costs
  - Key implementing agency or agencies
  - Implementation schedule and milestones
  - Expected geographic location if applicable
  - Quantified estimates of co-pollutant reductions (e.g., $PM_{2.5}$, NOx, SO_2, VOCs, air toxics)
  - A more robust or quantified analysis of benefits for LIDACs
  - A review of the statutory or regulatory authority to implement the measure (and a schedule and milestones for key entities to obtain authority if not existing)
  - Identification of funding sources that have been secured for implementation
  - Metrics for tracking progress
- A workforce planning analysis.

The 2027 CPRG Status Report will include the following:

- The implementation status of the quantified GHG reduction measures from the CCAP.
- Relevant updated analyses or projections supporting CCAP implementation.
- Next steps and future budget or staffing needs to continue CCAP implementation.

Table 17 outlines a general timeline for CCAP development and climate action implementation in the Commonwealth.

[142] US EPA. "CPRG Implementation Grants." October 23, 2023. https://www.epa.gov/inflation-reduction-act/cprg-implementation-grants.

Table 17: CCAP Development and Implementation Timeline

Milestone	Timeframe
2024	
Deliver final PCAP to EPA	**March 1, 2024**
Continue to engage with stakeholders on actions identified in the PCAP and seek input for the CCAP	**Throughout 2024**
Begin expanding the PCAP to lay the foundation for the CCAP	**Throughout 2024**
Begin GHG, benefits, LIDAC, workforce and supporting analysis for the CCAP	**Late 2024**
2025	
Continue to engage with stakeholders within and coordinate across the Commonwealth to determine opportunities to take initial actions across the PCAP measures	**Throughout 2025**
Continue GHG, benefits, LIDAC, workforce and supporting analyses for the CCAP	**Early 2025**
Deliver final CCAP to EPA	**Mid 2025**
2026	
Continue identifying opportunities to implement and secure funding for PCAP and CCAP measures and continue to engage with stakeholders	**Throughout 2026**
2027	
Deliver CPRG Status Report to EPA	**Mid 2027**
Continue to implement measures and reduce GHGs; track and report progress	**2027 onward**

As outlined in Section 1.2, DEQ will also continue to meaningfully engage with all stakeholders, including other state agencies, industry, community organizations, local governments, tribes, and the public throughout the development of the CCAP and in the implementation of climate actions throughout Virginia.

Appendix A. DEQ CPRG Monthly Progress Reports

Climate Pollution Reduction Grant (CPRG)

MONTHLY REPORT

Virginia Department of Environmental Quality
September 2023

Meetings and Coordination

- Internal DEQ CPRG Team meetings
  - 9/5, 9/11, 9/25
- Conveners Network sector-specific meetings: Power, Transportation, and Natural Lands & Waste
  - 9/5, 9/6, 9/7
- EPA CPRG subject workgroups: Analytics, Planning Process
  - 9/14, 9/18
- EPA CPRG meeting after NOFO release
  - 9/21
- DEQ locality-regional-state CPRG planning coordination meeting
  - 9/26

What's Coming Up Next Month?

- **LIDAC engagement planning meeting**
  - 10/5
- **Meetings with state agencies, EPA, stakeholders, and internal DEQ divisions**
  - 10/18 interagency committee meeting
- **DEQ Webinar on EPA's Notice of Funding Opportunities and implementation projects**
  - 10/31 11am. Sign up here: https://attendee.gotowebinar.com/register/5088672189031481696

Kickoff Webinar

DEQ hosted 2 webinars on September 26th to kick off the climate planning process under the recently awarded EPA Climate Pollution Reduction Grant (CPRG) program. Missed it?

View the presentation:

https://www.deq.virginia.gov/home/showpublisheddocument/19798/638314250682130000

Watch the webinar recording:

https://register.gotowebinar.com/recording/3321416154411596973

Website

DEQ has published a designated CPRG webpage for updates on the grant and planning process.

https://www.deq.virginia.gov/our-programs/air/greenhouse-gases/climate-pollution-reduction-grant

Email

Email DEQ's CPRG team with questions, comments, and concerns:

mailto:CPRG@deq.virginia.gov

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Climate Pollution Reduction Grant (CPRG)

MONTHLY REPORT

Virginia Department of Environmental Quality
October 2023

CPRG Meetings and Coordination

- Internal DEQ Air Division meetings
  - 10/3, 10/10, 10/16, 10/19, 10/23, 10/30, 10/31
- DEQ intra-agency meetings on LIDAC outreach and human geography
  - 10/5, 10/12, 10/16, 10/19, 10/23, 10/24
- Interagency and MSA meetings
  - 10/18, 10/19, 10/23
- Interstate Conveners Network CPRG Convention
  - 10/25, 10/26, 10/27
- EPA CPRG Technical workgroups
  - 10/4, 10/11, 10/12, 10/16, 10/17, 10/24, 10/25
- EPA CPRG Office Hours
  - 10/2, 10/9, 10/16, 10/23, 10/30
- Conveners Network sector meetings:
  - 10/3, 10/5, 10/12, 10/17, 10/18, 10/19

What's Coming Up in November?

- **Statewide public outreach survey**
- **Local coordination meeting**
- **Interagency meeting on measure ideas**
- **Quality Assurance Project Plan submission to EPA**
- **More internal, local-state, intra-agency, inter-agency, and regional workgroups and meetings**

DEQ Webinar on Implementation Grants

DEQ hosted a webinar on October 31st to discuss the competition for EPA Climate Pollution Reduction Grant (CPRG) implementation grants. Missed it?

View the presentation:
https://www.deq.virginia.gov/home/showpublisheddocument/21389

Watch the recording:
https://attendee.gotowebinar.com/recording/5610533393517690624

Coming to a community near you

All scheduled from 6-8pm

Monday, Dec 4: DEQ Southwest Regional Office, Training Room
355 Deadmore St SE, Abingdon, VA 24210
Tuesday, Dec 5: Danville Community College, Room 108
1007 Bonner Ave, Danville, VA 24541
Thursday, Dec 7: Massanutten Regional Library Central Branch
174 S Main St, Harrisonburg, VA 22801
Tuesday, Dec 12: Eastern Shore Community College, Rooms 147/148
29300 Lankford Hwy, Melfa, VA 23410
Thursday, Dec 14: Brunswick County Library
133 Hicks St, Lawrenceville, VA 23868

Contact Us

Visit the DEQ CPRG webpage
www.deq.virginia.gov/cprg

Email us with questions, comments, and concerns
CPRG@deq.virginia.gov

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VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Climate Pollution Reduction Grant (CPRG)

MONTHLY REPORT

Virginia Department of Environmental Quality
November 2023

CPRG Meetings

- Internal DEQ CPRG Meetings
  - 11/6 , 11/8, 11/9, 11/13 , 11/14, 11/20, 11/27
- Intra-Agency Meetings on LIDAC and Public Outreach
  - 11/2, 11/6, 11/8, 11/13, 11/16, 11/21, 11/29
- Inter-Agency Meetings
  - 11/15, 11/16, 11/30
- Local Coordination Meetings
  - 11/2, 11/14, 11/27, 11/30
- PCAP Administrative Meetings
  - 11/8, 11/17, 11/30
- EPA CPRG Technical Forums
  - 11/1, 11/2, 11/7, 11/8, 11/9, 11/13, 11/14, 11/20, 11/29
- EPA CPRG Office Hours
  - 11/6, 11/13, 11/20, 11/27

What's Coming Up in December?

- **Quality Assurance Project Plan submission to EPA**
- **Community meetings in Abingdon, Danville, Harrisonburg, Eastern Shore, and Brunswick completed**
- **Inter-agency, inter-state, and local coordination meetings on potential CPRG projects**
- **Internal DEQ Air Division meetings and intra-agency meetings**

Community Survey

DEQ has developed a Commonwealth-wide survey tool to gather input on greenhouse gas emission reduction measures. Please complete the survey by January 31st, 2024 at the link below:

https://forms.office.com/g/mFrRc9DfC0

January Community Meeting

Join DEQ for a statewide virtual meeting so we can learn about your emission reduction priorities.

Tuesday, January 9th, 6-7:30pm: Online Meeting

- Register here: https://shorturl.at/epOT3

Contact Us

Visit the DEQ CPRG webpage
www.deq.virginia.gov/cprg

Email us with questions, comments, and concerns
CPRG@deq.virginia.gov

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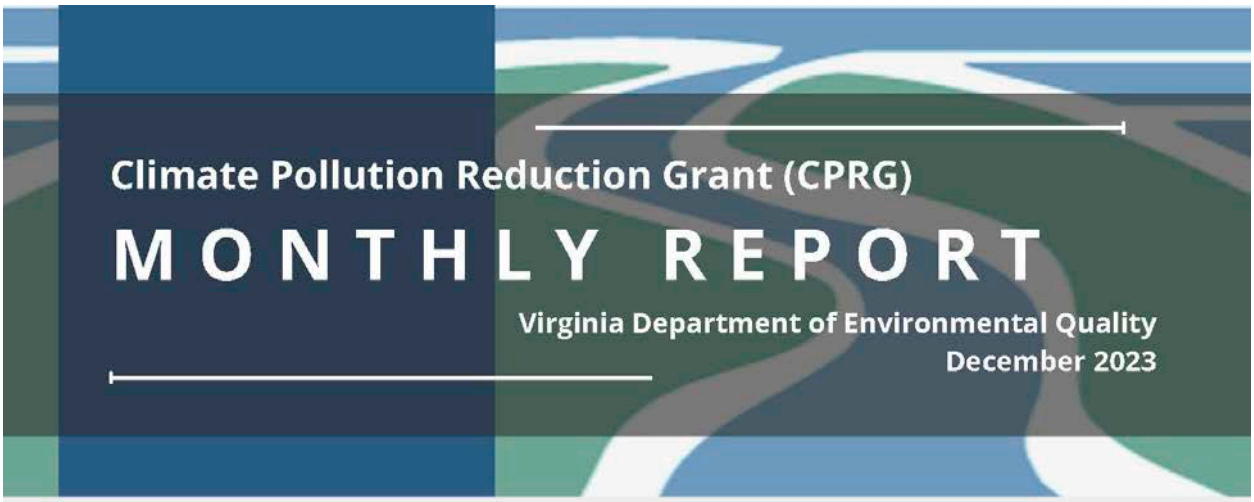

CPRG Meetings

- Internal DEQ CPRG Meetings
  - 12/4, 12/7, 12/11, 12/18, 12/19
- Community Meetings
  - 12/4, 12/5, 12/7, 12/12, 12/14
- Intra-Agency Meetings on LIDAC and Public Outreach
  - 12/7, 12/11, 12/12, 12/20
- Inter-Agency Meetings
  - 12/1, 12/14, 12/15, 12/19, 12/26
- Local Coordination Meetings
  - 12/1, 12/11
- MSA Coordination Meetings
  - 12/1, 12/15, 12/18
- Interstate Meetings
  - 12/1, 12/6, 12/20

What's Coming Up in January?

- **Priority Climate Action Plan community meetings completed**
- **Inter-agency, inter-state, and local coordination meetings on potential CPRG projects**
- **Interstate in-person convention**
- **ICF contractors on board**
- **Internal DEQ Air Division meetings and intra-agency meetings**

Community Survey

DEQ has developed a Commonwealth-wide survey tool to gather input on greenhouse gas emission reduction measures. Please complete the survey by **January 31st, 2024** at the link below:

https://forms.office.com/g/mFrRc9DfC0

January Community Meetings

Tues., Jan. 9, 2024, 6-7:30pm: Online Meeting
- Register here: https://shorturl.at/epOT3

Mon., Jan. 22, 2024, 6-8pm: DEQ Piedmont Office
- 4949-A Cox Rd., Glen Allen, VA 23060

Tues., Jan. 23, 2024, 6-8pm: DEQ Northern Office
- 1301 Crown Court, Woodbridge, VA 22193

Thurs., Jan. 25, 2024, 6-8pm: DEQ Tidewater Office
- 5636 Southern Blvd., Virginia Beach, VA 23462

Contact Us

Visit the DEQ CPRG webpage
www.deq.virginia.gov/cprg

Email us with questions, comments, and concerns
CPRG@deq.virginia.gov

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Climate Pollution Reduction Grant (CPRG)

MONTHLY REPORT

Virginia Department of Environmental Quality
January 2024

CPRG Meetings

- Internal DEQ CPRG Meetings
  - 1/3, 1/8, 1/9, 1/11, 1/24, 1/29
- Community Meetings
  - 1/9, 1/22, 1/23, 1/25
- Contractor Meetings
  - 1/4, 1/9, 1/12, 1/16, 1/24, 1/30, 1/31
- Inter-Agency Meetings
  - 1/16, 1/25, 1/29, 1/31
- Tribal, Local, and Regional Meetings
  - 1/4, 1/5, 1/29, 1/30
- Interstate Meetings
  - 1/16, 1/17, 1/18, 1/19, 1/25, 1/29, 1/31

What's Coming Up in February?

- Priority Climate Action Plan (PCAP) drafted based on:
  - Community survey
  - Community meeting input
  - Projects received from state agencies, localities, MSAs, tribes, and other entities
  - LIDAC benefits analysis
  - Virginia GHG Inventory
- 2 week informal public comment period on the Draft PCAP
  - Comments will be received by email and through February webinar

Conclusion of Community Meetings for PCAP

- January In-Person Community Input Meetings: 6-8pm on Jan 22 (Richmond), Jan 23 (Northern Virginia), and Jan 25 (Hampton Roads)
- Online Community Meeting: Jan 9, 6-7:30pm **https://shorturl.at/epOT3**
- Community input survey closes Jan 31: **https://forms.office.com/g/mFrRc9DfC0**

Draft PCAP Informal Public Comment Period is Feb 12-Feb 23

DEQ's Draft PCAP: **https://shorturl.at/jmGJV**

Submit comments to the CPRG email below and/or attend a Draft PCAP Comment Webinar on Feb 22

11am-12:30pm: **https://shorturl.at/amxD5**
6pm-7:30pm: **https://shorturl.at/emvzG**

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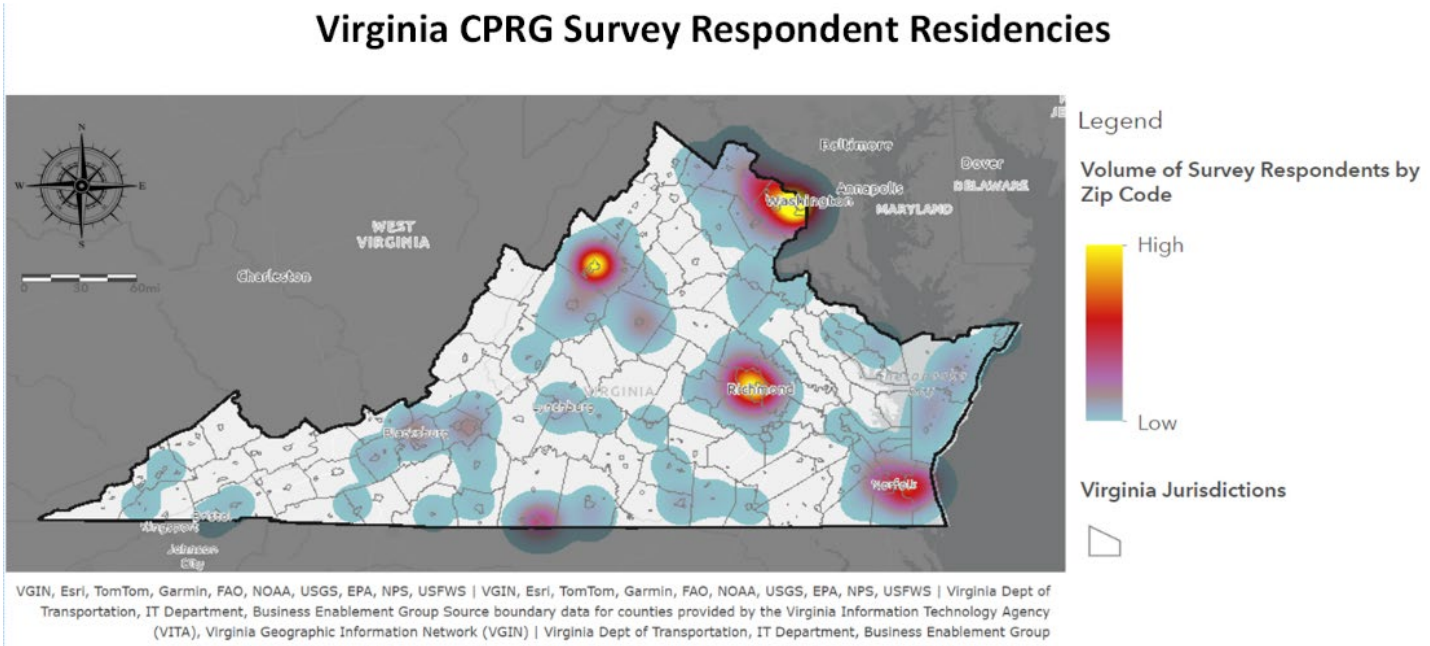
Appendix B. CPRG Community Survey Results

The Virginia DEQ has undertaken a robust initiative to develop a PCAP for the Commonwealth of Virginia that incorporates stakeholder and community priorities. As part of the EPA CPRG program, DEQ is dedicated to addressing climate change by integrating priority measures and projects to reduce carbon and GHG pollutants across various industries.

To capture the broad perspectives of communities in the Commonwealth, DEQ disseminated a CPRG Community Input on Greenhouse Gas Emission Reductions in Virginia survey to assess community-wide emissions reduction priorities, challenges related to emission reduction efforts, and preferred community-based actions. The survey was shared through multiple online channels, extending beyond formal committees to include distribution through social media, DEQ website, local representatives, mailing distribution lists, and community-based/non-governmental organizations. The survey received 322 responses from 171 different zip codes (see Figure 8) within the Commonwealth, encompassing a diverse range of individuals, organizations, coalitions, and agencies.

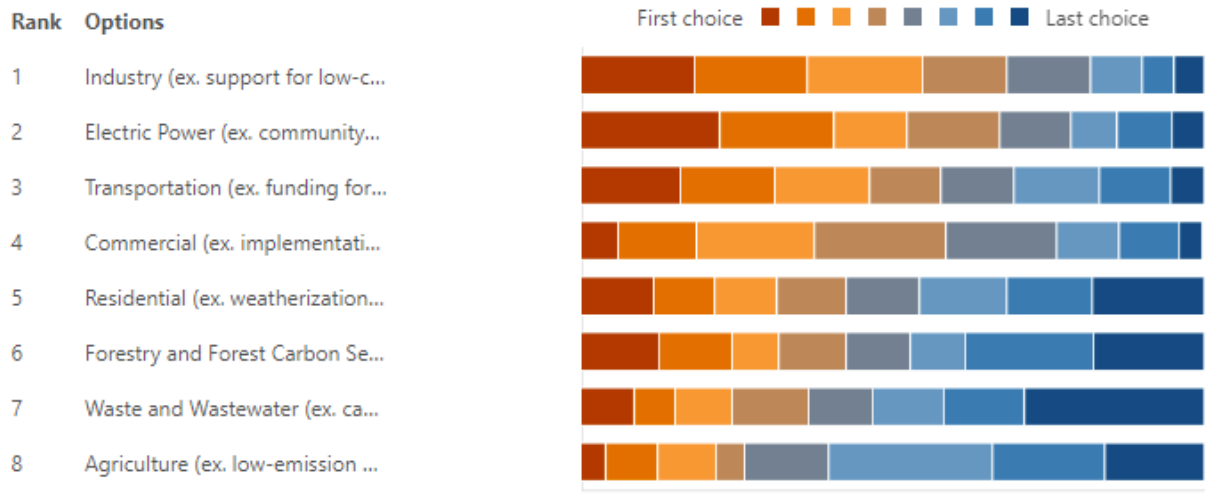
Figure 8: Commonwealth of Virginia Zip Codes with Responses to Community Survey



Community Priorities to Reduce Air Emissions

Participants were asked to rank the importance of reducing air emissions among different source categories. Figure 9 outlines the ranked source categories based on community input, listed from highest to least priority.

Figure 9: Response Ranking for Most Important Source Categories to Reduce Air Emissions



These rankings demonstrate which source categories the community believes contribute most to air emissions within their given zip codes. Despite responses from diverse set of residents across Virginia, most respondents agree that Industry, Electric Power, Transportation, and Commercial source categories, contribute the most to air pollution.

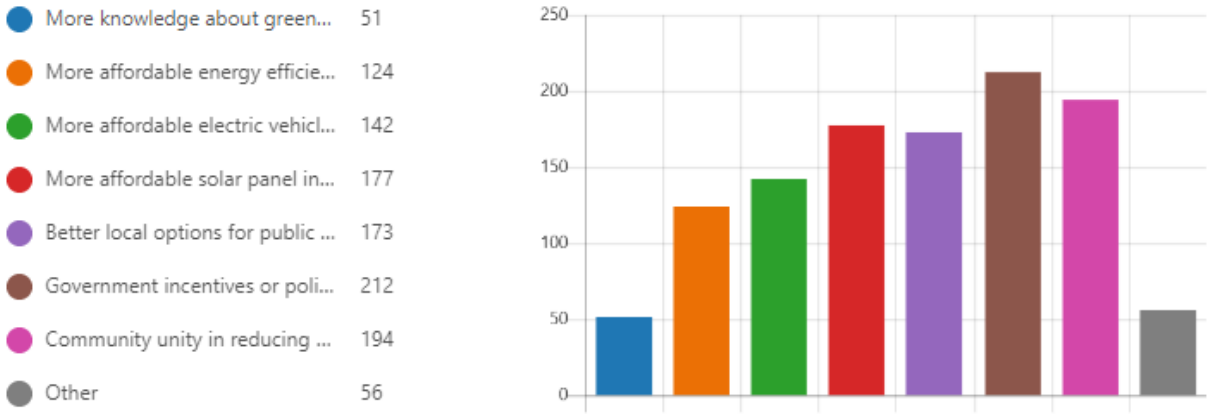
Community Action and Barriers to Action

While respondents are concerned about air pollution among larger source categories, many are also taking individual action to help reduce emissions. Reducing and recycling waste, using energy-efficient appliances, and consolidating errands or daily trips in a vehicle are among the most popular individual efforts that respondents selected to help reduce emissions. Over half of respondents also said that limited access to public or alternate transit and high cost of energy-efficient alternatives were the main barriers to taking more action to reduce emissions.

When asked about having specific actions in place, respondents asked for more renewable energy sources; more parks, trees, and greenspaces; better walkways; and more public transportation. Additional green spaces and safe access to safe green spaces was a theme throughout this survey.

When asked about resources that would support additional individual action, respondents were collectively less certain and selected options across the board. Figure 10 below reflects respondents' choices when considering additional resources or benefits to take additional individual action to reduce emissions.

Figure 10: What would make it easier for you to take additional actions to reduce emissions?



Government incentives or policies emerged as the most popular incentive that would encourage residents to take additional actions to reduce emissions. Meanwhile, affordability was surprisingly less popular even after respondents selected “high cost of energy-efficient alternatives” as the most significant barrier to preventing residents from taking next steps to reduce emissions.

Finally, improved air quality emerged as the number one most important emission reduction benefit for Virginia survey respondents. Transportation improvements and community resilience were second and third most important. These improvements track with residents requesting additional green spaces and access to those green spaces.

This community survey demonstrates that Virginia residents are interested in supporting climate change efforts but require additional incentives to do so in some cases. Government and community involvement through financial support for increased transit options, outdoor spaces, and access could also help residents choose more climate-friendly options and reduce emissions.

Conclusion

The Virginia DEQ values community input and will continue to engage with the stakeholders, the public and LIDACs within the Commonwealth on the development of the CCAP. The Virginia DEQ will use the responses of this survey to inform the CCAP and its engagement plan for the CCAP.

Appendix C. PCAP Draft Public Comments and Responses

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY

SUMMARY AND ANALYSIS OF PUBLIC COMMENT
CLIMATE POLLUTION REDUCTION GRANT, PRIORITY CLIMATE ACTION PLAN

SUMMARY OF PROPOSED PLAN

DEQ has received a Climate Pollution Reduction Grant (CPRG) for climate action planning from the U.S. Environmental Protection Agency (EPA). The CPRG planning grant and process will cover all of Virginia and include ways to reduce greenhouse gases (GHG) and other air pollutants in two phases:

1. Development of a Priority Climate Action Plan (PCAP) to identify near-term and high impact projects to reduce GHG and other air pollutant emissions.

2. Development of a Comprehensive Climate Action Plan (CCAP) to implement a longer-term statewide plan to reduce GHG and other air pollutant emissions.

The purpose of this comment period is to address the draft PCAP.

SUMMARY OF PUBLIC PARTICIPATION PROCESS
DEQ held an informal public comment period on the draft plan from February 12 through February 23, 2024. DEQ also held two online informational webinars on February 22, 2024. Notice of the comment period and the webinars was provided to the public on the DEQ web page, and via DEQ, CPRG, and EJ email lists, LinkedIn, and Facebook.

SUMMARY AND RESPONSE TO COMMENT
Below is a summary of each comment and the accompanying analysis. Included is a brief statement on the subject, the identification of the commenter, the text of the comment and the Department's response. Each issue is discussed in light of all of the comments received that affect that issue.

1. SUBJECT: General support for the plan.

COMMENTER: Bruce Vlk

TEXT: General support for the plan was expressed.

RESPONSE: Support for the plan is appreciated.

2. SUBJECT: Landfills.

COMMENTER: David Biderman

TEXT: Why does the draft ignore the solid waste sector? Landfills are one of the biggest sources of methane and other GHGs, and Virginia has a lot of landfills.

RESPONSE: DEQ agrees that landfills contribute a significant amount of methane to Virginia's GHG inventory. Landfills are addressed under Measure 8 of the proposal.

3. SUBJECT: Food waste.

COMMENTER: World Wildlife Fund

TEXT: In the U.S., growing food that is wasted generates 170 million metric tons of CO_2 emissions annually, equivalent to those of 42 coal-fired power plants. That's not counting methane emissions from food waste rotting in landfills. Landfills rank third in U.S. methane emissions. Global agriculture devours 40% of the world's land and 70% of its freshwater and emits one third of global greenhouse gas emissions. We estimate that 40% of the world's food is either lost on farms or discarded. We must revolutionize our food systems to feed more people without wrecking the planet. Cutting down on food waste can slash methane, support farmers, and boost local communities.

Coalitions and state toolkits are available that can be adapted and scaled. For example, California's Senate Bill 1383 sets methane reduction targets by curbing disposal of organic waste in landfills. It aims to ensure that edible food is recovered, food scraps are composted, compost is purchased by cities, and inedible food is used for industries and animal feed. What works in one state might not in another. But as cities and states work to address food waste, they can tap into shared best practices and amplify solutions. Energy and transportation are important, but the picture isn't complete without regenerative and waste-free food systems.

RESPONSE: DEQ agrees that management of food waste should be addressed. Potential controls for food waste are identified in Measure 8.

4. SUBJECT: R**esidential energy efficiency programs.**

COMMENTER: John Gallini, John Surr, Susan Perry, Miriam B., Mary Lou Burke, Andrew Joseph Scerri, Ladelle McWhorter, Maria Clymer Kurtz, Gail Shepherd, Linda A. Schneider, eve schwartz, Miranda Elliott-Rader, Anita Ward, CEWG

TEXT: The plan should **prioritize residential energy efficiency programs, particularly for low-income households and renters, including** the elderly and disabled who can't do any of the work themselves. **Making homes more energy efficient will not only reduce GHGs, but it will also make homes healthier, safer, and more comfortable, and it will lower utility bills.** Many homeowners and small-scale landlords are unable to shoulder the costs of energy efficiency

upgrades without help, whereas many larger businesses can. Renters should be protected from rising rents or evictions when their homes are improved. Include incentives for landlords to allow energy improvements without exorbitantly raising rent.

RESPONSE: Residential building energy efficiency is addressed in Measure 4. Protection of low-income and disadvantaged households is an integral part of the Plan; see, for example, subsections 1.1, 1.2, and section 3 of the proposal.

5. SUBJECT: Regional Greenhouse Gas Initiative (RGGI)

COMMENTER: Dell Erwin

TEXT: Do everything possible to save our planet and promote green energy in Virginia. Please help get Virginia back in RGGI.

RESPONSE: Upon a thorough technical review and rulemaking process, it has been determined that participation in RGGI is not an effective means of controlling GHGs for Virginia, and Virginia has therefore withdrawn from the organization. More transparent and efficient means of controlling GHG from the electric power sector are discussed in Measure 6 of the proposal.

6. SUBJECT: Electric power sector emissions.

COMMENTER: Glen Besa

TEXT: I appreciate that your inventory calculations may be the result of EPA guidance, but where are the electric power sector (Dominion Energy, APCO, Coops, merchant generators) emissions represented? I see a breakdown by Industrial, Residential and Commercial on page 12 which I presume captures the emissions from electricity use by these three subsectors but also a whole lot more. I am trying to understand where the utilities' GHG emissions are represented because their combined emissions are a major GHG source, and Dominion is not planning to reduce emissions but double them. As Dominion reported to EPA as reflected in the FLIGHT GHG inventory database in 2021 it had 17 million metric tons of GHG, and in Dominion's current IRP, it projects its emissions to increase to 36 million metric tons of GHG by 2048. This increase in Dominion's GHG emissions does not appear to be consistent with the language on page 13: "The expected development of renewable energy production primarily via wind, solar, and nuclear will likely decrease the demand for energy production in the coal and natural gas sectors and therefore decrease Virginia's energy production emissions in future years, in addition to reducing emissions related to electricity generation."

RESPONSE: The fact that Dominion anticipates potential GHG increases in one sector does not rule out GHG emissions decreases associated with other sectors. To be consistent with past DEQ GHG inventories, electric power in the 2020 GHG inventory is represented by the electricity end-

use sectors. A breakdown of DEQ's 2016-2020 GHG inventories is available on the 'Greenhouse Gases' tab of the 'Air' page on the DEQ website.

7. SUBJECT: Building decarbonization.

COMMENTER: Ceres

TEXT: Fast-track state program development and implementation of other federal funding programs such as Home Energy Rebate Programs (HOMES) and Home Electrification and Appliance Rebate (HEAR) program by identifying existing state programs that could be braided with HOMES and HEAR funding. Take advantage of DOE's concierge technical assistance opportunity and review DOE's sample applications to improve efficiency in program development and ensure timely distribution of federal funding to the Commonwealth.

Work collaboratively across state agencies such as the Virginia Public Utility Commission, the Virginia Dept. of Labor and Industry, and the Virginia Dept. of Housing and Community Development on program components such as access to updated appliances and home energy audits for renters, required workforce development, and community benefit planning to ensure all components of program design are discussed and any possible barriers for LMI customers are addressed.

Offer transparent timelines and messaging around available rebates and incentives so that businesses and residents can prepare to upgrade their homes and buildings accordingly.

RESPONSE: The commenter's specific suggestions are appreciated and may be considered as long-range measures addressed by the CCAP.

8. SUBJECT: Transmission siting and development.

COMMENTER: Ceres

TEXT: To ensure access to new resources and accommodate load growth, expand access to renewable energy sources for the expanding pool of commercial and industrial customers in Virginia, such as by enabling retail choice in the utility marketplace or expand opportunities for distributed generation.

RESPONSE: The commenter's specific suggestion is appreciated and may be considered as a long-range measure addressed by the CCAP.

9. SUBJECT: Grid resiliency.

COMMENTER: Ceres

TEXT: Including demand response, distributed energy, and battery energy storage: Ensure electric utilities meet the legislative mandates of the Virginia Clean Economy Act (VCEA) to decarbonize the electricity grid and continue to invest in renewable energy, energy efficiency, and battery storage, while retiring outdated, uneconomic, and underperforming assets. Consider setting ambitious energy efficiency targets that will act as a floor for energy efficiency programs in Virginia and develop programs that incentivize meeting energy efficiency targets yearly. Establish a cost-competitive corporate renewable purchasing mechanism that works for diverse sectors of businesses and energy customers.

RESPONSE: The commenter's specific suggestions are appreciated and may be considered as long-range measures addressed by the CCAP.

10. SUBJECT: Renewable energy deployment, including continued offshore wind development and solar on-grid technology development at-scale.

COMMENTER: Ceres

TEXT: Support and implement programs that incentivize competitive procurement of renewable energy projects, notably in the offshore wind marketplace. Create programs that incentive a streamlined system for bringing utility-scale solar projects on the grid in an efficient and cost-efficient manner to benefit large and small utility customers.

RESPONSE: The commenter's specific suggestions are appreciated and may be considered as long-range measures addressed by the CCAP.

11. SUBJECT: Justice40 requirements.

COMMENTER: Ceres

TEXT: Ceres is cognizant that CPRG funds are subject to federal Justice40 requirements (40% of the benefits of federal funds should be directed toward low-income and disadvantaged communities) and wholeheartedly support efforts that meet or exceed the Justice40 baseline. In order to ensure a thoughtful and systematic approach to Justice40, we recommend that the Commonwealth consider developing statewide agency or interagency guidance for Justice40 implementation, in a manner consistent with the Virginia Environmental Justice Act (VEJA).

RESPONSE: The comment is appreciated, and we will take it into consideration. We agree that environmental justice is important and given the time constraints imposed by the IRA, we have undertaken extensive efforts to engage LIDAC communities. These efforts will continue as we develop the CCAP.

12. SUBJECT: General plan recommendations.

COMMENTER: About 84 emails sponsored by the Sierra Club

TEXT: The plan could make it clear that the Solar for All program will work in conjunction with the HOMES/HEERA rebate programs so that low-income homeowners will receive, or have the opportunity to receive if they want, rooftop solar, energy efficiency work, and electric appliances in one transaction with the Solar for All program.

Virginia should include consideration of and application for DOE IRA and IIJA funding to site and build transmission to connect solar and especially wind.

This plan could include a map of the current energy communities for the bonus credit to measure 6 or 7. Virginia should be building clean energy across the state, but solar and other clean energy in the energy communities census tracts will be especially cost-effective.

Note the opportunity for use of U.S. DOE's energy infrastructure reinvestment loan program. Under that program any owner of fossil fuel infrastructure can apply for a low-interest loan to repurpose the facility to clean energy.

On page 26 of the report, in Table 5, "Identify and promote other clean transportation technologies using advanced biofuels, hydrogen, and others (particularly MD/HD)." I request that this be edited to focus only on promoting battery electric in order to ensure highest potential of carbon reduction from transportation.

On page 60 of the report, in Table 12, there is mention of a planned example action to "Incentivize Renewable Natural Gas distribution and usage." Please consider incentivization programs carefully and cautiously, so as not to encourage industry to develop dependency on renewable natural gas energy to receive incentives in place of more impactful carbon-cutting options.

Please also add specific, defined measures to resolve and address climate impacts of diesel generators or other fossil fuels to power data centers in Virginia.

RESPONSE: The commenter's specific suggestions are appreciated and may be considered as long-range measures addressed by the CCAP.

13. SUBJECT: Fossil fuel infrastructure.

COMMENTER: Climate Equity Working Group (CEWG)

TEXT: Measure 4 of the draft plan touts' utilities' efforts to achieve the "...VCEA's goals of making Virginia's power sector carbon neutral over the next two decades," but lacks a key acknowledgement of the increased emissions that will be created if utility companies bring proposed fossil fuel projects online. Framing utilities as unequivocal partners in Virginia's progress toward a resilient, clean energy future without naming their proposals for new emissions sources

lacks transparency and accuracy. The plan should detail how Virginia can achieve state climate goals without additional fossil fuel infrastructure. Measure 6's content detailing how best to decarbonize Virginia would be a prime opportunity to outline a path toward a clean energy economy without new fossil fuel infrastructure. It is also noteworthy that the draft takes time to name hazards disproportionately faced by low-income and minority groups (mentioning the lack of access to heating and cooling centers more than once) but leaves out the historic siting of emission-generating infrastructure in their communities.

RESPONSE: The PCAP is intended to provide an umbrella so that the widest possible range of GHG-reducing projects could be eligible for implementation funding under the CPRG. It also presents an "all of the above" foundation for development of Virginia's climate planning process that will take place in the CPRG's Comprehensive Climate Action Plan (CCAP) process over the next several years. The PCAP keeps the door open to the full spectrum of climate mitigation possibilities, while recognizing that some potential options could require revisions to existing laws and regulations.

14. SUBJECT: Outreach.

COMMENTER: CEWG

TEXT: To ensure that DEQ's centering of LIDACs is actionable, additional specific language and commitments are needed. Each measure's recommended items should include implementation details for LIDACs, plus connections to Justice40 priorities and funding. In addition, DEQ's future engagement overview (p.8) needs significant expansion. Community outreach to non-English speaking communities (including info sources, surveys, and communications), virtual and in-person feedback opportunities that fit multiple schedules (weekends, evenings), recorded information sessions, and 60+ day comment periods should all be explicitly named and implemented. The Virginia Environmental Justice Collaborative 2021 recommendation to the DEQ and other agencies is a great source of public participation best practices that should be included in the PCAP. Portland, Oregon, provides an additional example of equity-centered climate planning in their Climate Action Through Equity guide, a companion to their own climate action plan. This example illustrates how equity considerations should be named for each measure's example actions (p.17).

RESPONSE: The commenter's specific suggestions are appreciated and may be considered as we undergo the process for developing the CCAP.

15. SUBJECT: General concerns.

COMMENTER: Mary Finley-Brook

TEXT: Gas leakage rates cannot be ignored. Negative environmental externalities are large and costly for communities and the state government. Any plan that does not mitigate methane from fossil fuel infrastructure and from landfills has not achieved its objective. Methane gas is not a low carbon option, especially given the rates of leakage. Gas is expensive when compared to renewable alternatives. Gas is explosive and requires costly infrastructure paid for by taxpayers and ratepayers. DEQ needs to consider how the transition from fossil gas will impact climate change. This plan delays transition away from fossil fuels and dirty energy sources when we have less expensive renewable alternatives that provide more jobs. There should be a transition to sources that are truly renewable and green and bring community benefits and jobs. Benefits from new methane rules will favor early adaptors.

A two week comment period is too short. If the state truly wanted public input, there would be more time and greater outreach. The public comment period and information sessions were poorly announced. DEQ has not achieved standards for meaningful participation in spite of harm to vulnerable groups, including children and elderly. This draft plan is not protective of children as climate change poses increasing threat. This plan does not adequately protect the water resources of the Commonwealth.

RESPONSE: Potential controls on natural gas emissions and landfills are addressed throughout the plan.

DEQ undertook an extensive public participation process. The length of this public comment period was limited by the timeframes imposed on DEQ by federal CPRG requirements and the EPA deadline for submitting a plan by March 1, 2024. DEQ's outreach efforts, particularly with respect to LIDACs, have been as thorough and extensive as possible within EPA's restrictive timeframes. Since the original grant was received, the Air and Renewable Energy Division, in close concert with DEQ's Communications Division and Environmental Justice Office, conducted 4 informational webinars, 5 meetings with communities particularly identified as being LIDAC, a statewide virtual community meeting, and community meetings in the state's 3 major metropolitan areas. DEQ directly communicated and met with local governments, state agencies, Tribes, and many non-governmental organizations. Additionally, notifications were sent through the DEQ Newsletter; DEQ, CPRG, and EJ email lists; LinkedIn, and Facebook.

16. SUBJECT: Fuel switching/electrification.

COMMENTER: Washington Gas

TEXT: Adoption of fuel switching/electrification (page 38 of the draft) would remove energy choice for consumers, and is contrary to the General Assembly enactment of the Virginia Energy Innovation Act of 2022 which expands our company's portfolio, along with those of the Commonwealth's other natural gas utilities, to include bioenergy and hydrogen. It is our hope that this will be deleted, as it is counter to providing energy choice to our customers, the General

Assembly's express support for continued use of natural gas, and Governor Youngkin's Energy Plan.

RESPONSE: The PCAP is intended to provide an umbrella so that the widest possible range of GHG-reducing projects could be eligible for implementation funding under the CPRG. It also presents an "all of the above" foundation for development of Virginia's climate planning process that will take place in the CPRG's CCAP process over the next several years. In that respect, the PCAP is consistent with the Commonwealth's all of the above energy plan by keeping the door open to the full spectrum of climate mitigation possibilities, while recognizing that some potential options could require revisions to existing laws and regulations.

17. SUBJECT: Measure 1.

COMMENTER: The Nature Conservancy (TNC)

TEXT: Under Potential Implementing Agencies and Partners, for the Role of Utilities, after "Several utilities already offer EV charging station rebates," add, "and play a role in helping to connect and manage load." This more accurately describes the role that utilities are and will play in transportation electrification.

Under Example Actions, at Identify and promote other clean transportation technologies using advanced biofuels, hydrogen, and others (particularly MD/HD), add, "for which electrification is not feasible." Electrification is the most technologically effective and cost-effective way to decarbonize the transportation sector, particularly LDVs. Other methods of decarbonization should be supported only when electrification is not viable.

Under Metric, add, "number of EV rebates participants buying <u>used</u> vehicles." The VA EV Rebate Program includes a rebate for used vehicles. This metric would be informative.

RESPONSE: DEQ will take these specific recommendations under consideration.

18. SUBJECT: Measure 2.

COMMENTER: TNC

TEXT: Under LIDAC Benefits and Co-Benefits, add, "increased access to employment." Many benefits were listed, but we did not see this one.

RESPONSE: DEQ will take this specific recommendation under consideration.

19. SUBJECT: Measure 4.

COMMENTER: TNC

TEXT: Under Example Actions, "Strengthen building energy codes and increase code compliance and enforcement," change "Planned" to "Potential." There are no certain plans that the building energy codes will be strengthened over time.

Under Metrics, add, "Number of Low- and Moderate-Income households with reduced energy burden." The metric of "energy savings for each project" is listed, which is likely to mean that individual households save money, but it is not guaranteed. However, for LMI households, it is critical that their total energy costs decrease due to fuel switching.

RESPONSE: DEQ will take these specific recommendations under consideration.

20. SUBJECT: Measure 5.

COMMENTER: TNC

TEXT: Under Progress to Date, add, "The EERS also allows electric utilities to help industrial customers to improve their energy efficiency through programs approved by the SCC." Electric utility energy efficiency programs are an important current opportunity for industry to improve energy efficiency throughout the facility, not only CHP and Waste Heat to Power. The Virginia code allows this in the definition of energy efficiency program: "Energy efficiency programs may include, but are not limited to, (i) programs that result in improvements in lighting design, heating, ventilation, and air conditioning systems, appliances, building envelopes, and industrial and commercial processes."

RESPONSE: DEQ will take these specific recommendations under consideration.

21. SUBJECT: Measure 6.

COMMENTER: TNC

TEXT: Under Example Actions, thank you for adding "Expedite renewable energy siting on brownfields, mine lands, other disturbed lands."

RESPONSE: Support for the proposal is appreciated.

22. SUBJECT: Measure 7.

COMMENTER: TNC

TEXT: Under Example Actions, Identify and fund opportunities for renewable energy retrofits for school buildings, add, "and energy efficiency" before "retrofits." Improving the energy efficiency of school buildings is a huge opportunity to reduce GHGs and help schools save money on energy bills.

RESPONSE: DEQ will take these specific recommendations under consideration.

23. SUBJECT: Measure 8.

COMMENTER: TNC

TEXT: Under Example Actions, remove, "Incentivize Renewable Natural Gas distribution and usage." Whether RNG is beneficial to the climate depends on many variables. There are so many other projects listed in this document that have clear climate benefits without having to figure out if we come out ahead. This item should be removed so that other projects with definitive climate benefits are prioritized instead.

RESPONSE: DEQ will take these specific recommendations under consideration.

24. SUBJECT: Measure 9.

COMMENTER: TNC

TEXT: Under Example Actions, add, "Incentivize lower-carbon concrete." Concrete is a local industrial process that is technologically ready for lower carbon intensity. Because concrete is used in large amounts, it has a huge carbon footprint. This is an opportunity to create a financial incentive for local concrete companies that can demonstrate lower-than-average embodied carbon.

RESPONSE: DEQ will take these specific recommendations under consideration.

25. SUBJECT: Measure 10.

COMMENTER: TNC

TEXT: Thank you for including this measure and for listing The Nature Conservancy as a potential partner.

RESPONSE: Support for the proposal is appreciated.

26. SUBJECT: Overall plan and measures.

COMMENTER: Virginia Manufacturers Association

TEXT: The draft defines "ten high-level priority GHG reduction measures." The Draft Plan then proceeds to identify an expansive swath of reduction measures that would touch virtually all citizens in the state and cost billions of dollars to implement. Virginia has adopted various energy

and transportation laws and policies, but none are even remotely this extensive as the measures presented. Measures 1-10 include GHG reduction opportunities in the transportation, commercial, industrial, utility sector, and agricultural sectors. Broad, all of the above measures, such as fuel switching, are aimed at homes, businesses and institutions. Numerous Example Actions for all of these measures are identified as ongoing – the cumulative cost of which would substantially impact the Virginia economy.

The draft plan stated intent is to be “consistent with Commonwealth climate goals and policies." It is not. VMA urges DEQ not to craft new, ex parte energy and environmental policies for the Commonwealth. VMA observes that the draft did not undergo any regulatory review or formal public comment process. Yet, the plan will almost certainly be taken out of the context of the CPRG program. It will be misconstrued as a formal policy of the Commonwealth. This type of ad hoc policymaking is extremely misleading and destructive. The CPRG program does not invite or require DEQ to create a new GHG reduction policy for the Commonwealth. DEQ should revise the draft to clarify its purpose within the framework of the CPRG program. Measures that are not consistent with Virginia law and policy should be eliminated. DEQ should clarify that the remaining measures are voluntary opportunities and ideas and in no way are a high-level priority. We recognize that EPA’s PCAP requirements dictate that the state identify a focused list of near-term, high-priority, implementation-ready measures. However, the draft should clearly identify that the measures in the plan are solely for the purposes of maximizing the opportunities for the CPRG application.

RESPONSE: The first page of the draft plan, "Disclaimer and Acknowledgements," states, "The Virginia PCAP includes GHG reduction measures reflecting the Commonwealth’s priorities as they relate to implementation funding opportunities through the CPRG program. The high-level PCAP measures are designed to be inclusive of all projects, programs, and measures that Virginia’s state government, local governments, regional planning agencies, and other stakeholders submitted to the Virginia DEQ CPRG team. Specifics of each measure (e.g., key implementers, implementation activities, and milestones) are meant to be informative but are not exhaustive of all specifics of or opportunities to implement a given measure."

The PCAP is intended to provide an umbrella so that the widest possible range of GHG-reducing projects could be eligible for implementation funding under the CPRG. It also presents an all of the above foundation for development of Virginia’s climate planning process that will take place in the CCAP process over the next several years. The PCAP keeps the door open to the full spectrum of climate mitigation possibilities, recognizing that many potential options could require revisions to existing laws and regulations in the future.

In summary, the PCAP's purpose is clear. The federal government is providing planning money in order for states to commence short- and long-term planning. Nowhere is it suggested that these plans are intended to act as law, regulation, or even policy or guidance. That is strictly the purview of elected officials.

27. SUBJECT: Measure 5.

COMMENTER: Virginia Manufacturers Association

TEXT: This measure states that hydrogen and carbon capture utilization and storage (CCUS) technologies can be applied to mitigate emissions at industrial manufacturing facilities. DEQ suggests that fuel switching to electricity is an option in industrial processes in the examples. However, natural gas and diesel generators ensure on-demand energy within seconds of a power outage, especially during severe weather. The same is true for natural gas fired industrial boilers used for heat and steam. Further, hydrogen and CCUS are unavailable to manufacturing processes, but there is an interest in hydrogen generators. The bottom line is that fuel switching (electrification) is not possible for energy intensive sectors that require immediate, high thermal heat (high Btu values) for their product lines, those that use natural gas as a feedstock, and nearly all energy-intensive trade-exposed manufacturers.

RESPONSE: Fuel switching may indeed not be available to all facilities under all circumstances. It is premature to state that it should never be considered.

28. SUBJECT: Measure 6.

COMMENTER: Virginia Manufacturers Association

TEXT: Natural gas is an essential fuel for electricity generation and reliable energy storage, which helps minimize the risk of power disruptions during periods of peak demand. Natural gas energy generation is a national and economic security imperative.

RESPONSE: The commenter's observation is noted.

29. SUBJECT: Measure 9.

COMMENTER: Virginia Manufacturers Association

TEXT: This measure focuses on process emissions from industry. It suggests actions such as use of recycled materials, reinventing industrial processes, and redesigning products to reduce GHGs. While certain companies may voluntarily engage in these efforts, and many already do, Measure 9 cannot be universally employed and is not feasible for many industrial processes in Virginia.

RESPONSE: Measure 9 does not state that these options should be universally employed where unfeasible. It does suggest that they may be considered as a potential option where feasible.

30. SUBJECT: General comments.

COMMENTER: Virginia Petroleum & Convenience Marketers Association

TEXT: We were dismayed to learn for the first time this morning that DEQ has out for comment - ending today, a proposed Priority Climate Action Plan. The information surrounding this announcement states that it is the product of a "robust stakeholder and public outreach and input process will be employed to capture ideas and comments." There has been zero outreach to the business community regarding this draft manifesto. In particular, we are deeply concerned with the following. Measure 4: What about the impact on low-income consumers who will be forced to pay for expensive retrofits to their homes, and existing energy providers ? Measure 1: Our industry collected and remitted to the Commonwealth more than $1.4B in fuels tax revenue to the state last year alone. Electric vehicles receive a 54% discount on fuels taxes and pay fuels tax only on the first 11.600 miles driven per year – all of the rest are free. What consultation was done with the VDOT on this recommendation and its resultant impact on the transportation trust fund.

RESPONSE: Regarding public comment notification, see the response to comment 15. Regarding the other comments, the purpose of the PCAP is to identify all possible actions to reduce climate pollution. It is not meant to be prescriptive in any way and does not commit the Commonwealth to any specific carbon reduction strategy or path. The PCAP will be used to inform both the CPRG implementation grant and the CCAP plan processes. However, it does not set the priorities for grant application purposes. The PCAP imposes no cost obligations on anybody.

31. SUBJECT: Concentrate resources on a small handful of high-impact programs.

COMMENTER: Chesapeake Climate Action Network (CCAN)

TEXT: While the draft PCAP identifies 10 measures worthy of funding, spreading resources across all categories is unlikely to drive deep decarbonization in any particular sector. PCAP should rely on data to select a smaller number of high-impact measures that can be continued with state or local funding following an initial investment or fund-sharing through CPRG. Programs that rely on significant future federal funding, or which make one-time improvements, should not be prioritized.

RESPONSE: The PCAP is intended to provide an umbrella so that the widest possible range of GHG-reducing projects could be eligible for funding. It presents an "all of the above" foundation for development of Virginia's climate planning process that will take place in the CPRG's CCAP process over the next several years. The PCAP keeps the door open to the full spectrum of climate mitigation possibilities.

32. SUBJECT: Transportation decarbonization

COMMENTER: CCAN

TEXT: The GHG accounting on p. 12 states that transportation accounts for 36-38% of annual emissions. However, the U.S. Energy Information Association reports that transportation

accounted for 50.8% of Virginia's emissions in 2021. The PCAP also states that transportation emissions decreased between 2016 and 2020. It is well documented that travel decreased in 2020 and 2021 due to the COVID-19 pandemic. Emissions from transportation in Virginia increased by 55.82% between 1970 and 2021. Emissions peaked in 2019 before falling sharply in 2020 and increasing again in 2021. It is likely that 2022 and 2023 data will demonstrate that emissions continue to increase. The PCAP should accurately report Virginia's transportation emissions, and provide solutions that are focused on this high-emitting sector; this is particularly important given that transportation emissions are dependent upon society-level behavioral trends, and Virginia needs a long-term plan to create infrastructure that steers its residents toward low-carbon modes of transportation.

RESPONSE: Data do indicate that the transportation sector accounts for the greatest share of GHG emissions in Virginia.

33. SUBJECT: Transportation decarbonization initiative funding.

COMMENTER: CCAN

TEXT: PCAP correctly identifies that the light-duty vehicle fleet is the primary contributor to transportation emissions. DEQ also names an existing state program to provide rebates for electric vehicles (EVs). This program lacks funding. EV rebate policies in other states have significantly increased EV adoption, and tend to produce a positive feedback loop – by lowering the up-front cost, more consumers purchase EVs, incentivizing increased private market EV charging, and making EVs more feasible for more drivers and promoting additional EV adoption.

Virginia's EV rebate program, if funded, also meets objectives associated with the Inflation Reduction Act (IRA) Justice40 initiative by providing a higher point-of-sale rebate for low-income households. If a funded state rebate program is successful, and assists the Commonwealth in meeting EV sales targets associated with the Clean Car Standards, it may spur the legislature to provide state funding for the EV rebate program. It will also signal to manufacturers, many of whom have all-electric commitments, that Virginia seriously intends to meet Clean Car Standards targets. This provides confidence to manufacturers to meet fleet electrification goals, and further spurs the private market to deploy EV charging infrastructure statewide.

Through the National Electric Vehicle Infrastructure (NEVI) Formula Program, the Virginia Department of Transportation (VDOT) has already identified significant gaps in electric vehicle charging infrastructure and has built institutional knowledge of the process of deployment. CPRG funds could be easily allocated to VDOT to assist in build-out in identified gaps, without the need for the creation of new programs. If established by the legislature, DEQ could also consider allocating additional funding to the proposed Rural Electric Vehicle Program and Fund.

A third area where CPRG could contribute is in realizing plans cities and counties have put forth regarding transit-oriented development, to encourage fewer car trips and associated emissions.

RESPONSE: Measures 1, 2, and 3 of the PCAP address potential GHG reduction options for the transportation sector.

34. SUBJECT: Measure 4.

COMMENTER: Alliance of Nurses for Healthy Environments (ANHE)

TEXT: ANHE is particularly interested in Measure 4 and its impacts on LIDACs. We are glad to see that urban heat islands, flooding and particulate matter are being assessed in communities with residents that have low incomes, limited access to resources, and disproportionate exposure to environmental or climate burdens. Energy efficiency is of particular importance to nurses as energy poverty is a critical issue that we see patients and our communities experiencing every day. One in three U.S. households experience some form of energy poverty. When people struggle to pay for energy, this can result in serious health impacts with research demonstrating that access to affordable household energy is essential for maintaining good health. One measure of energy poverty is energy burden, or the percentage of gross household income that is spent on energy costs, which is a potentially important determinant of public health., Research has also found disproportionate distributions of energy burden evident in particular positions in social and economic systems, such as wealth, education, race or ethnic origin. Recent studies show that low income households and households of color spend less on energy overall yet spend a higher proportion of income on energy while spending more on energy per square foot of their domicile. As nurses we are very concerned about this inequitable distribution of health impacts as the health effects of energy burden are maintained across a range of health measures, from self-assessment to life expectancy to premature mortality; therefore mitigation of energy burden can provide a separate pathway toward the goal of public health equity. Reducing energy burden and energy poverty is a critical part of protecting human health. As nurses, we encourage Virginia DEQ to incorporate robust prioritization of residential energy efficiency programs, particularly for low-income households and renters in order to alleviate energy burden into the climate action plan and implementation grant. It is also critical for Virginia DEQ to create safeguards for those who rent their homes to be protected from rising rents or evictions when their homes are improved. Human health is influenced by an interconnected dynamic of factors from biology and genetics to the public policy that establishes access to health services.

RESPONSE: Support for the proposal is appreciated.

35. SUBJECT: GHG reduction measures.

COMMENTER: Fairfax County Office of Environmental and Energy Coordination

TEXT: Some suggested additions to metrics:

Measure 1: # of publicly accessible EV chargers installed <u>within LIDAC communities</u>

Measure 2: Alternative and public transit investments in LIDAC communities (% of total investment)

Measure 6: # of solar and other renewable energy projects deployed within and/or benefitting LIDAC communities (e.g., off-site community solar)

Measure 7: % or # of buildings that are all-electric and/or # of fuel-switching/building beneficial electrification projects

Measure 10: This measure addresses carbon sequestration on agricultural and forest lands, but it could be expanded to include the expansion of tree canopy and green space in urban areas (which would also help address the heat island effect addressed in section 3.3). Should this measure be expanded, suggest adding metrics including # of trees planted within LIDAC communities (with a focus on urban areas) and % of green space in urban areas, particularly within LIDAC communities.

RESPONSE: DEQ agrees that environmental justice issues are important. The CPRG specifically requires that impacts to LIDACs be analyzed in order for a project to be eligible for implementation funding. These specific recommendations will be taken under consideration.

36. SUBJECT: Miscellaneous corrections and comments.

COMMENTER: City of Charlottesville

TEXT: The document has a lot of good substance. We provide a copy of the draft with our comments and questions inserted.

RESPONSE: The comments contain a great many redlined revisions/suggestions of both a stylistic and substantive nature to the draft plan. These specific recommendations will be taken under consideration.

37. SUBJECT: White/cool roofs.

COMMENTER: Climate Action NOW Inc.

TEXT: White Roofs/Cool Roofs should be mandatory on all government buildings, all data centers, all businesses and corporate offices, universities, and required for on new homes beginning in 2025. Call Roofs are required now in at least six states, along with 13 major cities, and numerous US towns. Virginia is so far behind that it's scary. White roofs, reflect the sun and lower the heat 10° indoors, and cut CO_2 emissions 29%. Most school buses in Virginia have white roofs.

RESPONSE: DEQ will take this suggestion under consideration for the CCAP.

38. SUBJECT: Other federally funded programs.

COMMENTER: Virginia Energy Efficiency Council (VEEC)

TEXT: We appreciate DEQs recognition of energy efficiency as a decarbonization strategy in the built environment. While many of the decarbonization strategies mentioned in the plan are on the right path, we are concerned that the PCAP heavily relies on other federally funded initiatives such as the HER/HEAR rebates, clean energy tax credits, and the Energy Efficiency Conservation Block Grants. As this is supposed to be a standalone program, it is unclear how the grant funds will be used to support existing projects without duplication. Ideally, the funding sources will be braided to create long term solutions, which should include a comprehensive set of metrics identifying how to achieve that goal. For example, Measure Four spells out the need for increased energy efficiency in commercial buildings but does not list steps to achieve that goal, while Measure Five details techniques for reducing energy consumption and waste in industrial facilities but does not include strategies for smaller buildings. A broader view is needed to fully address the emissions and energy use of existing buildings in Virginia. Additionally, support services and transparent messaging will be critical to ensuring that consumers, localities, and businesses can easily access the funds once they are available. Federally funded programs are often difficult to navigate and inaccessible to LIDAC, so steps should be taken to avoid excluding communities who would benefit the most from these programs.

RESPONSE: DEQ will take these specific recommendations under consideration.

39. SUBJECT: General comments.

COMMENTER: William Penniman

TEXT: Every government agency should be required to expressly factor climate impacts into its decisions: Policies promoting greater energy efficiency and clean energy production will directly save money over time, in addition to achieving GHG reductions. It is essential to adopt regulations that require improvements in energy efficiency, zero-carbon energy, and pollution reductions from such sources as fossil fuel production and/or impose a price on GHG emissions. The public can and should offer financial incentives, but businesses and individuals should be prohibited from emitting GHG pollution at the public's expense.

Implementing the latest International Energy Conservation Code (IECC) should be seen as the minimum, particularly since funds have been offered to states that achieve that level and building occupants will save money, while GHG pollution is reduced. Failure of building codes to meet or exceed the latest and to achieve, where feasible, net zero emissions, will undermine Virginia's ability to achieve net zero by erecting physical barriers to GHG reductions. It is far more expensive to retrofit buildings than it is to maximize energy efficiency at the outset.

Building codes should require heat pumps if air conditioning will be installed anyway; buildings should be made ready for easy installation of EV charging and electric appliances by requiring

conduits for future electric lines to be installed during new construction from panels to the location of major appliances and to roofs for potential solar.

Data centers have soared to more than 20% of Dominion's load and their demands continue to rise. There needs to be minimum energy efficiency standards for building structures and for data operations, requirements for on-site and off-site renewable energy to serve these massive loads, and benchmarking with publicity to encourage continuous improvements. Bitcoin mining should be prohibited in Virginia absent maximum energy efficiency and operations fully supplied by solar or wind energy.

Transportation impact on GHGs must be addressed by promoting electric vehicles by expanding the availability of EV charging at home, along highways and in the locations of traditional gas stations. EV charging capacity needs to be powerful enough to serve trucks. Encourage walkable, bikeable, mixed-use development, and telecommuting.

Electric utilities need must be required to move faster to reduce GHG emissions. This includes increasing annual energy efficiency targets; accelerating their shift to zero-carbon renewable sources; saving ratepayer money by not chasing unproven technologies; consider rewiring existing transmission with more efficient conductors before building new transmission lines; and shift economic incentives away from maximizing utility owned facilities to generate electricity.

Measures to reduce emissions of high-potency GHGs are critical. The public should be notified of all such emissions and the identity of the responsible emitter. A price should be placed on high-potency emissions based on the social cost of carbon. Gas utilities must be required to identify and repair methane leaks as rapidly as possible.

State and local buildings and equipment need to be more energy efficient and better supplied by renewable energy. Sensible, more efficient buildings and equipment will save money over time, as well as reduce GHGs.

RESPONSE: DEQ will take these specific recommendations under consideration.

40. SUBJECT: Measure 1; Measure 10.

COMMENTER: Sierra Club, Transportation and Smart Growth Program

TEXT: Please consider removing efforts toward hydrogen, biofuels, and renewable gas, and instead focus efforts on transportation electrification. (p.24, 25; Table 5 p. 25). Almost all hydrogen in the U.S. is derived from natural gas, which is a climate-threatening fossil fuel. Electric vehicle options are available, more efficient, and cheaper to purchase and operate than hydrogen vehicles. Virginia should focus on subsidizing electric vehicle infrastructure, not methane-sourced hydrogen infrastructure. Biofuels are technologically challenging to produce and are devastating to native ecosystems such as grasslands, wetlands, and forests, which are destroyed to meet the demand for agricultural production of biofuel crops such as corn and soy. The destruction of native

ecosystems leads to greater water pollution from pesticide and fertilizer runoff, and declining wildlife species including bees and butterflies. The clearing of such land actually releases stores of carbon into the atmosphere, which can conceivably exceed the carbon emissions of fossil fuels. Transitioning personal and fleet vehicles to zero emission battery electric models will help reduce high-potency GHG emissions.

In the paragraph about the Electric Vehicle Rebate Program (p. 25), consider adding language about the equitable aspect of the rebate, and how it would complement federal incentives to put EVs within reach of lower- and middle-income Virginians. Consider adding language to emphasize that the program is already established; i.e., shovel ready, and GHG reductions should be relatively easy to calculate.

Consider adding language that Virginia seeks to build and protect a connected network of forests, meadows, wetlands, prime soils, and waters throughout the state, including parcels in urban areas. A sample action could include a program to acquire infill parcels in urban areas and regreening them with native trees and shrubs. Protecting a connected network of lands and waters would not only sequester carbon, it would lower ambient temperatures particularly in disadvantaged communities, contribute to the health and well-being of the public and Virginia's ecosystems, biodiversity and wildlife, and provide recreation areas and flood mitigation.

RESPONSE: DEQ will take these specific recommendations under consideration.

41. SUBJECT: General recommendations.

COMMENTER: Southern Environmental Law Center (SELC)

TEXT: Identify and prioritize projects with the highest emission reduction potential. The funding amount Virginia ultimately will receive is relatively small, which presents difficult choices about funding allocation. Implementation Grant applications should identify and prioritize project types that do not have sufficient, dedicated funding streams over those that do. The PCAP should identify where gaps in funding exist, and DEQ should prioritize projects to fill those gaps.

Identify a path to net-zero emissions by 2045. The VCEA establishes GHG emissions reduction goals across Virginia's economy that reach net-zero emissions by 2045. While VCEA lays out a strategy for transition of the energy sector, Virginia does not have a similar plan to meet these GHG reduction goals across the other sectors of the economy (transportation, solid waste, agriculture, land use, etc.). DEQ should use the CPRG process to identify detailed emission reduction pathways across all sectors of the economy. Because this will require an in-depth analysis, this work should be included in the CCAP due in 2025.

RESPONSE: DEQ will take these specific recommendations under consideration.

42. SUBJECT: Transportation.

COMMENTER: SELC

TEXT: We applaud DEQ for including VMT reduction targets to quantify transportation related GHG emissions reductions. However, these targets should be revised to provide for greater emissions reductions in line with the VCEA. The draft PCAP proposes VMT reduction targets for passenger vehicles of 9% from baseline by 2035 and 13% by 2050. Based on MWCOG's findings for the Washington, DC region, it appears that these VMT targets are not sufficient to achieve net-zero emissions economywide by 2045. We also do not agree that rural VMT reductions are not feasible.

DEQ should set targets for vehicle fleet electrification for each vehicle type or sector. Combined, VMT reduction and fleet electrification targets would allow DEQ and VDOT to quantify emission reduction progress, potential, and cost effectiveness of various transportation measures and projects. Combined targets should establish a pathway to achieve GHG reductions consistent with the VCEA.

Regarding VMT reduction targets, Appendix E states that "[t]he same baseline VMT. . . used for Measure 1 [was] used for Measure 2." However, the discussion in Measure 1 is not clear which base year is used to calculate VMT reductions. MWCOG uses 2005 as a base year, but whichever base year is chosen should be consistent across the PCAP if feasible. Further, the PCAP should clarify whether these are per-capita VMT reduction targets or total VMT reduction targets.

Currently, neither GHG nor VMT reduction play a significant role in Virginia's transportation planning, project selection, or funding allocation processes. Decisions to invest in highway capacity expansions and other project types that drive persistent, long-term increases in VMT and the associated emissions could more than offset positive progress under the CPRG and other climate-focused programs. An effective climate strategy must reduce emissions associated with Virginia's transportation programs and investments, regardless of the source of funding. Statewide and metropolitan transportation plans and fiscally-constrained project lists also should be analyzed for their VMT impacts and demonstrate VMT reductions necessary to meet VCEA-aligned GHG reduction targets.

RESPONSE: DEQ agrees that the transportation sector accounts for the greatest share of GHG emissions in Virginia, and the PCAP reflects this. The specific recommendations will be considered.

43. SUBJECT: Measure 1.

COMMENTER: SELC

TEXT: The draft PCAP provides a list of funding sources and policies that Virginia has adopted related to vehicle electrification and fuel switching, but it does not outline an actionable strategy to accelerate that transition or meet Virginia's climate targets. It also does not prioritize project types proposed for funding. Development of an actionable strategy may not be achievable by the PCAP deadline, but it should be a key goal of the CCAP development process. Life cycle emissions must

be included when assessing the potential benefits and impacts of various alternative fuels. For example, the GHG emissions of hydrogen fuel cell vehicles can vary widely depending on how that hydrogen is produced. Given the relatively low energy efficiency of hydrogen fuel cells compared to electrification, hydrogen may only be cost-effective and GHG-efficient in specific cases where electrification is impractical. Accordingly, DEQ should calculate costs and benefits using clean hydrogen as the baseline.

Address the need for EV-specific electricity rates. Include a discussion of the need for EV-specific electricity rates for different charging use cases, including time of use rates for residential, workplace, and fleet charging. Examine the need for specific rates for public charging, especially direct current fast charging, that ensure predictable pricing for drivers and that avoid cost-prohibitive demand charges. EV-specific rates provide key incentives for EV users to shift loads where possible, while supporting the development of a competitive private market for public EV charging. While the State Corporation Commission (SCC) regulates utility rates, the CCAP can make recommendations for the General Assembly and the SCC to consider.

Include electric utilities and the SCC as partners under this measure. Utility participation is essential to ensure an efficient and effective transition to transportation electrification. Utility companies, coops, and their regulator should be included on the partner list and in the CPRG planning process.

The charging discussion in the draft PCAP is primarily focused on public charging. A concerted effort is needed to provide equitable access to home charging, as well as workplace and other public charging for those who cannot easily access charging at home. Charging rebates should also leverage the Internal Revenue Service's (IRS) 30C tax credit for charging infrastructure where eligible. Tax-exempt organizations qualify for this credit under IRS elective pay provisions. EV rebate programs could incentivize EV adoption, but high rebate uptake may deplete CPRG funds if not capped or targeted. Consider whether rebates should focus on high-mileage drivers, also known as gasoline superusers. This could result in greater GHG reductions per dollar invested.

RESPONSE: The PCAP is intended to provide an umbrella covering the widest possible range of GHG-reducing projects could be eligible for implementation funding under the CPRG. The PCAP keeps the door open to the full spectrum of climate mitigation possibilities, while recognizing that some potential options could require revisions to existing laws and regulations. These specific recommendations will be considered.

44. SUBJECT: Measure 2.

COMMENTER: SELC

TEXT: The draft PCAP makes a brief reference to the importance of land use and development changes on page 29. We suggest expanding on this discussion, including best practices to integrate transportation and land use planning. More abundant housing opportunities in already-

developed areas with more diverse transportation options can increase housing and transportation affordability, while avoiding the significant infrastructure costs and environmental impacts associated with greenfield development. The CCAP could further examine the comprehensive benefits of integrated transportation and land use planning on GHG emissions. Existing VDOT multimodal measures listed on page 30 include project counts and lane miles for bicycle, micromobility, and pedestrian projects. A comprehensive network of safe bike infrastructure is key to encourage use among "interested but concerned" bike riders. While the primary focus of these projects is safety, active transportation mode share largely is driven by user safety and comfort.

In the draft PCAP, DRPT's sole project proposal in Appendix C is focused exclusively on zero-emission transit vehicle procurement. We support zero-emission transit, but electric bus procurements are capital intensive. While operational savings from reduced fuel cost and maintenance can reduce the total cost of vehicle ownership compared to diesel over the life of the bus, high upfront procurement costs could deplete CPRG funding available for other transportation projects. Further, zero-emission bus acquisitions are eligible for federal grant funding under The Federal Transit Administration's (FTA) Low-No Emission and Bus and Bus Facilities programs, in addition to other FTA funding streams. If zero-emission bus acquisitions are prioritized for CPRG funding, focus on vehicle acquisitions that will facilitate expanded transit service or significant reductions in operational costs.

Reduced-fare and fare-free transit service can lower barriers for low-income riders. Fare-free bus routes also can reduce fare collection costs and delays related to on-board fare payments (particularly cash payments, which are common among low-income riders). DRPT has funded several fare-free transit services with significant success.

Public-private and other partnerships can further leverage CPRG funds for transit service and fare-free operations. For example, businesses or new apartment buildings could provide transit payments in lieu of building parking. Employers can also provide transit incentives in lieu of dedicated parking or allow employees to "cash out" the value of a parking benefit. University partnerships often fund transit service either directly or indirectly. Direct payments for fare-free service may be the most efficient way to execute these partnerships.

Include comprehensive bus network redesign evaluations as an example project. Given changes in travel patterns following the Covid-19 health emergency, now is an ideal time to reevaluate longstanding transit routes to identify ways to improve frequency and reliability.

We applaud the inclusion of e-bike rebates as a potential project and urge DEQ and other grant applicants to consider this proposal.

In addition to multimodal transportation options and public transit, other transportation demand management (TDM) strategies can reduce congestion and vehicle miles traveled while avoiding construction of expanded highway capacity. The draft PCAP includes brief references to existing TDM programs in Virginia, such as the Commuter Assistance Program. TDM includes a wide array

of strategies, and including an explicit reference to TDM in the draft PCAP would give localities the flexibility to implement the strategies that fit their transportation needs and development context.

RESPONSE: The PCAP is intended to provide an umbrella covering the widest possible range of GHG-reducing projects that could be eligible for implementation funding under the CPRG. The PCAP keeps the door open to the full spectrum of climate mitigation possibilities, while recognizing that some potential options could require revisions to existing laws and regulations. These specific recommendations will be considered.

45. SUBJECT: Measure 3.

COMMENTER: SELC

TEXT: The draft PCAP mentions references to rail electrification in the 2022 Virginia state rail plan. The CCAP should identify rail lines that are most suitable for electrification, including potential operational improvements for passenger rail service and environmental justice benefits at freight hubs, including ports and rail yards.

RESPONSE: The commenter's specific suggestions are appreciated and may be considered as long-range measures addressed by the CCAP.

46. SUBJECT: Measure 4

COMMENTER: SELC

TEXT: Recommend requirements or incentives for single- and multifamily residential buildings to meet EV Ready standards for each parking space that is provided. Where feasible, EV Ready receptacles should be separately metered to allow users to take advantage of residential utility rates. This is one of the most cost-effective ways to provide expanded and equitable access to EV charging, particularly for renters and people living in multi-family housing. Ensuring new construction is EV Ready can provide a significant cost savings compared to a retrofit and provides convenient and affordable charging options. EV Capable, EV Ready, or EV Installed construction standards could also be evaluated for workplaces and other land uses.

RESPONSE: The commenter's specific suggestions are appreciated and may be considered as long-range measures addressed by the CCAP.

47. SUBJECT: Measure 7.

COMMENTER: SELC

TEXT: Focus fleet transition efforts on zero-emission sources. Vehicles procured today will be on the road a decade or more from the date they are put into service. As discussed under Measure 1, use a well-to-wheels analysis for any emissions reduction benefit calculations. An assessment of only operational emissions fails to account for upstream GHG emissions, especially high potency methane emissions from gas drilling and distribution. Fleet conversions should also consider any costs and potential impacts of needed fueling infrastructure and seek to avoid stranded assets or the potential to lock in polluting technology. The Inflation Reduction Act established the 45W commercial clean vehicle tax credit, which provides a credit up to 30% of the vehicle cost, up to a total of $40,000 per eligible vehicle. To maximize CPRG funding, grant recipients should be encouraged to combine tax credits with any grant funding, and grant award amounts should be tailored with tax credit stacking in mind.

VDOT currently manages a significant real estate portfolio that could provide carbon sequestration, resilience, renewable energy generation and transmission, and other benefits at low cost or even that generate revenue. Evaluate the feasibility installing solar panels in highway ROWs. Virginia should leverage the highway ROW for needed electrical transmission and distribution infrastructure. Encourage native habitats and cool pavements.

RESPONSE: The commenter's specific suggestions are appreciated and may be considered as long-range measures addressed by the CCAP.

48. SUBJECT: Energy measures and projects.

COMMENTER: SELC

TEXT: DEQ should use CPRG funding to help major utilities market and implement EE programs and measures more aggressively, with specific focus on increasing adoption in LIDACs. Managing energy demand with distribution side solutions can be immediately implemented and DEQ should prioritize making EE more accessible to those with limited access. DEQ should work with Virginia Energy (and other state agencies) to help maximize the impact of any funds received. The SCC is responsible for overseeing the certificate of public convenience and necessity (CPCN) process for large utility-scale solar projects. DEQ plays an important role in providing the SCC with an environmental review of these projects. DEQ could use CPRG funding to work with the SCC to identify areas that are well suited for both utility-scale solar projects and associated interconnection upgrades and identify areas where environmental impacts are more likely and potentially significant. The SCC also oversees the state's shared solar and multi-family shared solar programs. DEQ could use CPRG funding to incentivize more shared solar and multi-family shared solar projects

Given recent concerns about grid reliability, DEQ should use CPRG funding to support the use of proven, existing technologies like battery storage to increase reliability on the grid, as opposed to new plans for natural gas plants or hydrogen made from fossil fuels that will increase emissions or

new plans for unproven and costly technologies like small modular nuclear reactors (SMRs) and biofuels.

RESPONSE: The commenter's specific suggestions are appreciated and may be considered as long-range measures addressed by the CCAP.

49. SUBJECT: Measure 4.

COMMENTER: SELC

TEXT: Track residential EE and energy retrofit program utilization in LIDACs. The PCAP provides that "lower-income and minority groups will be at greater risk for heat-related illnesses due to decreased access to healthcare and cooling centers and be more disproportionately impacted by increased cooling costs during heat waves." The disproportionate health risks associated with increased heat and cooling costs experienced by low income and minority groups necessitate maximizing program utilization for LIDAC households. The metric should instead be based on maximizing energy efficiency and electrification program utilization, ensuring that eligible households are participating in all programs for which they are eligible. A better metric would be to track the number of programs for which a residential home or unit is eligible and the number that the residential home or unit utilizes.

Adopting the latest building energy codes for residential and commercial buildings, or adopting building energy codes that meet or exceed the zero energy provisions in the 2021 IECC should be a priority. Given Virginia's three-year code adoption cycle and the lasting impacts of the built environment, adopting the latest building energy codes should be a prioritized action for the near term.

RESPONSE: The commenter's specific suggestions are appreciated and may be considered as long-range measures addressed by the CCAP.

50. SUBJECT: Measure 6.

COMMENTER: SELC

TEXT: DEQ should consider prioritizing large point source areas for decarbonization of the electric power sector and should identify where grid reliability issues exist so that reliability improvements are focused and developed to address specific reliability concerns and are consistent across applicable programs.

The PCAP includes Example Actions that identify innovative, emerging technologies, including hydrogen and SMRs. These technologies are not currently commercially available and proven, and

thus not likely to add immediate benefit to the electric grid in the near term. PCAP actions should focus on rapid and strategic deployment of commercially available, proven technologies to developing these resources. Immediate actions should also focus on demand side solutions like expanding distributed energy resources deployment and maximizing non-wires alternatives so that near term solutions incorporate the locational benefits of renewable energy and enhance grid operational efficiency.

The primary implementing authorities with statutorily mandated carbon reduction goals are Virginia's two largest investor-owned utilities. Coordinating with these entities will be critical to achieving the carbon reduction envisioned by Virginia's draft PCAP. New programs should incentivize the provision of beneficial grid services, which could be accomplished through time of use/time of day rates as well as programs that aggregate grid services.

RESPONSE: The commenter's specific suggestions are appreciated and may be considered as long-range measures addressed by the CCAP.

51. SUBJECT: Measure 7.

COMMENTER: SELC

TEXT: Most of the Example Actions for this measure are "ongoing," and no gaps in funding have been identified. If there are funding gaps that CPRG can fill to accelerate these ongoing actions, these should be clearly identified, and metrics developed to measure progress toward specific goals.

RESPONSE: DEQ will take this suggestion under consideration.

52. SUBJECT: Measure 8.

COMMENTER: SELC

TEXT: DEQ should exercise caution in taking steps to incentivize renewable natural gas distribution and storage to ensure that proposed projects achieve the most significant emissions reductions possible.

RESPONSE: DEQ will take this suggestion under consideration.

53. SUBJECT: Measure 10.

COMMENTER: SELC

TEXT: We urge you to recommend refining the methodologies those funding programs use to score and rank project applications to place a stronger emphasis on wetland and floodplain preservation and restoration projects.

The list of key funding sources under Measure 10 is primarily focused on funds for protecting forestry and agricultural lands. However, several federal programs also provide significant funding opportunities for projects that are centered on preservation and restoration of natural resilience features. We urge you to expand the reference to the Carbon Sequestration Task Force included in the list of Example Actions for Measure 10 to indicate that it should be tasked with identifying and helping state and regional agencies and localities pursue grant opportunities for large-scale preservation projects that offer carbon sequestration co-benefits.

The Virginia Carbon Sequestration Taskforce emphasized the importance of Virginia's blue carbon resources in its 2022 report to the General Assembly. CPRG funds could be used to identify, preserve, and restore these critical ecosystems.

RESPONSE: DEQ will take this suggestion under consideration.

54. SUBJECT: Natural gas distribution and storage; electrification.

COMMENTER: Columbia Gas of Virginia

TEXT: Columbia recommends a balanced approach to the clean energy transition that recognizes not only the need for lowering carbon emissions but also the importance that affordability, reliability, and resiliency of energy access plays in Virginia. We strongly believe that natural gas infrastructure will and must play an important role in Virginia's energy future and in helping the state achieve its decarbonization goals. There are numerous options to leverage the reliability and affordability benefits of our natural gas infrastructure while making meaningful emissions reductions. This includes low-carbon fuels such as hydrogen, renewable natural gas, and energy efficiency.

Columbia supports the inclusion of Measure 8, especially the actions to incentivize Renewable Natural Gas (RNG) distribution and usage and to provide incentives and programmatic support for initiatives to reduce methane emissions from energy production activities, including methane capture and leak detection and repair. These initiatives will support innovative projects to reduce methane emissions in communities across Virginia. Columbia proposed potential projects for the implementation phase of the CPRG program that would help Virginia reach the goals outlined in Measure 8 of its PCAP. Columbia proposed an Advanced Leak Detection and Repair project that would fund the identification of large volume natural gas leaks on our system, which would be subsequently repaired. This is a cost-effective greenhouse gas reduction method that could provide several additional benefits, including enhanced safety for low-income and disadvantaged communities. Columbia also proposed a potential RNG project that would provide a cost-effective

choice for consumers seeking affordable, clean energy. RNG production is pivotal in decarbonizing the energy supply.

Measures 4 and 5 specifically call out fuel switching. Columbia opposes policy that forces fuel switching, including electrification, on our customers especially when it leads to higher energy costs and a less reliable and resilient energy system.

RESPONSE: The PCAP is intended to provide an umbrella so that the widest possible range of GHG-reducing projects could be eligible for implementation funding under the CPRG. It also presents an all of the above foundation for development of Virginia's climate planning process that will take place in the CPRG's Comprehensive Climate Action Plan (CCAP) process over the next several years. The PCAP keeps the door open to the full spectrum of climate mitigation possibilities, while recognizing that some potential options could require revisions to existing laws and regulations.

DEQ appreciates the commenter's efforts to control and reduce GHG emissions, and will take these comments into consideration. Opposition to Measures 3 and 4 are noted.

55. SUBJECT: Measure 4.

COMMENTER: Roanoke Gas

TEXT: Measure 4 is problematic and runs contrary to Virginia's 2022 Energy Plan. The most affordable and energy efficient manner in which to heat homes and businesses, heat water and cook food is through the direct use of natural gas. In addition, switching natural gas appliances in favor of electric appliances would be very expensive for homeowners and businesses. The replacement of natural gas in commercial and residential usage is also contrary to Virginia's Energy Plan that advocates an all of the above approach that includes natural gas.

RESPONSE: The PCAP is intended to provide an umbrella so that the widest possible range of GHG-reducing projects could be eligible for implementation funding under the CPRG. It also presents an "all of the above" foundation for development of Virginia's climate planning process that will take place in the CCAP process over the next several years. The PCAP keeps the door open to the full spectrum of climate mitigation possibilities, recognizing that many potential options could require revisions to existing laws and regulations in the future. Measure 4 of the PCAP does not call for the replacement of natural gas appliances; it is merely mentioned as one of numerous potential GHG-reduction options.

56. SUBJECT: Appliance replacement, electrification measures, decarbonization.

COMMENTER: Virginia Oil and Gas Association (VOGA)

TEXT: We have significant concerns with Measure 4 and Measure 5. The draft references replacing fossil-fuel appliances. The natural gas system is more efficient than electric, as natural gas is utilized with 91% efficiency from production to customer. Natural gas does not require conversion to another type of energy before it is used by customers and its infrastructure is primarily underground. There is no substantive evidence that electric cooking is cleaner when cooking byproducts are considered. The Federal Interagency Committee on Indoor Air Quality routinely addresses indoor air quality issues of public importance, and has not identified natural gas cooking emissions as an issue concerning respiratory illness. Furthermore, the U.S. Consumer Product Safety Commission and EPA do not consider gas ranges to be either a significant contributor to adverse air quality.

The draft Plan also erroneously mentions that Virginia is making strides to increase building electrification measures through legislative and regulatory actions. While various interest groups have proposed electrification measures to natural gas infrastructure in legislation and through building codes, these proposals have failed to advance due to significant, bipartisan opposition. The current DHCD building code processes also have received proposals from various groups in support of electrification. However, these proposals failed to advance. The most affordable way for a home and businesses to heat their property is with natural gas equipment. Natural gas is also the most efficient fuel source to support energy intensive manufacturing. While the natural gas industry's local distribution companies are supportive of RNG and hydrogen, the supply is limited and, cannot replace geologically sourced natural gas. Consequently, the local distribution companies support leveraging existing infrastructure to transport clean fuels to meet climate goals as this saves time, saves money, and avoids duplicative development.

VOGA also has concerns with some of Measure 6. Natural gas is a great fuel for flexible, fast-ramping generation and reliable energy storage, which helps minimize the risk of power disruptions during periods of peak demand. While VCEA includes a renewable portfolio standard for Phase 1 and Phase 2 utilities, the legislation allows for the continued use of fossil fuel infrastructure including natural gas generation if reliability of the electrical grid is threatened. The plan should include reference to this provision as well as information from recent integrated resource plans that show the continued use of fossil fuel generation to support Virginia's growing energy needs.

RESPONSE: The commenter's concerns are noted; see the response to comment 55.

57. SUBJECT: Measures 10 and 4.

COMMENTER: Joseph Young

Measure 10: I want to verify that certain parcels, farms, etc., will not be omitted from the study solely because they are relatively far from universities. I think there should be requirements to ensure this does not happen.

Measure 4: For residential building energy efficiency, will the measure account for historically disenfranchised homeowners? These groups often possess older houses and have the smallest amount of capital to make improvements.

RESPONSE: The PCAP is intended to provide an umbrella covering the widest possible range of GHG-reducing projects that could be eligible for implementation funding under the CPRG, and would not exclude consideration of the factors identified by the commenter.

58. SUBJECT: Measure 2.

COMMENTER: Coalition for Smarter Growth (CSG)

TEXT: VMT reduction is critical to meeting GHG reduction targets. CSG commends DEQ for including this measure. The PCAP's proposed implementation level for Measure 2 VMT reduction is not sufficient to meet Virginia's GHG target and most communities' 2030 target. DEQ assumes a 13% reduction in light duty VMT below the future 2050 baseline. This level is not adequate to achieve GHG targets and is below what other states have adopted.

VMT reduction through mode shift and demand management has significant co-benefits

RMI's Smarter Modes Calculator estimates that a 25% per capita VMT reduction in Virginia by 2050 would achieve the following co-benefits compared to forecast baseline VMT growth: Save each household $1,723 a year from reduced automobile fuel, maintenance and depreciation costs, improve vehicle crash outcomes and alleviate mortality risks from air pollution; road safety benefits up to $73B; lower energy demand by 52 TWh; save residents 501,017 cumulative years of congested travel time between 2024 and 2050.

RESPONSE: DEQ agrees that the transportation sector accounts for the greatest share of GHG emissions in Virginia. These comments will be taken under consideration.

59. SUBJECT: Land use strategies.

COMMENTER: CSG

TEXT: CSG is glad to see that Measure 2 includes land-use and development changes to reduce VMT. This is very important to reduce transportation emissions and provides other co-benefits. However, the PCAP omits strategies and projects.

RESPONSE: PCAP is intentionally broad.

60. SUBJECT: Measure 3.

COMMENTER: CSG

TEXT: The Appendix does not specify the level of EV adoption assumed in the estimated emissions reductions. Please clarify and also identify feasible and necessary levels of EV adoption for light, medium and heavy-duty vehicles to achieve 2030 and 2045 GHG reduction targets.

RESPONSE: DEQ agrees that the transportation sector accounts for the greatest share of GHG emissions in Virginia. These observations will be taken under consideration.

61. SUBJECT: 2045 net zero.

COMMENTER: CSG

TEXT: The PCAP lacks accountability in showing the degree to which its proposed measures and their implementation levels will help achieve the state's 2045 net-zero GHG target. We ask that the PCAP provide total emissions reductions from the identified measures estimated for 2045 and for milestone interim years. The PCAP should also identify a reductions target for 2030 or a similar interim year that is necessary for Virginia's contribution to limiting global warming to 1.5ºC. The CCAP needs to develop a set of policies and implementation levels that can achieve net-zero emissions by 2045 as well as 2030 or similar interim year reductions consistent with a 1.5ºC pathway.

RESPONSE: These comments will be taken under consideration.

62. SUBJECT: VDOT consultation.

COMMENTER: CSG

TEXT: The plan only includes one VDOT project and does not cross-reference and summarize VDOT's Carbon Reduction Strategy. This coordination is critical because transportation is the number one source of state GHG emissions, and cars and truck emissions comprise most of those. We hope that DEQ and VDOT collaborate to develop strong strategies and projects under Measures 1 and 2 in the CCAP.

RESPONSE: DEQ currently collaborates with VDOT on GHG reduction issues, and intends to continue this consultation in the future.

63. SUBJECT: General comments.

COMMENTER: Arlington County Department of Environmental Services

TEXT: On page 38, local government should be included as a Potential Implementing Agencies and Partners. Local governments have a key role to play in the implementation of this measure and

have active programs in the space. Examples of a local government providing programs are Arlington County's Green Building Incentive and Green Home Choice programs.

On Page 50, can an example action be for utilities and local governments to coordinate utility grid enhancements and local government climate planning efforts to accelerate decarbonization and grid reliability and security?

On page 58, can facility owners and operators be expanded to include other high energy/emissions facilities including wastewater treatment plant operators?

On page 62, local governments also have a role to play in this measure as a Potential Implementing Agencies and Partners in addition local economic development authorities.

RESPONSE: The commenter's specific suggestions are appreciated and may be considered as long-range measures addressed by the CCAP.

Appendix D. CPRG Implementation Ideas Shared with DEQ

The measure submission project ideas below were gathered through DEQ's CPRG survey and through stakeholder discussions. This is not an exhaustive list of projects or projects that could be used to take climate action in Virginia.

Table 18: Measure submissions for PCAP

Organization	Title	Description
Virginia Energy	Decarbonize the Farm	Funding incentives to agricultural communities for zero emission technologies in the form of rebates for equipment and charging Infrastructure…
Virginia Port Authority - The Port of Virginia	Port Decarbonization	Decarbonize port operations Virginia International Gateway Terminal by introducing battery technology including diesel-to-battery electric equipment upgrades.
Virginia Port Authority - The Port of Virginia	Port Decarbonization	Implement battery technology at the Pinners Point Container Yard (PPCY) to also include charging and diesel-to-battery electric equipment upgrades.
Virginia Energy	Electric Vehicle Rebate Program	Provide funding for the Virginia EV Rebate Program.
Virginia Energy	Rural Community EV Infrastructure Fund	Provide supplemental funding for Virginia Energy's BIL-SEP grant program for free public EV infrastructure in rural and disadvantaged communities.
Virginia Energy	Charge Forward -- Electric Charging Infrastructure for Government Fleets Rebate Program	Provide rebates to governments for charging infrastructure for electric fleets.
Virginia Energy	Transportation Alternatives E-bike Rebate Program	Provide funds for a tiered income rebate on electric bikes (e.g., e-bike rebate program base rate of $1,200 for low-income and $600 for medium-income).
Virginia Department of Transportation (VDOT)	Virginia Department of Transportation Fleet Electrification	Funds for a light duty truck electrification pilot. The initial set of electric light duty trucks would serve as a statewide pilot, allowing VDOT to test the performance of electric trucks in a range of transportation use cases traditionally filled by ICE trucks and apply lessons learned to expand fleet electrification efforts across VDOT and other state agencies.

Organization	Title	Description
Virginia Department of Rail and Public Transportation (DRPT)	Expanding Virginia's Zero-Emission Transit Bus Fleet	Provide funds to DRPT for zero-emission transit buses to complement its existing MERIT Capital Program. CPRG funding tied to DRPT's MERIT Capital program would allow the agency to meet existing demand for replacement vehicles, and to mitigate startup cost-burdens for rural agencies, while ensuring both the Commonwealth and localities maintain a financial and planning stake in the process.
Virginia Department of Housing and Community Development (DHCD)	Home Energy Audit Deferral and Repair (ADR)	Funds for a program modeled after WDR to address key household repairs preventing the installation of further energy efficiency measures, called Audit Deferral and Repair (ADR).
Virginia Department of Housing and Community Development (DHCD)	Housing Innovations in Energy Efficiency (HIEE) - Weatherization Deferral Repair (WDR)	Funds to supplement the pre-existing Weatherization Deferral Repair (WDR) program. WDR supports the Virginia Weatherization Assistance Program by providing repairs and energy efficiency upgrades to reduce energy bills for low-income households and reduce greenhouse gas emissions.
Virginia Department of Housing and Community Development (DHCD)	Housing Innovations in Energy Efficiency (HIEE) - Expansion of Affordable and Special Needs Housing (ASNH) Program	Funds to expand the current funding available to affordable housing developments designed to meet both a third-party green building certification standard (e.g. EarthCraft Gold) and energy performance criteria (e.g. Zero Energy Ready Homes certification or achieving an applicable Home Energy Rating System (HERS) score.)
Virginia Energy	Coal Mine Methane Utilization Incentive	Financial incentives for capture and placing coal mine methane into a productive use that also results in CO_2e reductions.
Virginia Energy	Virginia Brownfield and Coal Mine Renewable Energy Grant Fund and Program	Increase financial incentives for deployment of renewable energy systems on mined coal lands and brownfields.

Organization	Title	Description
Virginia Energy	Residential and Small Commercial Energy Audits	Virginia Energy is anticipating receiving funding for several residential and small commercial energy improvement programs from the U.S. Department of Energy. Ensuring this funding is deployed in the most effective way to achieve savings in individual buildings is contingent upon each building receiving an energy audit to identify high-impact energy upgrade opportunities. Unfortunately, there is no dedicated funding for diagnostic energy audits. Funding for diagnostic energy audits would be deployed through Virginia Energy alongside other new federal funding It would allow Virginia Energy to provide no- or very low-cost energy audits for single-family homes, multi-family housing properties, and small businesses to drive decision-making around energy upgrades (e.g., energy efficiency improvements and solar access).
Virginia DEQ: Division of Environmental Enhancement	Reduce Greenhouse Gas Emission from Lawn Equipment	Provide financial incentives for low/no GHG emission lawn care equipment.
Virginia DEQ: Division of Environmental Enhancement	Carbon Capture-and Beneficial Reuse	Provide financial incentives to scale up CO2 capture and beneficial reuse in commercial sector.
Virginia Department of Agriculture and Consumer Services	Anaerobic Digester/Clean Energy Generation	Increase financial incentives to reduce methane and other GHG emissions from agricultural lands.
Virginia Department of Forestry	Promote improved forest management to enhance carbon stocks on forested land	
Virginia Energy	Outreach and Technical Support for Clean Transportation Transition	Provide funds for technical support and outreach on transitioning to clean energy vehicles (e.g., engaging with utilities, car dealerships, the public and other stakeholders, hosting workshops, developing outreach and educational materials, an providing technical assistance).

Organization	Title	Description
Multi-State Coalition (VA, SC, NC, MD)	Protect and restore high-carbon coastal habitats and wetlands and protect, restore, use, and develop agricultural and forest lands.	Multi-state CRPG implementation $400,000,000 grant application between NC, SC, VA, and MD to do costal and forestry restoration projects to enhance carbon sequestration in each coalition member state. Virginia works with MD on the Chesapeake Bay Program and with NC on Albemarle-Pamlico estuarine system projects. Each state will tailor the grant to their individual strategies selected as part of their individual $50 million share and the $200 million regional fund. Example environmental and economic co-benefits include flood resilience and avoided property damage, improved water quality, wildlife protection, workforce development, forestry product market creation, and recreation (e.g., fishing, hunting).
Multi-State Coalition	Waste Biomass Methane Abatement	1) Reduce methane emissions associated with organic waste streams from the following but not limited to agriculture, food waste, landfills, forestry and vegetation (yard waste); 2) Support proper methane abatement implementation (to include anaerobic digestion) by identifying funding streams that support environmental improvements beyond methane abatement and energy generation for which markets do not yet exist or have not adequately matured, such as for the control of nutrients, odors, ammonia, runoff, and the recovery of solids to address underfunded pieces of anaerobic digestion initiatives to achieve proper methane abatement implementation; 3) Promote the economic, energy, and environmental benefits of proper methane abatement implementation through a multi-state grant program targeted at funding local pollution control compliance for methane abatement strategies; 4) Supplement methane abatement efforts through implementation of waste diversion programs; 5) Create a methane abatement strategies decision tree that supports multiple sectors and multiple methods with an emphasis on proper anaerobic digester implementation and methane emission prevention alternatives; and 6) Provide funding and implementation support for participating state programs and private parties applying for grant funding.
Albemarle County	Albemarle EV Bus Fleet Improvement w/ Vehicle-to-Building Charging Infrastructure	Albemarle County Public Schools will acquire 16 EV Buses and 16 vehicle-to-building chargers. We will deploy 8 of each to Monticello High School and 8 to Western Albemarle High School (WAHS) in order to replace diesel burning buses and expand the EV footprint in the West and South feeder patterns. Having the vehicle-to-building chargers will support the schools operations should they experience a power failure.
Albemarle County	Monticello High School Geothermal Retrofit	Retrofit existing Natural Gas Boilers and Electric Chiller with high-efficiency geothermal loops while reusing the school's existing 4-pipe fan coil system
City of Charlottesville	Deep Dive - Municipal Energy Performance Improvements	Intensive suite of energy conservation and efficiency measures along with renewable energy production projects on a portfolio of existing local government facilities (city and public school buildings). Opportunities have been recently identified through comprehensive technical energy audits. Project goal is intensive reduction of emissions from municipal stationary sources. Delivery of project can be accomplished through contract mechanism that is close to being finalized.
City of Harrisonburg	Solar on City Facilities	Installing over 180kw solar on four city facilities.

Organization	Title	Description
City of Harrisonburg	E-bike rebate program	Develop a program that incentivizes individuals to purchase E-bikes. The program would include some verification of income to ensure funds are used for those who cannot otherwise afford to purchase one.
City of Harrisonburg	Bluestone Trail Extension	The project closes a 0.7-mile gap between two sections of the Bluestone Trail, a 10' wide paved shared use path, between its current terminus at Stone Spring Rd and Rocktown High School, which is currently under construction. Path construction on the high school campus extends the Bluestone Trail 0.5 mile further south. The majority of this project is on independent alignment through city-owned property. A bridge over Blacks Run and the parallel railroad is needed to make this connection. The Bluestone Trail is the primary bicycle route in the I-81/US-11 corridor, and currently runs from Downtown Harrisonburg through James Madison University and Purcell Park. This path extension would provide a safer and more desirable bicycle and pedestrian route, as compared to traveling on Stone Spring Rd and S. Main Street. It would improve bicycle and pedestrian access to many destinations along the S. Main Street corridor in addition to the high school. It is also part of the regional path plan, shown in the Harrisonburg-Rockingham Metropolitan Planning Organization Bike/Ped Plan.
City of Harrisonburg	Northend Greenway Connection	The project constructs a shared use path along the south side of Mt. Clinton Pike between Virginia Ave and the railroad tracks, constructs intersection improvements at Mt. Clinton Pike and Virginia Ave to facilitate path connectivity through the intersection and constructs a path crossing of the railroad tracks that is separated from the existing Mt. Clinton Pike roadway. The project fills a key gap, approximately 500' in length, to improve safety and create a continuous Northend Greenway path extending over 1 mile in length. The vision of the Northend Greenway path is to connect multiple neighborhoods and destinations, including Downtown Harrisonburg and Eastern Mennonite University, in the north part of Harrisonburg. Additionally, the project constructs a new crosswalk across Virginia Ave and constructs sidewalk along the south side of Mt. Clinton Pike between the intersection and the existing sidewalk at Common Good Marketplace. This sidewalk will improve access between the Northend Greenway and the businesses and residences south of Mt. Clinton Pike. The sidewalk also provides a safe way for residents of the mobile home park to access the closest bus stop.
Town of Abingdon	Greaszilla	Reduce trip generation on roadways (closest locations are Roanoke, VA and Knoxville, TN), reduce grease entering wastewater treatment plant, and produce bio fuel.
Town of Abingdon	EV Conversion of Town-Wide Fleet	Convert Public Works trucks and other department vehicles into electric cars and create EV stations.
Town of Abingdon	Food Waste Reduction	Food hub and commercial kitchen to promote local farmers selling unused produce or providing community processing using sustainable energy-efficient building practices.
Town of Abingdon	Town Recreation Conversion	Convert recreation facilities to utilize renewable power including recreation centers, ball fields, pools, etc.

Organization	Title	Description
Commonwealth Regional Council	Regional Planner	The CRC is seeking funds for their localities to purchase solar panels for their municipal buildings.
Commonwealth Regional Council	Regional Planner	For municipalities that own their own decorative light poles within their town, these funds will be used to purchase solar power decorative light poles.
City of Martinsville	Reducing energy consumption in Residential and Commercial buildings	The overall goal of this measure is to reduce energy consumption of 1000 households and 30 commercial buildings by at least 25% by 2030 relative to 2022 levels. This measure will provide direct subsidies to qualifying households, businesses, and energy service providers to reduce energy consumption through more efficient technologies, to include high-efficiency water heaters, high-efficient appliances, insulation improvements, and smart technologies. Program eligibility would provide preferences for installation by local energy professionals, age/energy efficiency of existing appliances, income of homeowner/tenant, and other equitable measures.
Fairfax County	Clean Energy Clearinghouse	This project would establish a trusted NGO – perhaps begun as a program of a local government or regional body – with comprehensive information on energy efficiency and clean energy technologies and the valid incentives available for their implementation. In addition, the organization would be capable of providing referrals to vetted contractors, which is a service that local governments are prohibited from providing. This organization will also be able to provide guidance to individual customers, not unlike a 'concierge' service for clean energy.
Fairfax County	Energy Conservation Assistance Program	Fairfax County's Energy Conservation Assistance Program is an urban cost-share program that provides technical and financial assistance to property owners implementing energy efficiency updates, installing energy solutions, or enhancing the resilience of structures and property to withstand the impacts of climate change. Qualifying organizations include common-interest communities, places of worship and non-profit or community or charitable organizations.
Fairfax County	Resilience Hubs Pilot Program	This proposal is to develop one to three pilot resilience hubs in Fairfax County. Resilience hubs are community-serving facilities that distribute and centralize information and resources, connect residents to county assistance, support residents' resilience to climate events, and build community capacity and connection. Facilities will be upgraded to enhance their physical resilience to climatic effects and to ensure continuity of service during climate hazards, with upgrades to include energy efficiency improvements and clean energy installations. The hubs will be located in existing facilities that are trusted by community members, and on a day-to-day basis, function as a space for community gathering or events, location for trainings, and as a centralized place for community members to seek resources.
Fairfax County	Boost Low-Income Weatherization and Energy Efficiency Programs	Implement and expand marketing and promotion of local, utility-provided, and federal assistance programs offering weatherization and home energy efficiency improvements for age- and income-qualifying residents. Additionally, establish a "concierge" service to guide residents to the best program for their needs.

Organization	Title	Description
Middle Peninsula Planning District Commission	Adsorption of Carbon from the Atmosphere by Concrete	The MPPDC has strategies in place and is actively seeking to develop large-scale concrete manufacturing operations using sediment derived from dredging activities within the region. This presents an immediate opportunity to incorporate carbon absorption technology for concrete manufacturing as a primary strategy for the Commonwealth to meet its climate pollution reduction goals adopted under the current and ongoing planning effort.
City of Alexandria	Regional collaboration for passive-design and building performance education, training, and certification pathways	The City of Alexandria, along with a regional collaboration of higher education institutions, public schools, labor organizations, and PHIUS, will launch a new, first-of-its-kind passive house training for tradespeople. Along with launching the training, this initiative will develop a nationally recognized certification for individuals and businesses, seek to incorporate the certification into existing legal and procurement frameworks, and nationally scale the training and certification through a network of K-12, colleges, and universities—all with strong consideration for diversity, equity, and inclusion.
City of Alexandria	Healthy Homes Improvements, Capacity Building, and Monitoring	The Healthy Homes Initiative is an existing effort that focuses on identifying and improving indoor air quality issues for low-income and other minority populations. We are proposing to expand this initiative with CPRG implementation funds. Currently, the initiative focuses on minor improvements to individual housing units. The expansion would take a more systemic approach, seeking to implement building-scale measures for homes/multifamily dwellings, schools, and after-school facilities such as recreation centers. This project will leverage the collective expertise of residents, community-based organizations, city government, and housing providers to monitor indoor air quality in targeted locations and address the issues identified with both immediate fixes and longer-term policy solutions.
City of Alexandria	Developing a roadmap for investing in climate-resilient, low-carbon retrofits for affordable housing	This project seeks to develop a methodology to address both technical and financial barriers to energy and resilience retrofits for affordable housing. On the technical side, we will pilot new software to design building-scale retrofits that focus on electrification, energy efficiency, renewable energy (including an onsite microgrid), and resilience. We will design the retrofits and work with residents to ensure the approach reduces tenant energy costs, improves air quality, and allows implementation with residents in place to avoid disruption/displacement. On the financial side, we will develop a review existing and upcoming funding sources (incentives, financing mechanisms, etc.) for affordable housing and develop a roadmap for how to braid those opportunities together to achieve financially viable net-zero affordable housing. This roadmap is intended to be scalable and widely applicable. This work will provide improved tools for the design and construction industry as it tackles the enormous challenge of achieving multifamily building retrofits at the scale required to meet climate goals.

Organization	Title	Description
City of Alexandria	City-Owned Solar Revolving Fund	City-owned and managed facilities benefit from the direct installation and ownership of solar energy generation systems, rather than relying on third parties such as an ESCO or PPA which typically include additional fees. Once the solar is installed, COA would sell the RECS, thereby generating a revolving fund that would create an expanding amount available for additional solar installations.
Loudoun County	District Energy	This project will promote the development of District Energy in the region. The first step will be to identify locations with two or more entities that can share the benefits of reusing hot water or air ("waste" heat or water) through an outreach process where stakeholders can hear about the benefits and provide input. A report would be produced with governance options in a Public Private Partnership scenario. An existing report by the Northern Virginia Regional Commission describes some of those options and the legality under current law. (District Energy Systems: An Analysis of Virginia Law | Northern Virginia Regional Commission - Link: https://www.novaregion.org/1215/District-Energy-Systems) Pending Board approval in participating jurisdiction(s), the next phase would be to develop a District Energy Business Plan that would include a set of pilots at one or more locations. Likely entities to participate in the pilot projects are data centers, landfills, schools, businesses such as breweries, and residential communities. The Business Plan would address the governance structure of the entity that would comprise the District and describe the funding sources and initial costs to set up operations. Grant funding would cover the feasibility studies of the first phase of projects as described in the Business Plan. After that, future feasibility studies would be funded by Green Banks with revolving loan funds (initially capitalized by the grant) that is replenished with funds from completed projects.

Organization	Title	Description
Loudoun County	Electrified and Efficient Equipment Road Show	This new regional program would purchase electrified and efficient equipment and demonstrate their use to stakeholders, so they can try them out. It is based around the "Lending Library" programs that some jurisdictions have to help stakeholders and provide hands-on experience that leads to uptake and behavior change. Under the auspices of a group such as the Northern Virginia Regional Commission, an outreach coordinator would conduct demonstrations and hands-on road shows to stakeholders in order to promote the transition from fossil-fuel-based and less-efficient equipment to more efficient and electrified equipment. The equipment would include electric leaf blowers and chain saws, lawn mowers and weed whackers for lawn maintenance. Stakeholders would include agency public works and park and rec departments, Homeowners Associations (HOAs), as well as organizations with large landscape maintenance needs including the faith community, schools, and universities. Equipment would also include home energy audit equipment such as thermal cameras to allow interested home owners to conduct preliminary home energy audits that can lead them to hire professionally certified building energy efficiency companies. Thermal Camera Loan Program | Office of Environmental and Energy Coordination (fairfaxcounty.gov) The Road Show would also include a workforce development component to allow home improvement contractors and companies to become more educated on home energy performance by allowing them to make use of equipment such as blower doors and to function as an outreach arm for workforce training programs for clean energy and energy efficiency industry partners.
Richmond	Convert all city-owned streetlights to LED	Convert all city-owned streetlights to LED, integrate solar options where feasible, and streamline efficiency measures; Prioritize improvements in formerly redlined neighborhoods and proactively communicate climate impact and resilience benefits with the communities. To include Smart Cities technology where feasible
Richmond	Net-zero municipal buildings: Equitable energy retrofits on city buildings, electrification requirements into all CIPs , and renewable energy installations on new construction	Equitably prioritize energy efficiency retrofits of City-owned buildings in areas that serve the public therefore improving their health, safety, and accessibility while rating the highest return on investment in cost savings and GHG reductions. Incorporate electrification requirements into all Capital Improvement Plans (CIPs), including renewable energy and net-zero requirements

Organization	Title	Description
Richmond	Community-wide Energy Efficiency and renewable energy upgrades and low/no-cost financial options	Implement measures to reduce the energy burden of Richmond's most vulnerable communities and improve residential resilience to climate change
Richmond	Electrification and renewable energy education	Provide equitable education and outreach to make homes and small businesses healthy, safe, and affordable through solar installations, focusing on frontline communities reducing disproportionately high energy burden in these neighborhoods.
Richmond	Incentivize ground-mounted solar	Incentivize opportunities for ground-mounted solar and community (shared) solar on parking lots and non-buildable or previously disturbed land with access to community solar for energy-burdened communities.
Richmond	Fund microgrids and battery backup to CBOs	Provide funding for microgrids & battery backups for energy storage to community-based organizations particularly in frontline communities.
Richmond	Establish green job training programs in low-income neighborhoods	Establish training programs, apprenticeships, and a conservation corps/job placement program in low-income and diverse neighborhoods.
Richmond	Develop central repository of funding opps/incentives for net-zero building design	Develop a central repository of funding opportunities and incentives for green and net-zero construction that supports the local labor workforce with a focus on affordable housing in frontline communities.
Richmond	Adopt most recent IECC for all commercial and residential buildings and develop a building performance policy	Facilitate Energy Code Adoption by working with allied organizations to encourage the Board of Housing and Community Development to adopt the most recent International Energy Conservation Code (IECC) for all commercial and residential buildings. Implement an equitable building performance policy for existing commercial buildings over 5,000 sf through a phased approach.
Richmond	Develop incentives for employers for telework and alt transportation options	Develop incentives for employers to create telework and alternative transportation options programs to reduce greenhouse gas emissions from employee commuting.
Richmond	Explore carbon sequestration efforts	Explore the potential for carbon farming, sequestration, and removal on vacant public or private land, throughout the City's parks and open space system, schools, and in coordination with other landowners, prioritizing investments in frontline communities where feasible.

Organization	Title	Description
Richmond	Overhaul municipal fleet (light and medium duty) and charging infrastructure	Electrify Richmond's fleet of vehicles and equipment.
Richmond	Climate Resilient Transportation Infrastructure	Develop a climate resiliency plan for transportation infrastructure that prioritizes projects using Envision and the Climate Equity Index.
Richmond	Support a resilient Bus Transit System	Improve and expand bus routes, stops, and bike share options, with priority for low car ownership and underserved areas.
Richmond	Private and Commercial Vehicle Electrification and Charging Infrastructure	Facilitate the transition to electric vehicles including charging stations including expanding EVSE access and financial assistance programs
Richmond	Design a multi-jurisdictional networked geothermal planning program	In collaboration with other VA municipalities, begin planning the transition to networked geothermal as a community-wide energy source
Richmond	Design a waste gas to renewable energy program for WWTPs	In collaboration with other VA municipalities, design a standard Program, including staff training, engineering and technical support, and program management, to establish a waste gas to energy project that lowers emissions in the transportation sector
Arlington County	Low-Income Disadvantaged Communities (LIDAC) Energy Efficiency and Energy Performance Upgrades to Residential and Commercial Buildings	providing incentives for individual measures and bundled measures including without limitation energy efficiency, building envelope, fuel-switching systems and appliances, green infrastructure, renewable energy, and storage (collectively, "Energy Performance").
Arlington County	Energy Efficiency and Energy Performance Upgrades to (non-LIDAC) Commercial and Residential Buildings	providing incentives for individual measures and bundled measures including without limitation energy efficiency, building envelope, fuel-switching systems and appliances, green infrastructure, renewable energy, and storage (collectively, "Energy Performance").

Organization	Title	Description
Arlington County	Energy Efficiency/Performance Upgrades (including electrification) to Municipal and School Buildings	This Program would provide an ESCO/ESPC option but conditioned upon measures that blend near- and longer-term recoupment (longer-term recoupment typically reflect deep retrofit measures that produce higher energy efficiency improvements). A prudent set of incentives will ensure this blended approach. MUSH Programs also allow for clear metrics and direct, comprehensive modeling and tracking of energy efficiency, reduction in energy costs, and comparative analyses of cost-effectiveness.
Arlington County	Finance Mechanisms and Incentives - A Cross-Cutting Framework for Increasing Uptake and Conversion Rates in Energy Efficiency and Energy Performance Programs	This Program offers finance options and mechanisms that will to drive greater conversion rates, and mitigate finance-related barriers that impede the ability of property owners to take full advantage of IRA-funded grant programs; and will include without limitation, loan loss reserve and interest-rate buydown funds, as well as Technical Assistance to property owners interested in funding energy performance upgrades through C-PACE, Residential PACE (where it is authorized), Green Bank Programs and Green Mortgage options. This cross-cutting program is intended to be leveraged with the following Programs: Energy Performance for LIDAC Multifamily & Commercial Buildings, Energy Performance for Non-LIDAC Multifamily & Commercial Buildings, Energy Efficiency, Solar and Storage for Non-Profits and Places of Worship
Arlington County	Blank-Page to Performance Buildings: Education, Outreach and Training for Developers Building Owners and Manager/Operators, Architects, Contractors, Designers and Engineers	for developers, building owners, building manager/operators, architect and design firms and consultants, and contractors on advanced building design and retrofits, including without limitation, PHIUS, LEED® 5.0, adaptive reuse and embodied carbon. Envisioned as a hybrid in-person and virtual program that can be recorded and preserved online for national as well as regional use. Its scalability and replicability make this a highly cost-effective program that goes to the inception point of new construction or extensive retrofit to integrate energy performance and GHG-mitigation design.
Arlington County	Resilience Hubs Network Pilot	Energy Efficiency, Solar and Storage for Non-Profits and Places of Worship. Levering existing programs such as Solar for All and partnering with groups such as Faith Alliance for Climate Solutions and Inter-Faith Power & Light, to serve as aggregators and outreach channels. Implementation through ESCO contracts and complemented by Cross-Cutting Programs for Finance Mechanisms and Training/Workforce Development. Program will deploy enhanced incentives for properties located in and/or predominantly serving LIDAC populations and promote upgrades and improvements that blend measures with near- and longer-term paybacks in order to promote deeper energy savings and efficiency.

Organization	Title	Description
Arlington County	Energy Efficiency and Energy Performance Upgrades to Distressed Commercial Assets	Implement measures in aged, distressed commercial assets to implement energy efficiency and performance measures; program to include financing mechanisms and incentives to remove barriers to greater uptake and higher conversion rates in this program
CNX Resources	CMM Capture for Beneficial Use	Incentives to increase capture and beneficial reuse of methane from coal mines in Virginia.
North American Sustainable Refrigeration Council	Fluorinated Gas Reduction Incentive Program (FRIP)	Incorporate a state incentive program to replace hydrofluorocarbon (HFC)-based refrigeration equipment in your state with ultra-low-global warming potential (GWP) refrigeration equipment into your CPRG Priority Climate Action Plan (PCAP). This program will leverage the EPA's federal phase-down of HFC refrigerants to support businesses in your state and ensure a successful transition. Natural refrigerants are technically viable, climate-friendly alternatives. Natural refrigerants, including CO2 (R-744), Ammonia (R-717), and Hydrocarbons (R-290, R-600a) have zero or near-zero GWP and no ozone-depleting potential. Unlike most other low-GWP refrigerant alternatives, they are not at risk of being categorized as per-and polyfluoroalkyl substances (PFAS), making them the most future-proof solution for the refrigeration industry. • Provide incentives to offset the cost of replacing HFC-based equipment with ultra-low-GWP refrigeration equipment. • Prioritize small and independent businesses and those operating in disadvantaged communities. • Incorporate workforce development activities that create jobs and build a robust, trained workforce of refrigeration technicians. Under the American Innovation & Manufacturing (AIM) Act, the EPA is actively transitioning the industry away from HFCs through an 85% HFC phase down, HFC reclaim and management requirements, and sector-based restrictions on HFCs. However, without intervention, this transition puts many businesses at risk due to the high cost of transitioning away from HFCs. More affordable mid-range GWP (<1,400) solutions only offer a short-term fix and/or a risk of being regulated as PFAS in the future. The California Fluorinated Gas Reduction Incentive Program (FRIP) has established a tested, proven, and replicable model that can serve as a blueprint for your state. Launched in 2020, this program initially provided a total of $1M in funding to support food retail installations of low-GWP refrigeration equipment and proved to be one of the most impactful and cost-effective programs administered by the California Air Resources Board (CARB) ($27/MTCO2e).

Organization	Title	Description
Columbia Gas of Virginia	RNG Processing and Delivery Pilot	The CVA team has identified several landfills and other sources ideal for renewable natural gas (RNG) projects. Taking advantage of the Virginia Energy Innovation Act, commonly called the biogas bill, which allows a gas utility to invest in and own RNG facilities, provided the benefits are directed to the customer, our project is strategically aligned with this regulatory framework. To facilitate the successful implementation, we've identified a partner with extensive experience in RNG operations to oversee the facility. This collaborative effort ensures that we not only comply with regulatory guidelines but also optimize the project's effectiveness through the expertise of our chosen partner. Funding is essential to kickstart the RNG processing pilot. CVA's RNG processing pilot ensures that customers will not experience increased bills, thanks to strategic offsetting with credits leveraging the Virginia Energy Innovation Act. This provides the most cost-effective choice for consumers and is particularly advantageous for Justice 40 customers seeking affordable access to clean energy. Simultaneously, RNG production is pivotal in decarbonizing the energy supply and actively promotes investments in Justice 40 communities.
Columbia Gas of Virginia	Methane Emissions: Advanced Leak Detection and Repair	Advanced Leak Detection and Repair is a key decarbonization pathway to support the reduction of CVA's Scope 1 emissions. This initiative requires deploying Picarro-equipped vehicles to identify large-volume natural gas leaks from drivable assets and quantify their flow rates. After identifying the large volume leaks, prioritization of large volume leak repairs (including repairs by replacement of pipe) will result in significant reductions of fugitive methane emissions and enhance safety. Funding will expedite the widespread implementation of cutting-edge mobile leak detection technology in CVA's region. This will enhance our ability to detect and address methane leaks, which are 28 times more potent than carbon dioxide. In areas designated as Justice 40 within CVA territory, our program is ready for immediate action after months of testing.

Organization	Title	Description
Greenspeed Energy Solutions	EV Charging Infrastructure and Solar Energy to Support Virginia's GHG Reduction Goals	Project Description: Greenspeed Energy Solutions delivers EV charging infrastructure and solar energy projects and is currently engaged with stakeholders such as multi-unit dwelling developments, tribal communities, fleet operators and municipalities, with a focus on those located within the Justice40 boundaries, to develop projects to support Virginia's PCAP. We expect to have identified projects prior to NOFA release. Through our focus on both EV charging and solar energy projects, we are uniquely positioned to reduce greenhouse gas emissions by not only assisting in the overarching goal of vehicle electrification adoption and prevalence of ICE vehicles, but also creating alternative energy sources for communities across the country. Community Benefits, including to Disadvantaged Communities: As a minority owned company, we adhere to requirements set forth in the IIJA to ensure equitable practices regarding project locations, wages, workforce development and EEOC. Projects in tribal communities not only seek to bring economic development by generating onsite revenues but also utilize the tribal labor force in the construction of projects. Current locations for multi-unit dwellings seek to provide fair and equitable housing in disenfranchised communities. Our solar projects provide the infrastructure to ensure grid resilience in communities historically impacted by energy, health, and income inequities. Total project costs depend on the project's size and scope. The average project cost for EV charging installation with NEVI guidelines and standards are $915,000. Additionally, the project cost for solar installation currently ranges between $250,000 and $2 million. There are a wide range of IIJA and IRA funding available that we will also pursue to offset the available grant funding, allowing the possibility of further allocation to projects. We track government, municipal, and utility funding as well as federal tax incentives. Greenspeed is prepared to cost-share with these funding sources to ensure timely deployment of GHG-reducing projects.

Organization	Title	Description
Parallel Systems	Direct to Customer Distribution Centers, Battery Electric Rail Service	Parallel Systems is seeking support for a battery electric rail project that will replace heavy-duty class-8 diesel drayage trucks with zero-emission freight rail service that Project Description: Parallel Systems is seeking support for a battery electric rail project that will replace heavy-duty class-8 diesel drayage trucks with zero-emission freight rail service that connects distribution facilities typically serviced by freight trucks in Virginia. Rail is already the most efficient means of moving freight, and Parallel's vehicles can route directly to the customer location, unloading single or multiple containers at one time, very similar to how a truck interacts with warehouse loading docks today. This service eliminates lift and drayage costs, and cargo weight can be increased. This is an opportunity for extremely cost-effective emissions reductions. Parallel's zero-emission rail vehicles would be deployed by the end of 2026. There are many rail-served or rail adjacent sites around the country where customers currently rely on heavy-duty diesel trucks to move products to their storage warehouses. In the proposed project, products would be shuttled between the facilities by zero-emission rail, offsetting the heavy-duty truck transport.
Waste Management (WM)	WM Virginia CNG Refuse Vehicle Replacement Project	WM is seeking support to replace 14 heavy-duty diesel solid waste collection vehicles with near-zero emission compressed natural gas (CNG) solid waste collection vehicles at seven (7) facilities in Virginia. Natural gas engines have certified NOx levels that are 90% below the current diesel standard and provide an opportunity for extremely cost-effective emissions reductions. These vehicles will be deployed by the end of 2025 and will operate in local refuse collection and recycling routes out of WM's facilities in Chesapeake City, Falmouth, Harrisonburg, Manassas, Salem, Sterling, and Richmond, Virginia.

Appendix E. Virginia LIDAC Census Block IDs

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Accomack County	510010901022	**Alleghany County**	510050801003
Accomack County	510010902011	**Alleghany County**	510050802021
Accomack County	510010902021	**Alleghany County**	510050802022
Accomack County	510010902022	**Alleghany County**	510050802023
Accomack County	510010903001	**Amelia County**	510079301021
Accomack County	510010903002	**Amherst County**	510090101001
Accomack County	510010903003	**Amherst County**	510090101002
Accomack County	510010904011	**Amherst County**	510090101003
Accomack County	510010904012	**Amherst County**	510090101004
Accomack County	510010904021	**Amherst County**	510090104011
Accomack County	510010904022	**Amherst County**	510090105041
Accomack County	510010905001	**Amherst County**	510090105042
Accomack County	510010905002	**Amherst County**	510090105051
Accomack County	510010905003	**Amherst County**	510090105061
Accomack County	510010906001	**Amherst County**	510090106001
Accomack County	510010906003	**Amherst County**	510090106002
Accomack County	510010907001	**Appomattox County**	510110403001
Accomack County	510010907002	**Appomattox County**	510110403002
Accomack County	510010907003	**Appomattox County**	510110403003
Accomack County	510010907004	**Appomattox County**	510110403004
Accomack County	510010907005	**Arlington County**	510131003004
Accomack County	510010908001	**Arlington County**	510131007003
Accomack County	510010908002	**Arlington County**	510131016022
Accomack County	510010908003	**Arlington County**	510131016031
Albemarle County	510030106042	**Arlington County**	510131016035
Albemarle County	510030107011	**Arlington County**	510131017011
Albemarle County	510030107022	**Arlington County**	510131017031
Albemarle County	510030108022	**Arlington County**	510131017041
Albemarle County	510030109041	**Arlington County**	510131017042
Albemarle County	510030109042	**Arlington County**	510131017051
Albemarle County	510030109043	**Arlington County**	510131017052
Albemarle County	510030113022	**Arlington County**	510131018033
Alleghany County	510050701001	**Arlington County**	510131018041
Alleghany County	510050701002	**Arlington County**	510131020011
Alleghany County	510050701003	**Arlington County**	510131020012
Alleghany County	510050701004	**Arlington County**	510131020021
Alleghany County	510050801001	**Arlington County**	510131020031
Alleghany County	510050801002	**Arlington County**	510131020032

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Arlington County	510131020033	**Augusta County**	510150710002
Arlington County	510131021001	**Augusta County**	510150710003
Arlington County	510131021002	**Augusta County**	510150710004
Arlington County	510131022001	**Augusta County**	510150712023
Arlington County	510131022002	**Bath County**	510179201011
Arlington County	510131022003	**Bath County**	510179201012
Arlington County	510131022004	**Bath County**	510179201021
Arlington County	510131022005	**Bath County**	510179201022
Arlington County	510131023023	**Bath County**	510179201023
Arlington County	510131024004	**Bedford County**	510190304042
Arlington County	510131025001	**Bedford County**	510190304043
Arlington County	510131027011	**Bedford County**	510190305011
Arlington County	510131027012	**Bedford County**	510190305012
Arlington County	510131027022	**Bedford County**	510190305013
Arlington County	510131028042	**Bedford County**	510190306031
Arlington County	510131028044	**Bedford County**	510190306032
Arlington County	510131029043	**Bedford County**	510190306041
Arlington County	510131030002	**Bedford County**	510190306042
Arlington County	510131031002	**Bedford County**	510190501011
Arlington County	510131032001	**Bedford County**	510190501012
Arlington County	510131032002	**Bedford County**	510190501021
Arlington County	510131032004	**Botetourt County**	510230401001
Arlington County	510131033001	**Botetourt County**	510230401002
Arlington County	510131033002	**Botetourt County**	510230401003
Arlington County	510131034052	**Botetourt County**	510230401004
Arlington County	510131035031	**Botetourt County**	510230402001
Arlington County	510131035051	**Botetourt County**	510230404022
Arlington County	510131035052	**Brunswick County**	510259301001
Arlington County	510131035053	**Brunswick County**	510259301002
Arlington County	510131036021	**Brunswick County**	510259301003
Arlington County	510131036022	**Brunswick County**	510259301004
Arlington County	510131038003	**Brunswick County**	510259302011
Arlington County	510131038004	**Brunswick County**	510259302012
Augusta County	510150701001	**Brunswick County**	510259302021
Augusta County	510150701002	**Brunswick County**	510259302031
Augusta County	510150701003	**Brunswick County**	510259302032
Augusta County	510150701004	**Brunswick County**	510259302033
Augusta County	510150706021	**Brunswick County**	510259302034
Augusta County	510150706022	**Brunswick County**	510259303011
Augusta County	510150710001	**Brunswick County**	510259303012

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Brunswick County	510259303021	**Campbell County**	510310205002
Brunswick County	510259303022	**Campbell County**	510310206001
Brunswick County	510259303023	**Campbell County**	510310207001
Buchanan County	510270101001	**Campbell County**	510310207002
Buchanan County	510270101002	**Campbell County**	510310207003
Buchanan County	510270101003	**Campbell County**	510310208001
Buchanan County	510270101004	**Campbell County**	510310209002
Buchanan County	510270101005	**Campbell County**	510310209003
Buchanan County	510270102001	**Caroline County**	510330301003
Buchanan County	510270102002	**Caroline County**	510330302021
Buchanan County	510270102003	**Caroline County**	510330303002
Buchanan County	510270102004	**Caroline County**	510330304001
Buchanan County	510270103001	**Caroline County**	510330304002
Buchanan County	510270103002	**Caroline County**	510330305032
Buchanan County	510270103003	**Caroline County**	510330306001
Buchanan County	510270104001	**Caroline County**	510330306002
Buchanan County	510270104002	**Carroll County**	510350801002
Buchanan County	510270105001	**Carroll County**	510350802001
Buchanan County	510270105002	**Carroll County**	510350802002
Buchanan County	510270106001	**Carroll County**	510350802003
Buchanan County	510270106002	**Carroll County**	510350802004
Buchanan County	510270106003	**Carroll County**	510350803001
Buchanan County	510270106004	**Carroll County**	510350803002
Buchanan County	510270107001	**Carroll County**	510350803003
Buchanan County	510270107002	**Carroll County**	510350803004
Buchanan County	510270107003	**Carroll County**	510350804011
Buchanan County	510270107004	**Carroll County**	510350806011
Buckingham County	510299301011	**Carroll County**	510350806012
Buckingham County	510299301012	**Carroll County**	510350806031
Buckingham County	510299301013	**Carroll County**	510350806032
Buckingham County	510299301021	**Carroll County**	510350806033
Buckingham County	510299301022	**Carroll County**	510350806041
Buckingham County	510299301023	**Charles City County**	510366001001
Buckingham County	510299302011	**Charles City County**	510366001002
Buckingham County	510299302012	**Charles City County**	510366003002
Buckingham County	510299302013	**Charlotte County**	510379301011
Buckingham County	510299302021	**Charlotte County**	510379301012
Buckingham County	510299302022	**Charlotte County**	510379301021
Buckingham County	510299302023	**Charlotte County**	510379301022
Campbell County	510310205001	**Charlotte County**	510379302001

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Charlotte County	510379302002	**Chesterfield County**	510411005052
Charlotte County	510379302003	**Chesterfield County**	510411005054
Charlotte County	510379303001	**Chesterfield County**	510411005055
Charlotte County	510379303002	**Chesterfield County**	510411005062
Charlotte County	510379303003	**Chesterfield County**	510411005063
Chesterfield County	510411001071	**Chesterfield County**	510411005071
Chesterfield County	510411001072	**Chesterfield County**	510411005081
Chesterfield County	510411002061	**Chesterfield County**	510411005082
Chesterfield County	510411002062	**Chesterfield County**	510411005101
Chesterfield County	510411002063	**Chesterfield County**	510411005102
Chesterfield County	510411002065	**Chesterfield County**	510411006001
Chesterfield County	510411002091	**Chesterfield County**	510411006002
Chesterfield County	510411002092	**Chesterfield County**	510411006003
Chesterfield County	510411002093	**Chesterfield County**	510411007011
Chesterfield County	510411002094	**Chesterfield County**	510411007012
Chesterfield County	510411002101	**Chesterfield County**	510411007013
Chesterfield County	510411002111	**Chesterfield County**	510411007014
Chesterfield County	510411002112	**Chesterfield County**	510411007021
Chesterfield County	510411002121	**Chesterfield County**	510411008041
Chesterfield County	510411002122	**Chesterfield County**	510411008042
Chesterfield County	510411002123	**Chesterfield County**	510411008043
Chesterfield County	510411003001	**Chesterfield County**	510411008051
Chesterfield County	510411003002	**Chesterfield County**	510411008052
Chesterfield County	510411004033	**Chesterfield County**	510411008053
Chesterfield County	510411004041	**Chesterfield County**	510411008054
Chesterfield County	510411004042	**Chesterfield County**	510411008061
Chesterfield County	510411004051	**Chesterfield County**	510411008062
Chesterfield County	510411004052	**Chesterfield County**	510411008071
Chesterfield County	510411004061	**Chesterfield County**	510411008121
Chesterfield County	510411004071	**Chesterfield County**	510411008141
Chesterfield County	510411004072	**Chesterfield County**	510411008142
Chesterfield County	510411004073	**Chesterfield County**	510411008152
Chesterfield County	510411004091	**Chesterfield County**	510411008161
Chesterfield County	510411004092	**Chesterfield County**	510411008162
Chesterfield County	510411004093	**Chesterfield County**	510411008163
Chesterfield County	510411004094	**Chesterfield County**	510411008171
Chesterfield County	510411004095	**Chesterfield County**	510411008172
Chesterfield County	510411004101	**Chesterfield County**	510411008181
Chesterfield County	510411004102	**Chesterfield County**	510411008191
Chesterfield County	510411005051	**Chesterfield County**	510411008192

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Chesterfield County	510411008193	**Dickenson County**	510510401003
Chesterfield County	510411008201	**Dickenson County**	510510401004
Chesterfield County	510411008202	**Dickenson County**	510510402001
Chesterfield County	510411008232	**Dickenson County**	510510402002
Chesterfield County	510411008233	**Dickenson County**	510510402003
Chesterfield County	510411009071	**Dickenson County**	510510403001
Chesterfield County	510411009072	**Dickenson County**	510510403002
Chesterfield County	510411009101	**Dickenson County**	510510403003
Chesterfield County	510411009102	**Dickenson County**	510510403004
Chesterfield County	510411009103	**Dickenson County**	510510403005
Chesterfield County	510411009104	**Dickenson County**	510510404001
Chesterfield County	510411009151	**Dickenson County**	510510404002
Chesterfield County	510411009152	**Dickenson County**	510510404003
Chesterfield County	510411009191	**Dickenson County**	510510404004
Chesterfield County	510411009192	**Dinwiddie County**	510538401022
Chesterfield County	510411009193	**Dinwiddie County**	510538403002
Chesterfield County	510411009201	**Dinwiddie County**	510538403003
Chesterfield County	510411009211	**Dinwiddie County**	510538404001
Chesterfield County	510411009213	**Dinwiddie County**	510538405001
Chesterfield County	510411009214	**Dinwiddie County**	510538405002
Chesterfield County	510411009221	**Essex County**	510579506001
Chesterfield County	510411009222	**Essex County**	510579506002
Chesterfield County	510411009223	**Essex County**	510579506003
Chesterfield County	510411009231	**Essex County**	510579507001
Chesterfield County	510411009232	**Essex County**	510579507002
Chesterfield County	510411009343	**Essex County**	510579507003
Culpeper County	510479302021	**Fairfax County**	510594153003
Culpeper County	510479302022	**Fairfax County**	510594154011
Culpeper County	510479302023	**Fairfax County**	510594154012
Culpeper County	510479302031	**Fairfax County**	510594154013
Culpeper County	510479303001	**Fairfax County**	510594155004
Culpeper County	510479303002	**Fairfax County**	510594160002
Culpeper County	510479305011	**Fairfax County**	510594201001
Cumberland County	510499301011	**Fairfax County**	510594203003
Cumberland County	510499301012	**Fairfax County**	510594205033
Cumberland County	510499301013	**Fairfax County**	510594206002
Cumberland County	510499301021	**Fairfax County**	510594208001
Cumberland County	510499301022	**Fairfax County**	510594210023
Dickenson County	510510401001	**Fairfax County**	510594211021
Dickenson County	510510401002	**Fairfax County**	510594214002

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Fairfax County	510594214003	**Fairfax County**	510594506021
Fairfax County	510594215001	**Fairfax County**	510594506022
Fairfax County	510594215002	**Fairfax County**	510594506023
Fairfax County	510594215003	**Fairfax County**	510594507021
Fairfax County	510594215004	**Fairfax County**	510594507022
Fairfax County	510594216001	**Fairfax County**	510594508003
Fairfax County	510594216002	**Fairfax County**	510594510001
Fairfax County	510594216003	**Fairfax County**	510594514001
Fairfax County	510594217011	**Fairfax County**	510594514002
Fairfax County	510594217012	**Fairfax County**	510594515011
Fairfax County	510594218002	**Fairfax County**	510594515012
Fairfax County	510594219001	**Fairfax County**	510594515013
Fairfax County	510594221013	**Fairfax County**	510594515014
Fairfax County	510594221024	**Fairfax County**	510594515022
Fairfax County	510594223021	**Fairfax County**	510594515023
Fairfax County	510594223024	**Fairfax County**	510594516011
Fairfax County	510594302021	**Fairfax County**	510594516012
Fairfax County	510594306001	**Fairfax County**	510594516013
Fairfax County	510594306002	**Fairfax County**	510594516022
Fairfax County	510594306003	**Fairfax County**	510594519003
Fairfax County	510594306004	**Fairfax County**	510594520001
Fairfax County	510594307001	**Fairfax County**	510594521012
Fairfax County	510594310011	**Fairfax County**	510594521021
Fairfax County	510594310013	**Fairfax County**	510594522001
Fairfax County	510594316021	**Fairfax County**	510594522002
Fairfax County	510594401003	**Fairfax County**	510594522003
Fairfax County	510594402022	**Fairfax County**	510594522004
Fairfax County	510594402023	**Fairfax County**	510594523011
Fairfax County	510594405031	**Fairfax County**	510594523012
Fairfax County	510594405041	**Fairfax County**	510594523021
Fairfax County	510594405051	**Fairfax County**	510594523022
Fairfax County	510594501002	**Fairfax County**	510594524001
Fairfax County	510594502001	**Fairfax County**	510594524002
Fairfax County	510594503001	**Fairfax County**	510594524003
Fairfax County	510594503002	**Fairfax County**	510594524004
Fairfax County	510594503003	**Fairfax County**	510594524005
Fairfax County	510594503004	**Fairfax County**	510594525011
Fairfax County	510594504001	**Fairfax County**	510594525013
Fairfax County	510594505001	**Fairfax County**	510594525022
Fairfax County	510594505002	**Fairfax County**	510594525023

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Fairfax County	510594526001	**Fairfax County**	510594913031
Fairfax County	510594526003	**Fairfax County**	510594913032
Fairfax County	510594527001	**Fairfax County**	510594916011
Fairfax County	510594527002	**Fairfax County**	510594916021
Fairfax County	510594527003	**Fairfax County**	510594917061
Fairfax County	510594528012	**Fairfax County**	510594918012
Fairfax County	510594528013	**Fauquier County**	510619307061
Fairfax County	510594616041	**Floyd County**	510639201021
Fairfax County	510594617003	**Floyd County**	510639201022
Fairfax County	510594619011	**Floyd County**	510639201023
Fairfax County	510594619021	**Floyd County**	510639201031
Fairfax County	510594712042	**Floyd County**	510639201032
Fairfax County	510594713011	**Floyd County**	510639201033
Fairfax County	510594713012	**Floyd County**	510639201041
Fairfax County	510594714012	**Floyd County**	510639201042
Fairfax County	510594714021	**Floyd County**	510639202011
Fairfax County	510594802031	**Floyd County**	510639202012
Fairfax County	510594808013	**Floyd County**	510639202021
Fairfax County	510594809011	**Floyd County**	510639202022
Fairfax County	510594809012	**Franklin County**	510670202001
Fairfax County	510594809013	**Franklin County**	510670202002
Fairfax County	510594809014	**Franklin County**	510670202003
Fairfax County	510594809021	**Franklin County**	510670204002
Fairfax County	510594809022	**Franklin County**	510670205011
Fairfax County	510594809031	**Franklin County**	510670206001
Fairfax County	510594809032	**Franklin County**	510670206004
Fairfax County	510594809033	**Franklin County**	510670207011
Fairfax County	510594810001	**Franklin County**	510670207012
Fairfax County	510594810002	**Franklin County**	510670207021
Fairfax County	510594811032	**Franklin County**	510670207022
Fairfax County	510594812021	**Franklin County**	510670208011
Fairfax County	510594812022	**Franklin County**	510670208012
Fairfax County	510594812023	**Franklin County**	510670208013
Fairfax County	510594814001	**Franklin County**	510670209011
Fairfax County	510594822061	**Franklin County**	510670209012
Fairfax County	510594823022	**Franklin County**	510670209021
Fairfax County	510594901012	**Franklin County**	510670209022
Fairfax County	510594901042	**Franklin County**	510670209023
Fairfax County	510594911032	**Frederick County**	510690508011
Fairfax County	510594912013	**Frederick County**	510690508041

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Frederick County	510690508072	**Halifax County**	510839306012
Frederick County	510690509001	**Halifax County**	510839306021
Frederick County	510690510021	**Halifax County**	510839306022
Frederick County	510690511022	**Halifax County**	510839308001
Giles County	510719302002	**Halifax County**	510839308002
Giles County	510719303001	**Halifax County**	510839308003
Giles County	510719303003	**Hanover County**	510853206012
Giles County	510719303004	**Hanover County**	510853206013
Giles County	510719303005	**Hanover County**	510853206022
Giles County	510719304002	**Hanover County**	510853208041
Grayson County	510770601011	**Hanover County**	510853209021
Grayson County	510770601012	**Hanover County**	510853210011
Grayson County	510770601013	**Hanover County**	510853210013
Grayson County	510770602011	**Hanover County**	510853211001
Grayson County	510770602012	**Hanover County**	510853211002
Grayson County	510770602013	**Hanover County**	510853211003
Grayson County	510770603001	**Hanover County**	510853212011
Grayson County	510770603002	**Hanover County**	510853212012
Greensville County	510818801011	**Hanover County**	510853212013
Greensville County	510818801012	**Hanover County**	510853212022
Greensville County	510818801013	**Hanover County**	510853212023
Greensville County	510818801014	**Hanover County**	510853213001
Greensville County	510818801021	**Hanover County**	510853213002
Greensville County	510818802002	**Hanover County**	510853214011
Greensville County	510818802003	**Hanover County**	510853214021
Halifax County	510839301002	**Henrico County**	510872001061
Halifax County	510839301003	**Henrico County**	510872001062
Halifax County	510839302021	**Henrico County**	510872001063
Halifax County	510839302022	**Henrico County**	510872001064
Halifax County	510839302023	**Henrico County**	510872001233
Halifax County	510839302031	**Henrico County**	510872001243
Halifax County	510839302032	**Henrico County**	510872001251
Halifax County	510839302033	**Henrico County**	510872001252
Halifax County	510839302041	**Henrico County**	510872001253
Halifax County	510839302042	**Henrico County**	510872001254
Halifax County	510839303023	**Henrico County**	510872001262
Halifax County	510839304001	**Henrico County**	510872001311
Halifax County	510839304004	**Henrico County**	510872001312
Halifax County	510839305001	**Henrico County**	510872001321
Halifax County	510839306011	**Henrico County**	510872001322

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Henrico County	510872001332	**Henrico County**	510872006003
Henrico County	510872001343	**Henrico County**	510872007001
Henrico County	510872001361	**Henrico County**	510872007002
Henrico County	510872001443	**Henrico County**	510872007003
Henrico County	510872001531	**Henrico County**	510872007004
Henrico County	510872001532	**Henrico County**	510872008011
Henrico County	510872003011	**Henrico County**	510872008012
Henrico County	510872003012	**Henrico County**	510872008013
Henrico County	510872003022	**Henrico County**	510872008021
Henrico County	510872003023	**Henrico County**	510872008022
Henrico County	510872003031	**Henrico County**	510872008051
Henrico County	510872003032	**Henrico County**	510872008052
Henrico County	510872003051	**Henrico County**	510872008053
Henrico County	510872003052	**Henrico County**	510872008054
Henrico County	510872003053	**Henrico County**	510872008061
Henrico County	510872004041	**Henrico County**	510872008071
Henrico County	510872004042	**Henrico County**	510872008072
Henrico County	510872004043	**Henrico County**	510872008073
Henrico County	510872004073	**Henrico County**	510872008074
Henrico County	510872004091	**Henrico County**	510872009042
Henrico County	510872004112	**Henrico County**	510872009044
Henrico County	510872004113	**Henrico County**	510872009051
Henrico County	510872004121	**Henrico County**	510872009052
Henrico County	510872004122	**Henrico County**	510872009053
Henrico County	510872004171	**Henrico County**	510872009054
Henrico County	510872004172	**Henrico County**	510872009073
Henrico County	510872004173	**Henrico County**	510872009081
Henrico County	510872004174	**Henrico County**	510872009082
Henrico County	510872004181	**Henrico County**	510872010011
Henrico County	510872004182	**Henrico County**	510872010013
Henrico County	510872004183	**Henrico County**	510872010021
Henrico County	510872005011	**Henrico County**	510872010022
Henrico County	510872005012	**Henrico County**	510872010023
Henrico County	510872005021	**Henrico County**	510872010031
Henrico County	510872005022	**Henrico County**	510872010032
Henrico County	510872005031	**Henrico County**	510872010033
Henrico County	510872005032	**Henrico County**	510872011021
Henrico County	510872005033	**Henrico County**	510872011022
Henrico County	510872006001	**Henrico County**	510872011023
Henrico County	510872006002	**Henrico County**	510872011024

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Henrico County	510872011031	**Henry County**	510890101002
Henrico County	510872011032	**Henry County**	510890101003
Henrico County	510872011041	**Henry County**	510890101004
Henrico County	510872011042	**Henry County**	510890102001
Henrico County	510872012031	**Henry County**	510890102002
Henrico County	510872012032	**Henry County**	510890102003
Henrico County	510872012041	**Henry County**	510890103002
Henrico County	510872012042	**Henry County**	510890104001
Henrico County	510872012043	**Henry County**	510890104002
Henrico County	510872012051	**Henry County**	510890104003
Henrico County	510872012052	**Henry County**	510890105001
Henrico County	510872012053	**Henry County**	510890105002
Henrico County	510872012061	**Henry County**	510890105003
Henrico County	510872012062	**Henry County**	510890106011
Henrico County	510872014031	**Henry County**	510890106021
Henrico County	510872014033	**Henry County**	510890106022
Henrico County	510872014034	**Henry County**	510890107001
Henrico County	510872014035	**Henry County**	510890107002
Henrico County	510872014041	**Henry County**	510890107003
Henrico County	510872014042	**Henry County**	510890107004
Henrico County	510872014043	**Henry County**	510890108001
Henrico County	510872014051	**Henry County**	510890108002
Henrico County	510872014061	**Henry County**	510890108003
Henrico County	510872014062	**Henry County**	510890109001
Henrico County	510872014063	**Henry County**	510890109002
Henrico County	510872014064	**Henry County**	510890110001
Henrico County	510872015021	**Henry County**	510890110002
Henrico County	510872015023	**Henry County**	510890110003
Henrico County	510872015031	**Henry County**	510890111001
Henrico County	510872015033	**Henry County**	510890111002
Henrico County	510872015042	**Henry County**	510890111003
Henrico County	510872015043	**Henry County**	510890112001
Henrico County	510872016011	**Henry County**	510890112002
Henrico County	510872016012	**Henry County**	510890112003
Henrico County	510872016021	**Henry County**	510890113001
Henrico County	510872016022	**Henry County**	510890113002
Henrico County	510872016023	**Henry County**	510890113003
Henrico County	510872017011	**Highland County**	510919701001
Henrico County	510872017012	**Highland County**	510919701002
Henry County	510890101001	**Highland County**	510919701003

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Isle of Wight County	510932801051	**Loudoun County**	511076105054
Isle of Wight County	510932801052	**Loudoun County**	511076110181
Isle of Wight County	510932801053	**Loudoun County**	511076110183
James City County	510950801021	**Loudoun County**	511076112041
James City County	510950801022	**Loudoun County**	511076112042
James City County	510950801023	**Loudoun County**	511076112043
James City County	510950801032	**Loudoun County**	511076112051
King & Queen County	510979504002	**Loudoun County**	511076112092
King &Queen County	510979505001	**Loudoun County**	511076114001
King George County	510990403021	**Loudoun County**	511076114002
King William County	511019502001	**Loudoun County**	511076114003
Lancaster County	511030301001	**Loudoun County**	511076115013
Lancaster County	511030301002	**Loudoun County**	511076115022
Lee County	511059501001	**Loudoun County**	511076115023
Lee County	511059501002	**Loudoun County**	511076116021
Lee County	511059501003	**Loudoun County**	511076116022
Lee County	511059501004	**Loudoun County**	511076117011
Lee County	511059501005	**Loudoun County**	511076117012
Lee County	511059502001	**Loudoun County**	511076117021
Lee County	511059502002	**Loudoun County**	511076117022
Lee County	511059502003	**Loudoun County**	511076118041
Lee County	511059502004	**Louisa County**	511099502011
Lee County	511059503011	**Louisa County**	511099502012
Lee County	511059503012	**Louisa County**	511099502013
Lee County	511059503021	**Louisa County**	511099504001
Lee County	511059503022	**Louisa County**	511099504002
Lee County	511059504001	**Lunenburg County**	511119301001
Lee County	511059504002	**Lunenburg County**	511119301002
Lee County	511059504003	**Lunenburg County**	511119301003
Lee County	511059505001	**Lunenburg County**	511119301004
Lee County	511059505002	**Lunenburg County**	511119302001
Lee County	511059505003	**Lunenburg County**	511119302002
Lee County	511059505004	**Lunenburg County**	511119302003
Lee County	511059506001	**Lunenburg County**	511119302004
Lee County	511059506002	**Lunenburg County**	511119303001
Lee County	511059506003	**Lunenburg County**	511119303002
Lee County	511059506004	**Madison County**	511139301012
Loudoun County	511076105051	**Madison County**	511139302011
Loudoun County	511076105052	**Madison County**	511139302021
Loudoun County	511076105053	**Madison County**	511139302022

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Mecklenburg County	511179301011	**Montgomery County**	511210204011
Mecklenburg County	511179301012	**Montgomery County**	511210204012
Mecklenburg County	511179301013	**Montgomery County**	511210204021
Mecklenburg County	511179301031	**Montgomery County**	511210204022
Mecklenburg County	511179301041	**Montgomery County**	511210205001
Mecklenburg County	511179301042	**Montgomery County**	511210205002
Mecklenburg County	511179302011	**Montgomery County**	511210205003
Mecklenburg County	511179302012	**Montgomery County**	511210206002
Mecklenburg County	511179302013	**Montgomery County**	511210207011
Mecklenburg County	511179302021	**Montgomery County**	511210207012
Mecklenburg County	511179302022	**Montgomery County**	511210207021
Mecklenburg County	511179303001	**Montgomery County**	511210208011
Mecklenburg County	511179303002	**Montgomery County**	511210208013
Mecklenburg County	511179303003	**Montgomery County**	511210208021
Mecklenburg County	511179304011	**Montgomery County**	511210208022
Mecklenburg County	511179304012	**Montgomery County**	511210209002
Mecklenburg County	511179304021	**Montgomery County**	511210209003
Mecklenburg County	511179304022	**Montgomery County**	511210212022
Mecklenburg County	511179305002	**Montgomery County**	511210214001
Mecklenburg County	511179306001	**Montgomery County**	511210214002
Mecklenburg County	511179306002	**Montgomery County**	511210215011
Mecklenburg County	511179306003	**Montgomery County**	511210215012
Mecklenburg County	511179307002	**Montgomery County**	511210215013
Mecklenburg County	511179308001	**Nelson County**	511259501011
Mecklenburg County	511179308002	**Nelson County**	511259501022
Mecklenburg County	511179308003	**New Kent County**	511277001001
Mecklenburg County	511179308004	**New Kent County**	511277001003
Middlesex County	511199509001	**New Kent County**	511277002001
Middlesex County	511199509002	**New Kent County**	511277002002
Middlesex County	511199511001	**New Kent County**	511277002003
Middlesex County	511199511002	**Northampton County**	511319301001
Middlesex County	511199511003	**Northampton County**	511319301002
Montgomery County	511210202011	**Northampton County**	511319301003
Montgomery County	511210202012	**Northampton County**	511319301004
Montgomery County	511210202013	**Northampton County**	511319302001
Montgomery County	511210202021	**Northampton County**	511319302002
Montgomery County	511210202022	**Northampton County**	511319303011
Montgomery County	511210203011	**Northampton County**	511319303012
Montgomery County	511210203012	**Northampton County**	511319303013
Montgomery County	511210203014	**Northampton County**	511319303021

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Northampton County	511319303022	**Patrick County**	511410301011
Northampton County	511319901000	**Patrick County**	511410301012
Northumberland County	511330201001	**Patrick County**	511410301021
Northumberland County	511330201002	**Patrick County**	511410301022
Northumberland County	511330201003	**Patrick County**	511410301023
Northumberland County	511330201004	**Patrick County**	511410302021
Northumberland County	511330202001	**Patrick County**	511410303011
Northumberland County	511330202003	**Patrick County**	511410303012
Northumberland County	511330203011	**Patrick County**	511410303013
Northumberland County	511330203013	**Patrick County**	511410303021
Nottoway County	511350001011	**Patrick County**	511410303022
Nottoway County	511350001012	**Patrick County**	511410303023
Nottoway County	511350001021	**Pittsylvania County**	511430101001
Nottoway County	511350001022	**Pittsylvania County**	511430101002
Nottoway County	511350001023	**Pittsylvania County**	511430101003
Nottoway County	511350002001	**Pittsylvania County**	511430102001
Nottoway County	511350002002	**Pittsylvania County**	511430102002
Nottoway County	511350002003	**Pittsylvania County**	511430102003
Nottoway County	511350003001	**Pittsylvania County**	511430103011
Nottoway County	511350003002	**Pittsylvania County**	511430103021
Nottoway County	511350003003	**Pittsylvania County**	511430103022
Nottoway County	511350003004	**Pittsylvania County**	511430103023
Nottoway County	511350003005	**Pittsylvania County**	511430104001
Nottoway County	511350003006	**Pittsylvania County**	511430104002
Nottoway County	511350003007	**Pittsylvania County**	511430104003
Nottoway County	511359801001	**Pittsylvania County**	511430104004
Orange County	511371102001	**Pittsylvania County**	511430105001
Orange County	511371102002	**Pittsylvania County**	511430105002
Orange County	511371103012	**Pittsylvania County**	511430105003
Page County	511390301001	**Pittsylvania County**	511430106001
Page County	511390304011	**Pittsylvania County**	511430106002
Page County	511390304012	**Pittsylvania County**	511430106003
Page County	511390304021	**Pittsylvania County**	511430107001
Page County	511390304022	**Pittsylvania County**	511430107002
Page County	511390304023	**Pittsylvania County**	511430108031
Page County	511390305001	**Pittsylvania County**	511430108032
Page County	511390305002	**Pittsylvania County**	511430108033
Page County	511390305003	**Pittsylvania County**	511430108041
Page County	511390305004	**Pittsylvania County**	511430108042
Page County	511390305005	**Pittsylvania County**	511430110021

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Pittsylvania County	511430111001	**Prince William County**	511539004031
Pittsylvania County	511430111002	**Prince William County**	511539004032
Pittsylvania County	511430112001	**Prince William County**	511539004036
Pittsylvania County	511430112002	**Prince William County**	511539004041
Pittsylvania County	511430112003	**Prince William County**	511539004042
Pittsylvania County	511430114001	**Prince William County**	511539004043
Pittsylvania County	511430114002	**Prince William County**	511539004071
Pittsylvania County	511430114003	**Prince William County**	511539004072
Prince Edward County	511479301011	**Prince William County**	511539004074
Prince Edward County	511479301023	**Prince William County**	511539004091
Prince Edward County	511479302021	**Prince William County**	511539004092
Prince Edward County	511479302022	**Prince William County**	511539004102
Prince Edward County	511479302023	**Prince William County**	511539005031
Prince Edward County	511479302041	**Prince William County**	511539005032
Prince Edward County	511479302043	**Prince William County**	511539005041
Prince Edward County	511479302044	**Prince William County**	511539005042
Prince Edward County	511479303021	**Prince William County**	511539005043
Prince George County	511498501001	**Prince William County**	511539006011
Prince George County	511498501002	**Prince William County**	511539006012
Prince George County	511498502001	**Prince William County**	511539006021
Prince George County	511498502002	**Prince William County**	511539006022
Prince George County	511498502003	**Prince William County**	511539006023
Prince George County	511498502004	**Prince William County**	511539007021
Prince George County	511498502005	**Prince William County**	511539007024
Prince George County	511498503011	**Prince William County**	511539008031
Prince George County	511498503012	**Prince William County**	511539009011
Prince George County	511498503013	**Prince William County**	511539009012
Prince George County	511498503014	**Prince William County**	511539009013
Prince George County	511498503021	**Prince William County**	511539009014
Prince George County	511498503022	**Prince William County**	511539010132
Prince William County	511539002011	**Prince William County**	511539010142
Prince William County	511539002012	**Prince William County**	511539010152
Prince William County	511539002021	**Prince William County**	511539011022
Prince William County	511539002022	**Prince William County**	511539012031
Prince William County	511539002023	**Prince William County**	511539012032
Prince William County	511539002031	**Prince William County**	511539012082
Prince William County	511539002032	**Prince William County**	511539012091
Prince William County	511539002033	**Prince William County**	511539012112
Prince William County	511539003011	**Prince William County**	511539012113
Prince William County	511539003022	**Prince William County**	511539012121

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Prince William County	511539012124	**Richmond County**	511590401004
Prince William County	511539012233	**Roanoke County**	511610302061
Prince William County	511539012272	**Roanoke County**	511610302062
Prince William County	511539014031	**Roanoke County**	511610302071
Prince William County	511539014032	**Roanoke County**	511610302072
Prince William County	511539014033	**Roanoke County**	511610307022
Prince William County	511539014034	**Roanoke County**	511610310001
Prince William County	511539014071	**Roanoke County**	511610311011
Prince William County	511539014072	**Roanoke County**	511610311012
Prince William County	511539014093	**Rockbridge County**	511639304001
Prince William County	511539014162	**Rockbridge County**	511639304002
Prince William County	511539014181	**Rockbridge County**	511639304003
Prince William County	511539014182	**Rockbridge County**	511639304004
Prince William County	511539014183	**Rockingham County**	511650101001
Prince William County	511539014191	**Rockingham County**	511650101002
Prince William County	511539016013	**Rockingham County**	511650105002
Prince William County	511539017021	**Rockingham County**	511650109002
Prince William County	511539017022	**Rockingham County**	511650110001
Prince William County	511539017023	**Rockingham County**	511650110002
Prince William County	511539017031	**Rockingham County**	511650110003
Prince William County	511539017032	**Rockingham County**	511650111001
Prince William County	511539017041	**Rockingham County**	511650114005
Prince William County	511539017042	**Rockingham County**	511650117002
Prince William County	511539017043	**Russell County**	511670301001
Prince William County	511539017044	**Russell County**	511670301002
Prince William County	511539019001	**Russell County**	511670301003
Prince William County	511539019003	**Russell County**	511670301004
Pulaski County	511552101021	**Russell County**	511670301005
Pulaski County	511552102011	**Russell County**	511670302011
Pulaski County	511552102013	**Russell County**	511670302012
Pulaski County	511552103003	**Russell County**	511670302013
Pulaski County	511552104011	**Russell County**	511670302014
Pulaski County	511552104012	**Russell County**	511670302021
Pulaski County	511552104013	**Russell County**	511670302022
Pulaski County	511552104021	**Russell County**	511670303001
Pulaski County	511552104022	**Russell County**	511670303002
Pulaski County	511552106001	**Russell County**	511670303003
Richmond County	511590401001	**Russell County**	511670303004
Richmond County	511590401002	**Russell County**	511670304033
Richmond County	511590401003	**Russell County**	511670305001

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Russell County	511670305002	**Smyth County**	511730303022
Russell County	511670306001	**Smyth County**	511730303023
Russell County	511670306002	**Smyth County**	511730303024
Russell County	511670306003	**Smyth County**	511730304001
Russell County	511670306004	**Smyth County**	511730304002
Scott County	511690301001	**Smyth County**	511730305001
Scott County	511690302001	**Smyth County**	511730305002
Scott County	511690302002	**Smyth County**	511730306001
Scott County	511690302003	**Smyth County**	511730306002
Scott County	511690302004	**Smyth County**	511730306003
Scott County	511690303001	**Smyth County**	511730307011
Scott County	511690303002	**Smyth County**	511730307012
Scott County	511690303003	**Smyth County**	511730307013
Scott County	511690304001	**Smyth County**	511730307014
Scott County	511690304002	**Smyth County**	511730307021
Scott County	511690304003	**Smyth County**	511730307022
Scott County	511690306001	**Smyth County**	511730307023
Scott County	511690306002	**Southampton County**	511752003001
Scott County	511690306003	**Spotsylvania County**	511770201081
Scott County	511690306004	**Spotsylvania County**	511770202013
Shenandoah County	511710401022	**Spotsylvania County**	511770202021
Shenandoah County	511710405011	**Spotsylvania County**	511770202022
Shenandoah County	511710405012	**Spotsylvania County**	511770202043
Shenandoah County	511710405013	**Spotsylvania County**	511770203051
Shenandoah County	511710405014	**Spotsylvania County**	511770203071
Shenandoah County	511710405021	**Spotsylvania County**	511770203115
Shenandoah County	511710405022	**Spotsylvania County**	511770203131
Shenandoah County	511710407001	**Stafford County**	511790102011
Smyth County	511730301001	**Stafford County**	511790102111
Smyth County	511730301002	**Stafford County**	511790102113
Smyth County	511730301003	**Stafford County**	511790102151
Smyth County	511730301004	**Stafford County**	511790102162
Smyth County	511730302001	**Stafford County**	511790102163
Smyth County	511730302002	**Surry County**	511818601001
Smyth County	511730302003	**Surry County**	511818601002
Smyth County	511730302004	**Surry County**	511818601003
Smyth County	511730303011	**Sussex County**	511838703001
Smyth County	511730303012	**Sussex County**	511838703002
Smyth County	511730303013	**Sussex County**	511838703003
Smyth County	511730303021	**Sussex County**	511838704001

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Sussex County	511838704002	**Warren County**	511870205004
Tazewell County	511850201001	**Warren County**	511870206011
Tazewell County	511850201002	**Warren County**	511870206022
Tazewell County	511850202001	**Washington County**	511910101012
Tazewell County	511850202002	**Washington County**	511910103011
Tazewell County	511850202003	**Washington County**	511910103012
Tazewell County	511850202004	**Washington County**	511910103021
Tazewell County	511850203011	**Washington County**	511910103022
Tazewell County	511850203012	**Washington County**	511910105021
Tazewell County	511850203013	**Washington County**	511910105022
Tazewell County	511850203021	**Washington County**	511910105023
Tazewell County	511850203022	**Washington County**	511910106011
Tazewell County	511850203023	**Washington County**	511910106021
Tazewell County	511850203024	**Washington County**	511910106022
Tazewell County	511850204001	**Washington County**	511910107001
Tazewell County	511850204002	**Washington County**	511910107002
Tazewell County	511850204003	**Washington County**	511910107003
Tazewell County	511850204004	**Washington County**	511910108001
Tazewell County	511850205001	**Washington County**	511910108002
Tazewell County	511850205002	**Washington County**	511910108003
Tazewell County	511850205003	**Washington County**	511910109001
Tazewell County	511850207001	**Washington County**	511910109002
Tazewell County	511850207002	**Washington County**	511910109003
Tazewell County	511850208001	**Westmoreland County**	511930101011
Tazewell County	511850208002	**Westmoreland County**	511930101012
Tazewell County	511850209001	**Westmoreland County**	511930101021
Tazewell County	511850209002	**Westmoreland County**	511930101022
Tazewell County	511850210001	**Westmoreland County**	511930101023
Tazewell County	511850210002	**Westmoreland County**	511930101024
Tazewell County	511850210003	**Westmoreland County**	511930102002
Tazewell County	511850210004	**Westmoreland County**	511930102003
Warren County	511870203001	**Westmoreland County**	511930103001
Warren County	511870204001	**Westmoreland County**	511930104012
Warren County	511870204002	**Westmoreland County**	511930104021
Warren County	511870204003	**Wise County**	511959307001
Warren County	511870204004	**Wise County**	511959307002
Warren County	511870204005	**Wise County**	511959307003
Warren County	511870205001	**Wise County**	511959308001
Warren County	511870205002	**Wise County**	511959308002
Warren County	511870205003	**Wise County**	511959309001

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Wise County	511959309002	**Alexandria City**	515102001042
Wise County	511959310001	**Alexandria City**	515102001043
Wise County	511959310002	**Alexandria City**	515102001051
Wise County	511959311001	**Alexandria City**	515102001052
Wise County	511959311002	**Alexandria City**	515102001064
Wise County	511959312001	**Alexandria City**	515102001092
Wise County	511959312002	**Alexandria City**	515102001093
Wise County	511959312003	**Alexandria City**	515102003012
Wise County	511959312004	**Alexandria City**	515102003021
Wise County	511959312005	**Alexandria City**	515102003022
Wise County	511959313001	**Alexandria City**	515102003041
Wise County	511959313002	**Alexandria City**	515102003042
Wise County	511959315001	**Alexandria City**	515102003043
Wise County	511959315002	**Alexandria City**	515102003051
Wise County	511959315003	**Alexandria City**	515102003052
Wise County	511959315004	**Alexandria City**	515102004062
Wise County	511959316001	**Alexandria City**	515102004081
Wise County	511959316002	**Alexandria City**	515102004082
Wise County	511959317001	**Alexandria City**	515102004083
Wise County	511959317002	**Alexandria City**	515102004091
Wythe County	511970501011	**Alexandria City**	515102004092
Wythe County	511970501012	**Alexandria City**	515102004093
Wythe County	511970501022	**Alexandria City**	515102004094
Wythe County	511970502011	**Alexandria City**	515102005001
Wythe County	511970502012	**Alexandria City**	515102005002
Wythe County	511970502013	**Alexandria City**	515102005003
Wythe County	511970502021	**Alexandria City**	515102006003
Wythe County	511970502022	**Alexandria City**	515102007032
Wythe County	511970504011	**Alexandria City**	515102008022
Wythe County	511970504012	**Alexandria City**	515102011001
Wythe County	511970504013	**Alexandria City**	515102012041
Wythe County	511970504022	**Alexandria City**	515102012051
Wythe County	511970504023	**Alexandria City**	515102012052
York County	511990502071	**Alexandria City**	515102012061
York County	511990503061	**Alexandria City**	515102012062
York County	511990505001	**Alexandria City**	515102012063
Alexandria City	515102001021	**Alexandria City**	515102016022
Alexandria City	515102001022	**Alexandria City**	515102018021
Alexandria City	515102001023	**Alexandria City**	515102018052
Alexandria City	515102001041	**Bristol City**	515200201001

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Bristol City	515200201002	**Chesapeake City**	515500204002
Bristol City	515200201003	**Chesapeake City**	515500204003
Bristol City	515200202011	**Chesapeake City**	515500205001
Bristol City	515200202012	**Chesapeake City**	515500207001
Bristol City	515200202013	**Chesapeake City**	515500207002
Bristol City	515200202021	**Chesapeake City**	515500207003
Bristol City	515200202022	**Chesapeake City**	515500207004
Bristol City	515200203001	**Chesapeake City**	515500208053
Bristol City	515200203002	**Chesapeake City**	515500208091
Bristol City	515200203003	**Chesapeake City**	515500208111
Buena Vista City	515309306011	**Chesapeake City**	515500209031
Buena Vista City	515309306012	**Chesapeake City**	515500209052
Buena Vista City	515309306013	**Chesapeake City**	515500209101
Buena Vista City	515309306021	**Chesapeake City**	515500209112
Buena Vista City	515309306022	**Chesapeake City**	515500214021
Charlottesville City	515400002013	**Chesapeake City**	515500214024
Charlottesville City	515400002021	**Chesapeake City**	515500214031
Charlottesville City	515400002022	**Chesapeake City**	515500214033
Charlottesville City	515400002023	**Chesapeake City**	515500214051
Charlottesville City	515400004011	**Chesapeake City**	515500214072
Charlottesville City	515400004012	**Chesapeake City**	515500215071
Charlottesville City	515400005011	**Chesapeake City**	515500216021
Charlottesville City	515400005012	**Chesapeake City**	515500216024
Charlottesville City	515400005013	**Colonial Heights City**	515708301001
Charlottesville City	515400006001	**Colonial Heights City**	515708302001
Charlottesville City	515400006002	**Colonial Heights City**	515708302002
Charlottesville City	515400006003	**Colonial Heights City**	515708302003
Charlottesville City	515400008004	**Colonial Heights City**	515708303002
Chesapeake City	515500200031	**Colonial Heights City**	515708304001
Chesapeake City	515500201001	**Colonial Heights City**	515708304002
Chesapeake City	515500201002	**Colonial Heights City**	515708305001
Chesapeake City	515500201003	**Colonial Heights City**	515708305002
Chesapeake City	515500201004	**Covington City**	515800601001
Chesapeake City	515500202001	**Covington City**	515800601002
Chesapeake City	515500202002	**Covington City**	515800601003
Chesapeake City	515500202003	**Danville City**	515900001001
Chesapeake City	515500202004	**Danville City**	515900001002
Chesapeake City	515500203001	**Danville City**	515900001003
Chesapeake City	515500203002	**Danville City**	515900001004
Chesapeake City	515500204001	**Danville City**	515900002001

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Danville City	515900002002	**Franklin City**	516200902002
Danville City	515900002003	**Franklin City**	516200902003
Danville City	515900003001	**Fredericksburg City**	516300002012
Danville City	515900003002	**Fredericksburg City**	516300003011
Danville City	515900003003	**Fredericksburg City**	516300004001
Danville City	515900004001	**Fredericksburg City**	516300004003
Danville City	515900004002	**Fredericksburg City**	516300005001
Danville City	515900004003	**Fredericksburg City**	516300005005
Danville City	515900005001	**Grayson County**	516400701011
Danville City	515900005002	**Galax City**	516400701012
Danville City	515900006001	**Galax City**	516400701013
Danville City	515900006002	**Galax City**	516400701014
Danville City	515900006003	**Galax City**	516400701015
Danville City	515900008001	**Galax City**	516400701016
Danville City	515900008002	**Galax City**	516400701021
Danville City	515900009001	**Galax City**	516400701022
Danville City	515900009002	**Hampton City**	516500101042
Danville City	515900009003	**Hampton City**	516500101044
Danville City	515900010001	**Hampton City**	516500101045
Danville City	515900010002	**Hampton City**	516500103062
Danville City	515900010003	**Hampton City**	516500103063
Danville City	515900011001	**Hampton City**	516500103091
Danville City	515900012001	**Hampton City**	516500103111
Danville City	515900012002	**Hampton City**	516500103121
Danville City	515900013011	**Hampton City**	516500103141
Danville City	515900013021	**Hampton City**	516500103152
Danville City	515900014002	**Hampton City**	516500103162
Emporia City	515958901001	**Hampton City**	516500104001
Emporia City	515958901002	**Hampton City**	516500104002
Emporia City	515958901003	**Hampton City**	516500104003
Emporia City	515958902001	**Hampton City**	516500104004
Emporia City	515958902002	**Hampton City**	516500104005
Emporia City	515958902003	**Hampton City**	516500105021
Emporia City	515958902004	**Hampton City**	516500105032
Fairfax City	516003001002	**Hampton City**	516500105042
Fairfax City	516003001004	**Hampton City**	516500106011
Fairfax City	516003002001	**Hampton City**	516500106012
Fairfax City	516003005003	**Hampton City**	516500106021
Franklin City	516200901001	**Hampton City**	516500106022
Franklin City	516200902001	**Hampton City**	516500107011

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Hampton City	516500107012	**Harrisonburg City**	516600003022
Hampton City	516500107021	**Harrisonburg City**	516600003023
Hampton City	516500108001	**Harrisonburg City**	516600003024
Hampton City	516500109001	**Harrisonburg City**	516600004012
Hampton City	516500109002	**Harrisonburg City**	516600004021
Hampton City	516500110022	**Harrisonburg City**	516600004022
Hampton City	516500112001	**Harrisonburg City**	516600004023
Hampton City	516500112002	**Harrisonburg City**	516600004024
Hampton City	516500113001	**Harrisonburg City**	516600004025
Hampton City	516500113002	**Hopewell City**	516708201001
Hampton City	516500114001	**Hopewell City**	516708203001
Hampton City	516500116003	**Hopewell City**	516708203002
Hampton City	516500118001	**Hopewell City**	516708204001
Hampton City	516500118002	**Hopewell City**	516708204002
Hampton City	516500118003	**Hopewell City**	516708204003
Hampton City	516500118004	**Hopewell City**	516708204004
Hampton City	516500118005	**Hopewell City**	516708205001
Hampton City	516500118006	**Hopewell City**	516708205002
Hampton City	516500119001	**Hopewell City**	516708205003
Hampton City	516500119002	**Hopewell City**	516708205004
Hampton City	516500119003	**Hopewell City**	516708206001
Hampton City	516500120001	**Hopewell City**	516708206002
Hampton City	516500120002	**Hopewell City**	516708206003
Harrisonburg City	516600001011	**Hopewell City**	516708206004
Harrisonburg City	516600001012	**Hopewell City**	516708206005
Harrisonburg City	516600001013	**Hopewell City**	516708207001
Harrisonburg City	516600001014	**Lexington City**	516789305013
Harrisonburg City	516600001021	**Lynchburg City**	516800002052
Harrisonburg City	516600002041	**Lynchburg City**	516800003002
Harrisonburg City	516600002042	**Lynchburg City**	516800004001
Harrisonburg City	516600002043	**Lynchburg City**	516800004002
Harrisonburg City	516600002044	**Lynchburg City**	516800005001
Harrisonburg City	516600002051	**Lynchburg City**	516800006001
Harrisonburg City	516600002052	**Lynchburg City**	516800006002
Harrisonburg City	516600002053	**Lynchburg City**	516800006003
Harrisonburg City	516600002054	**Lynchburg City**	516800007001
Harrisonburg City	516600002071	**Lynchburg City**	516800007002
Harrisonburg City	516600002072	**Lynchburg City**	516800007003
Harrisonburg City	516600002073	**Lynchburg City**	516800008011
Harrisonburg City	516600003021	**Lynchburg City**	516800008022

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Lynchburg City	516800009013	**Newport News City**	517000301002
Lynchburg City	516800009022	**Newport News City**	517000301003
Lynchburg City	516800010002	**Newport News City**	517000301004
Lynchburg City	516800011001	**Newport News City**	517000303001
Lynchburg City	516800011002	**Newport News City**	517000303002
Lynchburg City	516800014001	**Newport News City**	517000303003
Lynchburg City	516800014002	**Newport News City**	517000303004
Lynchburg City	516800014003	**Newport News City**	517000303005
Lynchburg City	516800016012	**Newport News City**	517000304001
Lynchburg City	516800019001	**Newport News City**	517000304002
Lynchburg City	516800019002	**Newport News City**	517000305001
Lynchburg City	516800019003	**Newport News City**	517000305002
Lynchburg City	516800019004	**Newport News City**	517000306001
Manassas City	516839102012	**Newport News City**	517000306002
Manassas City	516839102021	**Newport News City**	517000308001
Manassas City	516839102022	**Newport News City**	517000308002
Manassas City	516839102023	**Newport News City**	517000308003
Manassas City	516839102024	**Newport News City**	517000309001
Manassas City	516839103011	**Newport News City**	517000309002
Manassas City	516839103021	**Newport News City**	517000312001
Manassas City	516839104011	**Newport News City**	517000312002
Manassas City	516839104012	**Newport News City**	517000313001
Manassas City	516839104013	**Newport News City**	517000313002
Manassas City	516839104014	**Newport News City**	517000313003
Manassas Park City	516859201001	**Newport News City**	517000314003
Manassas Park City	516859201002	**Newport News City**	517000314004
Manassas Park City	516859201005	**Newport News City**	517000316022
Manassas Park City	516859202011	**Newport News City**	517000316023
Martinsville City	516900001001	**Newport News City**	517000316041
Martinsville City	516900001002	**Newport News City**	517000316042
Martinsville City	516900002001	**Newport News City**	517000319021
Martinsville City	516900002002	**Newport News City**	517000320021
Martinsville City	516900002003	**Newport News City**	517000320061
Martinsville City	516900003001	**Newport News City**	517000320062
Martinsville City	516900003002	**Newport News City**	517000320063
Martinsville City	516900003003	**Newport News City**	517000321132
Martinsville City	516900004001	**Newport News City**	517000321171
Martinsville City	516900004002	**Newport News City**	517000321172
Martinsville City	516900004003	**Newport News City**	517000321173
Newport News City	517000301001	**Newport News City**	517000321231

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
Newport News City	517000321261	**Norfolk City**	517100009012
Newport News City	517000321262	**Norfolk City**	517100009013
Newport News City	517000321281	**Norfolk City**	517100009014
Newport News City	517000321282	**Norfolk City**	517100009015
Newport News City	517000321283	**Norfolk City**	517100009021
Newport News City	517000321313	**Norfolk City**	517100011001
Newport News City	517000321331	**Norfolk City**	517100011002
Newport News City	517000321332	**Norfolk City**	517100012002
Newport News City	517000322114	**Norfolk City**	517100013001
Newport News City	517000322121	**Norfolk City**	517100013002
Newport News City	517000322122	**Norfolk City**	517100014001
Newport News City	517000322123	**Norfolk City**	517100014002
Newport News City	517000322232	**Norfolk City**	517100014003
Newport News City	517000322251	**Norfolk City**	517100016001
Newport News City	517000322252	**Norfolk City**	517100016002
Newport News City	517000322253	**Norfolk City**	517100025001
Newport News City	517000322261	**Norfolk City**	517100025002
Newport News City	517000322262	**Norfolk City**	517100026001
Newport News City	517000322263	**Norfolk City**	517100026002
Newport News City	517000322271	**Norfolk City**	517100026003
Newport News City	517000322282	**Norfolk City**	517100027001
Newport News City	517000323001	**Norfolk City**	517100027002
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Newport News City	517000323003	**Norfolk City**	517100028002
Newport News City	517000323004	**Norfolk City**	517100029001
Newport News City	517000323005	**Norfolk City**	517100029002
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Norfolk City	517100002022	**Norfolk City**	517100029004
Norfolk City	517100003002	**Norfolk City**	517100030001
Norfolk City	517100004002	**Norfolk City**	517100031001
Norfolk City	517100004003	**Norfolk City**	517100031002
Norfolk City	517100005001	**Norfolk City**	517100031003
Norfolk City	517100005003	**Norfolk City**	517100032003
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Norfolk City	517100006003	**Norfolk City**	517100034001
Norfolk City	517100006004	**Norfolk City**	517100034002
Norfolk City	517100008001	**Norfolk City**	517100035011
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Norfolk City	517100009011	**Norfolk City**	517100035013

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
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Norfolk City	517100042002	**Norfolk City**	517100059023
Norfolk City	517100043001	**Norfolk City**	517100059031
Norfolk City	517100043002	**Norfolk City**	517100059032
Norfolk City	517100043003	**Norfolk City**	517100060001
Norfolk City	517100043004	**Norfolk City**	517100060002
Norfolk City	517100044001	**Norfolk City**	517100060003
Norfolk City	517100044002	**Norfolk City**	517100061003
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Norfolk City	517100045001	**Norfolk City**	517100061005
Norfolk City	517100046001	**Norfolk City**	517100062001
Norfolk City	517100046002	**Norfolk City**	517100062002
Norfolk City	517100047001	**Norfolk City**	517100064002
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Norfolk City	517100048001	**Norfolk City**	517100065012
Norfolk City	517100048002	**Norfolk City**	517100065024
Norfolk City	517100050001	**Norfolk City**	517100066032
Norfolk City	517100050002	**Norfolk City**	517100066042
Norfolk City	517100050003	**Norfolk City**	517100066061
Norfolk City	517100051001	**Norfolk City**	517100066063
Norfolk City	517100051002	**Virginia Beach City**	517100068001
Norfolk City	517100051003	**Norfolk City**	517100069012
Norfolk City	517100051004	**Norfolk City**	517100069013
Norfolk City	517100055001	**Norfolk City**	517100069021
Norfolk City	517100055002	**Norfolk City**	517100070011
Norfolk City	517100055003	**Norton City**	517209601001
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Norfolk City	517100058002	**Petersburg City**	517308103003
Norfolk City	517100058003	**Petersburg City**	517308104001
Norfolk City	517100059011	**Petersburg City**	517308104002
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Norfolk City	517100059013	**Petersburg City**	517308105002

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
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Petersburg City	517308106002	**Portsmouth City**	517402121002
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Petersburg City	517308107002	**Portsmouth City**	517402123002
Petersburg City	517308109001	**Portsmouth City**	517402123003
Petersburg City	517308109002	**Portsmouth City**	517402123004
Petersburg City	517308109003	**Portsmouth City**	517402124001
Petersburg City	517308110001	**Portsmouth City**	517402124002
Petersburg City	517308110002	**Portsmouth City**	517402124003
Petersburg City	517308110003	**Portsmouth City**	517402125001
Petersburg City	517308112001	**Portsmouth City**	517402126001
Petersburg City	517308112002	**Portsmouth City**	517402126002
Petersburg City	517308112003	**Portsmouth City**	517402126003
Petersburg City	517308113001	**Portsmouth City**	517402127011
Petersburg City	517308113002	**Portsmouth City**	517402127012
Petersburg City	517308113003	**Portsmouth City**	517402127013
Petersburg City	517308113004	**Portsmouth City**	517402127021
Portsmouth City	517402102001	**Portsmouth City**	517402127022
Portsmouth City	517402103001	**Portsmouth City**	517402128012
Portsmouth City	517402103002	**Portsmouth City**	517402128013
Portsmouth City	517402103003	**Portsmouth City**	517402131011
Portsmouth City	517402105001	**Portsmouth City**	517402131012
Portsmouth City	517402111001	**Portsmouth City**	517402131013
Portsmouth City	517402111002	**Portsmouth City**	517402131033
Portsmouth City	517402114001	**Portsmouth City**	517402131034
Portsmouth City	517402114002	**Portsmouth City**	517402132001
Portsmouth City	517402115001	**Portsmouth City**	517402132002
Portsmouth City	517402115002	**Portsmouth City**	517409801001
Portsmouth City	517402116003	**Radford City**	517500101011
Portsmouth City	517402117001	**Radford City**	517500101012
Portsmouth City	517402117002	**Radford City**	517500101013
Portsmouth City	517402117003	**Radford City**	517500101022
Portsmouth City	517402118001	**Radford City**	517500102021
Portsmouth City	517402118002	**Radford City**	517500102023
Portsmouth City	517402118003	**Richmond City**	517600102011
Portsmouth City	517402118004	**Richmond City**	517600102012
Portsmouth City	517402119001	**Richmond City**	517600102021
Portsmouth City	517402119002	**Richmond City**	517600103001

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
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Richmond City	517600105001	**Richmond City**	517600209004
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Richmond City	517600108001	**Richmond City**	517600301001
Richmond City	517600108002	**Richmond City**	517600301002
Richmond City	517600108003	**Richmond City**	517600302001
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Richmond City	517600109002	**Richmond City**	517600302003
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Richmond City	517600202001	**Richmond City**	517600404001
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Richmond City	517600205022	**Richmond City**	517600409002
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Richmond City	517600206002	**Richmond City**	517600411002
Richmond City	517600207001	**Richmond City**	517600411003
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Richmond City	517600208001	**Richmond City**	517600412001

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
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Richmond City	517600414002	**Richmond City**	517600706013
Richmond City	517600416001	**Richmond City**	517600706014
Richmond City	517600501001	**Richmond City**	517600706021
Richmond City	517600602001	**Richmond City**	517600706022
Richmond City	517600602002	**Richmond City**	517600707001
Richmond City	517600602003	**Richmond City**	517600707002
Richmond City	517600604001	**Richmond City**	517600707003
Richmond City	517600604002	**Richmond City**	517600708021
Richmond City	517600604003	**Richmond City**	517600708022
Richmond City	517600604004	**Richmond City**	517600708031
Richmond City	517600604005	**Richmond City**	517600708032
Richmond City	517600605012	**Richmond City**	517600708041
Richmond City	517600605013	**Richmond City**	517600708042
Richmond City	517600605022	**Richmond City**	517600708043
Richmond City	517600605023	**Richmond City**	517600709011
Richmond City	517600606001	**Richmond City**	517600709012
Richmond City	517600606002	**Richmond City**	517600709013
Richmond City	517600607001	**Richmond City**	517600709021
Richmond City	517600607002	**Richmond City**	517600709022
Richmond City	517600607003	**Richmond City**	517600709023
Richmond City	517600607004	**Richmond City**	517600710021
Richmond City	517600607005	**Richmond City**	517600710022
Richmond City	517600608001	**Richmond City**	517600710031
Richmond City	517600608002	**Richmond City**	517600710032
Richmond City	517600608003	**Richmond City**	517600710041
Richmond City	517600608004	**Richmond City**	517600710042
Richmond City	517600609001	**Richmond City**	517600711001
Richmond City	517600610011	**Richmond City**	517600711002
Richmond City	517600610012	**Richmond City**	517600711003
Richmond City	517600610013	**Richmond City**	517600711004
Richmond City	517600610021	**Roanoke City**	517700001001
Richmond City	517600610022	**Roanoke City**	517700001002
Richmond City	517600610023	**Roanoke City**	517700001003
Richmond City	517600701002	**Roanoke City**	517700003003
Richmond City	517600701003	**Roanoke City**	517700004001
Richmond City	517600703001	**Roanoke City**	517700004002
Richmond City	517600703002	**Roanoke City**	517700004003

Virginia Jurisdiction	Census Block ID	Virginia Jurisdiction	Census Block ID
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Roanoke City	517700005003	**Salem City**	517750105011
Roanoke City	517700005004	**Staunton City**	517900002001
Roanoke City	517700006013	**Staunton City**	517900002002
Roanoke City	517700006014	**Staunton City**	517900002003
Roanoke City	517700006021	**Staunton City**	517900002004
Roanoke City	517700006022	**Staunton City**	517900005003
Roanoke City	517700006023	**Suffolk City**	518000651001
Roanoke City	517700009001	**Suffolk City**	518000651002
Roanoke City	517700009002	**Suffolk City**	518000652001
Roanoke City	517700010001	**Suffolk City**	518000653011
Roanoke City	517700010002	**Suffolk City**	518000653012
Roanoke City	517700012001	**Suffolk City**	518000653021
Roanoke City	517700012002	**Suffolk City**	518000653022
Roanoke City	517700012003	**Suffolk City**	518000654011
Roanoke City	517700019001	**Suffolk City**	518000654012
Roanoke City	517700019004	**Suffolk City**	518000654013
Roanoke City	517700022001	**Suffolk City**	518000654021
Roanoke City	517700023011	**Suffolk City**	518000655001
Roanoke City	517700024001	**Suffolk City**	518000655002
Roanoke City	517700024002	**Suffolk City**	518000655003
Roanoke City	517700024003	**Suffolk City**	518000655004
Roanoke City	517700025011	**Suffolk City**	518000751031
Roanoke City	517700025012	**Suffolk City**	518000751032
Roanoke City	517700025021	**Suffolk City**	518000751063
Roanoke City	517700025022	**Suffolk City**	518000753023
Roanoke City	517700026001	**Suffolk City**	518000755031
Roanoke City	517700026002	**Suffolk City**	518000755032
Roanoke City	517700026003	**Suffolk City**	518000755041
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Roanoke City	517700027003	**Suffolk City**	518000756011
Roanoke City	517700027004	**Suffolk City**	518000756012
Roanoke City	517700027005	**Suffolk City**	518000757012
Roanoke City	517700028001	**Virginia Beach City**	518100402001
Roanoke City	517700028004	**Virginia Beach City**	518100402002
Roanoke City	517700030003	**Virginia Beach City**	518100402003
Salem City	517750103001	**Virginia Beach City**	518100404031
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Virginia Beach City	518100406001	**Virginia Beach City**	518100454142
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Virginia Beach City	518100406004	**Virginia Beach City**	518100454301
Virginia Beach City	518100408011	**Virginia Beach City**	518100454323
Virginia Beach City	518100408012	**Virginia Beach City**	518100456051
Virginia Beach City	518100408024	**Virginia Beach City**	518100456061
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Virginia Beach City	518100410022	**Virginia Beach City**	518100458082
Virginia Beach City	518100410032	**Virginia Beach City**	518100458101
Virginia Beach City	518100410041	**Virginia Beach City**	518100460023
Virginia Beach City	518100410042	**Virginia Beach City**	518100460132
Virginia Beach City	518100410043	**Virginia Beach City**	518100460133
Virginia Beach City	518100428012	**Virginia Beach City**	518100460192
Virginia Beach City	518100428013	**Virginia Beach City**	518100462064
Virginia Beach City	518100428015	**Virginia Beach City**	518100462073
Virginia Beach City	518100428021	**Virginia Beach City**	518100462132
Virginia Beach City	518100428022	**Virginia Beach City**	518100462211
Virginia Beach City	518100432001	**Virginia Beach City**	518100462212
Virginia Beach City	518100440041	**Virginia Beach City**	518100462213
Virginia Beach City	518100440042	**Virginia Beach City**	518100462232
Virginia Beach City	518100440051	**Waynesboro City**	518200031001
Virginia Beach City	518100442021	**Waynesboro City**	518200032001
Virginia Beach City	518100442022	**Waynesboro City**	518200032002
Virginia Beach City	518100448051	**Waynesboro City**	518200032003
Virginia Beach City	518100448052	**Waynesboro City**	518200032004
Virginia Beach City	518100448061	**Waynesboro City**	518200033001
Virginia Beach City	518100448062	**Waynesboro City**	518200033002
Virginia Beach City	518100448063	**Waynesboro City**	518200033003
Virginia Beach City	518100448071	**Waynesboro City**	518200033004
Virginia Beach City	518100448072	**Waynesboro City**	518200034003
Virginia Beach City	518100448074	**Williamsburg City**	518303701001
Virginia Beach City	518100448075	**Williamsburg City**	518303702003
Virginia Beach City	518100448081	**Williamsburg City**	518303703002
Virginia Beach City	518100448083	**Winchester City**	518400001011
Virginia Beach City	518100452001	**Winchester City**	518400001012
Virginia Beach City	518100452002	**Winchester City**	518400001013
Virginia Beach City	518100452003	**Winchester City**	518400001021

Virginia Jurisdiction	Census Block ID
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Winchester City	518400001023
Winchester City	518400001024
Winchester City	518400002025
Winchester City	518400003012
Winchester City	518400003013
Winchester City	518400003014
Winchester City	518400003021
Winchester City	518400003024

Appendix F. GHG Inventory Data Sources and Approaches for Quantifying GHG Reductions from PCAP Measures

GHG Inventory Data Sources

Table 19 displays the data sources used to develop Virginia's most recent statewide GHG inventory.

Table 19: GHG Inventory Data Sources

Sector	Data Input	Default Data Source
On-road Transportation	Vehicle Miles Traveled	FHWA
	Annual mileage accumulation	EPA
	Emissions control technologies	EPA
	Age distribution of vehicles	EPA
	Emissions factors	EPA
Off-road Transportation	Aviation fuel consumption and activity	Energy Information Administration (EIA)
	Boat fuel consumption	FHWA and EPA
	Locomotive activity	EIA
	Agriculture, construction, and other off-road gasoline consumption	FHWA
	Other off-road activity	EPA
	Emissions factors	EIA and Intergovernmental Panel on Climate Change (IPCC)
Residential, Commercial, and Industrial Energy	Electricity consumption	EIA
	Stationary combustion	EIA
Industrial Processes	Iron and steel production	American Iron and Steel Institute (AISI)
	Cement and lime production	United States Geological Survey (USGS)
	Semiconductor and ozone depleting substances substitutes national emissions	EPA
	Soda ash production and consumption	EPA
	Limestone and dolomite consumption	EPA
	Ammonia production and urea consumption	USGS
	Electric power SF_6 consumption	EPA
	Emissions factors	IPCC and EPA
Agriculture	Livestock population	USDA
	Crop production	USDA

Sector	Data Input	Default Data Source
	Crop area burned	EPA
	Manure management data	EPA
	Urea and fertilizer consumption	Association of American Plant Food Control Officials (AAPFCO) and The Fertilizer Institute
	Liming application	USGS
Coal	Abandoned and underground mines	EPA
	Coal production	EIA
	Ventilation systems data	EPA
Solid Waste	Methane flared or recovered	EPA
	Solid waste quantity	EPA
Natural Gas and Oil	Pipeline data	U.S. Department of Transportation (DOT)
	Natural gas production	EIA
Wastewater	Population	U.S. Census
	Industrial wastewater treatment	EPA
Agriculture, Forestry, and Other Land Use	Settlement soils data	AAPFCO and The Fertilizer Institute
	Landfilled yard trimmings and food scraps	EPA
	Forest carbon flux	U.S. Forest Service (USFS)
	Urban tree coverage	USFS
	Agricultural soil carbon flux	EPA

Priority GHG Reduction Measure Quantification

A preliminary analysis of the cumulative short- and long-term GHG emission reductions (carbon sequestration for Measure 10) using standard EPA, DOE, and other accepted modeling tools on these 10 measures are presented below. The following is a summary of methods used for calculating emissions reductions in the Virginia PCAP. In some cases, there may be areas of overlap between emissions reduction values between measures. For example, electricity emissions factors associated with a progressively cleaner grid were used to determine emissions reduction potential for a range of measures (such as efficiency and electrification). This might result in double counting when comparing it to the measure to reduce GHG emissions from the power sector, which also accounts for emissions reductions from cleaner electricity.

The estimates provided in this PCAP reflect the implementation of each measure with all the identified actions included, to the extent data were available to support the analysis for this PCAP. Since a number of these measures cover the same activity sector, their impacts are not additive as they sometimes overlap with each other.

Further, due to limited time for PCAP analysis, interaction between certain measures were not captured, and in some instances, depending on the available tool or model, the GHG benefits analysis was not aligned with the most recent state-wide GHG inventory. These interactions and the calibration with the state GHG inventory will be captured in the GHG reduction analysis completed for the CCAP.

Measure 1. Reduce GHG emissions from the on-road transportation sector through vehicle electrification and other zero- and low-carbon fuels.

The measure models the resulting GHG emissions reductions of the transition of vehicles to electric alternative fuels. GHG emission reductions for this measure were estimated using the DOE State and Local Planning for Energy (SLOPE) tool.[143] Two cases for Virginia were run in the tool to estimate carbon reductions. As defined by SLOPE these include:

1. **Reference Case:** This scenario evaluates the effects of business-as-usual projections for the evolution of electricity supply and energy demand sectors. The electricity generation mix evolves over time based on existing policies and default market and technology assumptions. End-use electrification, energy efficiency, and demand-side flexibility measures are assumed to grow modestly over time, consistent with current adoption and participation rates.

2. **95% Grid Decarbonization by 2050 & Moderate Electrification** This scenario evaluates the effects of a steady transition to a decarbonized electricity supply, electrification of cost-competitive opportunities in buildings and transportation, and increased participation in demand-side flexibility programs. The electricity generation mix is capped to follow a linear reduction in carbon dioxide emissions from the present through 2050, when it achieves

[143] https://maps.nrel.gov/slope

95% decarbonization. The decarbonized electricity supply is designed to accommodate the significant electrification of light-duty vehicles and heating services in milder climate regions, but growing participation in demand-side flexibility programs lessens the cumulative capacity expansion of electricity generation and transmission assets.

Also refer to the SLOPE Scenario Planner methodology documentation for additional information.[144] Cumulative reductions were estimated by comparing emissions in each year of the moderate electrification case to reference case emissions in the corresponding year.

Measure 2. Support alternative modes of transportation such as micro-mobility and active transportation to reduce vehicle miles traveled (VMT).

The measure models the resulting GHG emissions reductions if Virginia implements a variety of strategies to reduce VMT, described below. The VMT reduction targets are based on results from work conducted for the National Capital Region Transportation Planning Board of Metropolitan Washington Council of Government.[145] That project assessed three different mode shift and travel behavior scenarios, and the VMT reduction targets for Virginia for this measure are based off the moderate reduction scenario for that study. To extrapolate these results to account for rural areas in Virginia, it was assumed that these VMT reductions are only applicable to urban areas since the impacts of VMT policy and strategies is expected to be minimal in rural areas. According to FHWA Highway Statistics, in 2020, 65% of Virginia VMT was associated with urban travel, while rural travels accounted for the remaining 35%. The targets of 9% passenger VMT reduction from baseline by 2035 and 13% passenger VMT reduction from baseline by 2050, with linear growth in interim years starting in 2025, were derived using this proportion of urban versus rural VMT. The same baseline VMT, vehicle population, energy consumption, and emissions by fuel type and vehicle source type from EPA MOVES4 used for Measure 1 were used for Measure 2.

This analysis sourced data from EPA MOVES4, FHWA Highway Statistics, and eGRID.

Measure 3. Reduce GHG emissions from the off-road transportation sector, including ports and airports.

Ports: The GHG reduction calculations represented for ports target specific potential projects at select port facilities and locations. These include a set number of equipment and system upgrades and replacements for forklifts, vans, cruisers, shuttles, pickups, buses, and battery systems.

For the battery systems a 12 MW battery storage system and a 5 MW system at different facilities was modeled. To calculate the avoided/reduced emissions that will be garnered by these investments, the following assumptions were made: the 12 MW system would shave demand by a minimum of 8 hours each over 2 daily 2 hour peak demand windows, while the 5 MW system would shave 4 MWh twice a day as well. This amounts to 16 MWh daily per larger system and 8 MWh daily

[144] DOE. "SLOPE Scenario Planner 2021 Data Sources & Methodology." 2021. https://gds-files.nrelcloud.org/auto-sync/slope/SLOPE-Scenario-Planner-Methodology.pdf
[145] Transportation Planning Board. " Climate Change Mitigation Study of 2021." 2022. https://www.mwcog.org/tpb-climate-change-mitigation-study-of-2021/

at PPCY that would no longer need to be generated. Assuming the terminals work 360 days a year, this amounts to an annual avoidance of 8,640 MWh of grid generation. Emission factors to support this calculation were taken from EPA's eGRID Power Profiler.

For other equipment, including forklifts, vans, cruisers, shuttles, pickups, and buses, the analysis assumes replacing diesel equipment with zero emission battery electric alternatives. All the equipment replacement emission reduction estimates below have been made utilizing the EPA's Diesel Emissions Quantifier tool.[146]

Agriculture and other miscellaneous off-road: GHG emissions from agricultural equipment energy use and other off-road equipment were taken from Virginia's 2020 GHG inventory and held constant through 2050 to develop an estimated BAU case. An annual percentage of emission reduction from the BAU for each year was applied to estimate emission reductions. This annual percent reduction from BAU was developed based on California's Scoping Plan and a calculated percent reduction for agricultural energy and off-road relevant emissions in each year.[147]

Measure 4. Increase residential and commercial building energy efficiency and identify and implement GHG emission reduction solutions at homes, businesses, and institutions.

The measure models the resulting GHG emissions reductions if a proportion of residential and commercial buildings implement energy efficiency and other emission reduction solutions. Carbon reductions for this measure were estimated using the DOE SLOPE tool.[148] Three cases for Virginia were run in the tool to estimate carbon reductions for energy efficiency and other options to reduce GHG emissions. As defined by SLOPE these include:

3. **Reference Case:** This scenario evaluates the effects of business-as-usual projections for the evolution of electricity supply and energy demand sectors. The electricity generation mix evolves over time based on existing policies and default market and technology assumptions. End-use electrification, energy efficiency, and demand-side flexibility measures are assumed to grow modestly over time, consistent with current adoption and participation rates.

4. **95% Grid Decarbonization by 2050 & Best-Available Energy Efficiency in Buildings:** This scenario evaluates the combined effects of a steady transition to a decarbonized electricity supply and enhanced adoption of commercial and research-grade energy conservation measures in buildings (expected to be commercialized no later than 2030). The electricity generation mix is capped to follow a linear reduction in carbon dioxide emissions from the present through 2050, when it achieves 95% decarbonization. The decarbonized electricity supply is designed to accommodate a reduced level of electricity demand from buildings due to consumers pursuing aggressive equipment, envelope, and other energy efficiency

[146] EPA. Diesel Emissions Quantifier. https://cfpub.epa.gov/quantifier/index.cfm?action=main.home
[147] California Air Resources Board. "Final 2022 Scoping Plan Update and appendices." December 2022. https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/2022-scoping-plan-documents
[148] https://maps.nrel.gov/slope

improvements, which reduce site energy consumption in buildings by 22% in 2050. Rates for customer participation in demand-side flexibility programs and adoption of electric technologies are assumed to remain at current levels.

5. **95% Grid Decarbonization by 2050 & Moderate Electrification & Enhanced Demand-Side Flexibility:** This scenario evaluates the effects of a steady transition to a decarbonized electricity supply, electrification of cost-competitive opportunities in buildings and transportation, and increased participation in demand-side flexibility programs. The electricity generation mix is capped to follow a linear reduction in carbon dioxide emissions from the present through 2050, when it achieves 95% decarbonization. The decarbonized electricity supply is designed to accommodate the significant electrification of light-duty vehicles and heating services in milder climate regions, but growing participation in demand-side flexibility programs lessens the cumulative capacity expansion of electricity generation and transmission assets.

Refer to the SLOPE Scenario Planner methodology documentation for additional information.[149] Cumulative reductions were estimated by comparing emissions in each of these cases to reference case emissions in each year.

Measure 5. Increase industrial energy efficiency and identify and implement opportunities for GHG emission reduction solutions at industrial facilities.

The measure models the resulting GHG emissions reductions from two primary methods for implementing emissions reductions within the industrial sector: thermal efficiency gains and CCUS. These methods were applied to stationary combustion emissions from direct emitters in the industrial sector. The sum of these two emission reduction methods yields the reported annual GHG reduction trajectory reported for Virginia's industrial sector combustion/energy emissions.

Thermal efficiency gains. To estimate the emissions reductions that could be achieved through the adoption of more efficient thermal processes in industrial applications, total emissions from stationary industrial sources are quantified by industry type. Using the latest DOE resource for industry sector decarbonization, efficiency potentials were identified for each industry type using thermal efficiency potentials when available and combined (thermal and electric) potentials otherwise. Summing up the products of the efficiency potentials and the stationary combustion emissions yielded a total thermal efficiency potential of 22.3%. Assuming this thermal efficiency potential is achieved through linear, incremental growth from 2020 to 2050, emissions reductions were calculated against the BAU case, which had no assumed efficiency gains.

CCUS. For the remaining stationary combustion emissions from industrial sources, CCUS technology is assumed to be available to some facilities by 2030, ramping up in deployment and availability by 2050. Excluding facilities with annual stationary combustion emissions less than

[149] DOE. "SLOPE Scenario Planner 2021 Data Sources & Methodology." 2021. https://gds-files.nrelcloud.org/auto-sync/slope/SLOPE-Scenario-Planner-Methodology.pdf

100,000 MT per year, roughly 85% of stationary combustion emissions are modeled to remain available for the emission reduction potential of CCUS. A trajectory was developed using industry expectations and expert opinion to model CCUS deployment as a percent of total CCUS potential as follows: 1% in 2030, 10% in 2035, 40% in 2040, 60% in 2045, and 80% in 2050. Assuming a capture rate of 87.5%, consistent with assumptions from the Congressional Budget Office in late 2023, emissions reductions in the policy case are calculated against a BAU that models no implementation of CCUS and holds industry emissions flat through 2050.

Data used was from EPA Flight Facility-level GHG Emissions Data, Greenhouse Gas Reporting Program,[150] the DOE Industrial Decarbonization Roadmap,[151] and the Congressional Budget Office (CBO) Carbon Capture and Storage in the United States.[152]

Measure 6. Reduce GHG emissions from the electric power sector and improve grid reliability and security.

The measure models the resulting GHG emissions reductions from achievement of VCEA and increased distributed solar adoption, representing the general potential for distributed clean resource additions in the state.

The Integrated Planning Model (IPM) was used to model changes in the electric generating mix over time in Virginia in line with VCEA achievement. IPM is the same model used by EPA to analyze the projected impact of environmental policies on the electric power sector. Detailed documentation of the model is available here.

Total technical potential for rooftop solar in Virginia was sourced from NREL's dataset on rooftop solar potential. To determine an adoption rate, the most aggressive 2050 adoption scenario from NREL's Storage Futures Study (20%) was applied to the state's technical potential.[153] Distributed solar data from the PJM load forecast for the Dominion region was used to estimate the current level of distributed solar in the state, which was then grown to meet the assumed 2050 level. To calculate the kWh of solar output, the capacity factor for residential solar from NREL's annual technology baseline was used. The incremental growth in solar output from current levels, multiplied by grid emissions factors, resulted in the potential avoided emissions from rooftop solar.

The grid emissions factor used was the output of electric power sector modeling conducted using the Integrated Planning Model (IPM®). IPM is a multi-regional, dynamic, and deterministic linear programming model of the North American electric power sector. The model provides forecasts of least cost capacity expansion, electricity dispatch, and emission control strategies, while meeting

[150] https://ghgdata.epa.gov/ghgp/main.do?site_preference=normal
[151] DOE. "Industrial Decarbonization Roadmap." 2022. https://www.energy.gov/industrial-technologies/doe-industrial-decarbonization-roadmap
[152] CBO. "Carbon Capture and Storage in the United States." 2023. https://www.cbo.gov/publication/59345
[153] NREL. "Storage Futures Study." https://www.nrel.gov/analysis/storage-futures.html

energy demand, environmental, transmission, dispatch, and reliability constraints. Key assumptions included for Virginia include:

- Load: 2024 PJM load forecast
- Cost: 2023 NREL ATB capital cost and performance assumptions for new clean energy resources, with the additional inclusion of Inflation Reduction Act (IRA) tax credits for existing nuclear resources as well as new clean energy resources.
- Policy: Assumed to meet power sector targets in the Virginia Clean Economy Act. Virginia is not assumed to be a participant in the Regional Greenhouse Gas Initiative (RGGI).

The CO_2 emissions factors from IPM were combined with CH_4 and N_2O eGRID emission factor data from the SRVC region to estimate a CO_2e emission factor for the state.

Key data sources and assumptions include:

- Rooftop Solar Photovoltaic Technical Potential in the United States: A Detailed Assessment (2016), NREL Technical Report and dataset
- Prasanna, Ashreeta, Kevin McCabe, Ben Sigrin, and Nate Blair. Storage Futures Study: Distributed Solar and Storage Outlook: Methodology and Scenarios. Golden, CO: National Renewable Energy Laboratory. NREL/TP-7A40-79790. https://www.nrel.gov/docs/fy21osti/79790.pdf.
- 2023 Electricity Annual Technology Baseline, NREL
- EPA eGRID, electric grid emissions factor data, 2020

Measure 7. Deploy renewable energy, energy efficiency, energy storage, and low-carbon and resilient solutions for state and local government buildings and public fleets and transit, including infrastructure.

The GHG quantification for this measure represents an example of potential GHG reductions for state-owned office facilities. Due to current timing and data limitations, additional reductions from other state and all local government buildings and all state and local government and school operations could not be estimated but will be for the CCAP. The GHG reductions presented here likely overlap with the GHG reductions presented for Measures 1, 3, 4, and 8.

State-owned facility office building square footage information was obtained, and information on energy use intensity (EUI) from EPA's ENERGY STAR Program was used to estimate potential reduced energy use per year. The median national office building EUI from a recent EPA report was applied to estimate a baseline energy use for state-owned office buildings.[154] A lower EUI for office buildings (representing the top 25th percentile for building performance) was then applied to

[154] EPA. "Two Decades of ENERGY STAR®: A Retrospective Study of EPA's ENERGY STAR Office Buildings Score and Certification." 2022. https://www.energystar.gov/buildings/tools-and-resources/two_decades_energy_star_retrospective_study_epas_energy_star_office_buildings

estimate potential new/reduced energy use because of energy efficiency retrofits in state-owned office buildings. The difference between these different annual energy use estimates was then combined with emission factors from EPA and Measure 6 to estimate an annual potential avoided emissions for state-owned office buildings.

Measure 8. Identify and implement strategies to reduce high-potency GHG emissions from industrial processes, energy production, agriculture, waste, and wastewater treatment.

This measure used data from EPA's non-CO_2 GHG projections and mitigation assessments.[155] The reductions included high-potency GHGs in specified sectors relevant for Virginia based upon state-level emissions estimates. EPA's mitigation estimates were generated using an engineering cost approach that analyzed the costs of a wide range of mitigation technologies for each sector and incorporated them into a marginal abatement cost curve representing potential emission reductions available at incrementally higher prices.[156] Note that cost considerations were not included in this PCAP. Specific source sectors and associated gas types were included based upon Virginia's climate context and potential actions under this measure. The included source sectors and gas type are presented in Table 20.

Table 20: Sources and Types of High Potency GHG Emissions

Sector Source	Gas Type
Semiconductor Manufacturing	F-GHGs
Electric power systems	F-GHGs
Coal mining	Methane
Oil and gas systems	Methane
Landfills	Methane and N_2O
Wastewater	Methane and N_2O

The emission projections were generated using a combination of the U.S. state-level GHG inventory data and projected emissions from the U.S. Fourth Biennial Report submission to the U.N. Framework Convention on Climate Change.

Measure 9. Reduce GHG emissions from manufacturing and industrial processes, materials, and products.

This measure used data from EPA's non-CO_2 GHG projections and mitigation assessments.[157] The data captures industrial high GWP (F-GHG emissions). There is some overlap with the estimates included for Measure 8. Along with these non-CO_2 emission reduction potentials, data used was from EPA Flight Facility-level GHG Emissions Data, Greenhouse Gas Reporting Program,[158] to estimate potential reductions for process carbon capture opportunities for the ammonia

[155] EPA. "Non CO_2 Greenhouse Gas Data Tool." https://cfpub.epa.gov/ghgdata/nonco2/
[156] U.S. EPA. Non-CO2 Greenhouse Gas Data Tool. https://cfpub.epa.gov/ghgdata/nonco2/.
[157] EPA. "Non CO_2 Greenhouse Gas Data Tool." https://cfpub.epa.gov/ghgdata/nonco2/
[158] https://ghgdata.epa.gov/ghgp/main.do?site_preference=normal

production, cement, and steel production sectors. Assumed rates of capture between 85% - 90% were applied.[159, 160]

While not estimated for the PCAP, there is opportunity to further reduce manufacturing and industrial emissions in Virginia through technology such as Bioenergy with Carbon Capture and Storage. For example, the pulp and paper industry, prevalent in the Commonwealth, is a primary opportunity for the application of this technology due to the quantity of biogenic carbon emissions. This will be explored further in the CCAP.

Measure 10. Protect and restore high-carbon coastal habitats, wetlands, agricultural, forest and tribal lands.

The measure models the resulting GHG emissions reductions from expansion of tree canopy and changes in soil and cropland management in Virginia. Multiple sources of data and methods were used to estimate potential reductions.

Urban tree canopy and forests: Data sources and tools used include the 2010 and 2020 Census Urban Rural Areas[161] and i-Tree.[162] Expansion of urban tree canopy is assumed to meet an average of goals for urbanized areas for various local governments in Virginia. For the entire state tree cover in 2024 is 40.5% so it is modelled to show carbon sequestration if it were increased to 47% in 2035 because that is the average of goals different jurisdictions. Percent Tree canopy cover for Virginia was estimated through i-Tree Canopy by using 500 random points designated as "tree" or "non-tree" and the percent was derived from the proportion of identified points in urban areas only by using Census urban area shapefile. The imagery was from 2024. The native trees in Virginia's carbon sequestration are taken from i-Tree MyTree and the trees are denoted as "new planting" and in "partial sun" with 1 inch in diameter.

Agriculture: Changes in emissions from soil and croplands management were estimated using the EPA's non-CO_2 GHG projections and mitigation assessments.[163]

Coastal Habitats and Wetlands: The IPCC Tier 1 method for estimation of GHG emissions and removals from tidal marsh and seagrass meadow wetlands that are newly established or restored in Virginia entails:

1. Determine annual soil carbon stock losses and soil carbon accumulation from coastal wetland type that will be restored:
    a. Above-ground biomass C loss/accumulation rate

[159] McKinsey. "Net-zero-steel-in-building-and-construction-the-way-forward." https://www.mckinsey.com/capabilities/sustainability/our-insights/net-zero-steel-in-building-and-construction-the-way-forward
[160] Ammonia Energy. "Decarbonizing fossil based ammonia production in north-America." https://www.ammoniaenergy.org/articles/decarbonizing-fossil-based-ammonia-production-in-north-america/
[161] https://www.census.gov/programs-surveys/geography/guidance/geo-areas/urban-rural.html
[162] https://www.itreetools.org/
[163] EPA. "Non CO_2 Greenhouse Gas Data Tool." https://cfpub.epa.gov/ghgdata/nonco2/

   b. Belowground biomass C loss/accumulation rate (t C ha-1, yr-1) = above-ground biomass growth (IPCC Table 4.4) * tonne root dm, tonne shoot dm (IPCC Table 4.5) * carbon fraction
   c. Dead organic matter C accumulation
   d. CH4 flux
2. Determine annual soil carbon stock losses and accumulation from current (soon to be previous) land cover type, and
3. Determine difference between current land category and restored coastal wetlands.

No data could be found on land areas committed for restoration of coastal wetlands, nor specifics on what the current land cover types of any committed areas.

There is evidence to suggest that up to one quarter of Virginia's wetlands are coastal, and that since 1780 when Virginia had approximately 1,849,000 acres of wetlands, Virginia has lost 42%of wetlands, with 1,074,613 acres remaining (Table 21).[164] This indicates that the area of lost coastal wetlands is roughly 774,387 acres. Under the assumption that the proportion of coastal wetlands was not different prior to 1780 as in 1980, approximately 193,597 acres of coastal wetlands have been lost and could be targeted for wetland restoration or re-establishment.

Table 21: Virginia Wetlands Land Areas Lost

Year	Land area (acres)	Reference
1780	1,849,000	Virginia Institute of Marine Science (VIMS): https://www.vims.edu/_infographics/wetlands/
1980	1,074,613	Virginia Institute of Marine Science (VIMS): https://www.vims.edu/_infographics/wetlands/
Wetlands losses	774,387	Calculation
Coastal wetlands losses	193,597	Calculation + assumption (25% of lost wetlands are coastal)

Using IPCC default emission factors, the carbon sequestered through rewetting, revegetation or creation of coastal wetlands under a 5%, 10% and 15% land area restoration scenarios are 3,576 tons of carbon (tC)/year, 7153 tC/year and 10,729 tC/year respectively. It is assumed the restoration occurs on saline lands, and therefore there are no CH_4 emissions using IPCC default CH_4 emission factors.

Table *22*: Coastal Wetland Restoration Scenarios and Emission Removal Estimates Based on Default IPCC Emission Factors

Coastal wetland restoration scenario	Area (acres)	EFREWET1 (tC yr-1)	EFREWET (kg CH4 ha-1 yr-1)	Total tC yr-1
5% restoration	9,680	(3,576)	0	(3,576)
10% restoration	19,360	(7,153)	0	(7,153)
15% restoration	29,040	(10,729)	0	(10,729)

[164] VIMS Infographic | Virginia Institute of Marine Science

It is assumed that 3% of coastal wetlands are restored annually in the PCAP analysis.

If the lands are used for aquaculture, any N_2O emissions related to fish production are not insignificant and should be estimated. No soil organic carbon emissions were included in this analysis and would need to be conducted with information on what land cover types would be restored to coastal wetlands.

Appendix G. Virginia MSA PCAP Reports

RICHMOND, VA METRO AREA METROPOLITAIN STATISTICAL AREA PRIORITY CLIMATE ACTION PLAN

Prepared for the U.S. EPA under the Climate Pollution Reduction Grants (CPRG) Program, Section 60114(a) of the Inflation Reduction Act

March 1, 2024

DISCLAIMER

This project has been funded wholly or in part by the United States Environmental Protection Agency (EPA) under assistance agreement 95317301 to the Richmond Regional Planning District Commission (PlanRVA). The contents of this document do not necessarily reflect the views and policies of the EPA, nor does the EPA endorse trade names or recommend the use of commercial products mentioned in this document.

PlanRVA, established in 1969 following adoption of the Regional Cooperation Act by the VA General Assembly, is the convener, planner, and shaper of Central Virginia's future. PlanRVA focuses on promoting regional cooperation and collaboration among localities and with the private sector and community organizations to address shared challenges through holistic solutions that sustain regional growth. PlanRVA manages regional programs and initiatives in partnership with affiliate organizations in the areas of community development, emergency management, the environment, and transportation.

This Priority Climate Action Plan (PCAP) for the Richmond, VA Metropolitan Statistical Area (MSA) was developed to meet the requirements of the Climate Pollution Reduction Grants program (authorized under section 60114(a) of the Inflation Reduction Act 60114), and it provides a set of priorities for the MSA that will enable governments and other stakeholder in the region to seek competitive implementation funding through the Climate Pollution Reduction Grants program, Inflation Reduction Act 60114(b).

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Table of Contents

Acronyms

ACCII	Advanced Clean Cars II
AEO	Annual Energy Outlook (from EIA)
BAU	Business-as-usual
BEPS	Building Energy Performance Standards
BEV	Battery electric vehicle
CAP	Climate Action Plan
CBO	Community-based organization
CCA	Community Choice Aggregation
CCAP	Comprehensive Climate Action Plan
CEJST	Climate and Economic Justice Screening Tool
CPRG	Climate Pollution Reduction Grants
CVWMA	Central Virginia Waste Management Authority
DEQ	Virgina Department of Environmental Quality
DER	Distributed Energy Resources
EPA DEQ	Diesel Emissions Quantifier
ECH	Empty container handler
eGRID	Emissions and Generation Resource Integrated Database (EPA)
EIA	U.S. Energy Information Administration
EPA	U.S. Environmental Protection Agency
DOE	U.S. Department of Energy
EV	Electric vehicle
FCEV	Fuel cell electric vehicle
GHG	Greenhouse gas (emission)
HVAC	Heating, ventilation, and air conditioning
ICEV	Internal combustion engine vehicle
IRA	Inflation Reduction Act
LDV	Light-duty vehicle
LIDAC	Low-Income and Disadvantaged Community
LMOP	Landfill Methane Outreach Program (EPA)
MHDV	Medium and heavy-duty vehicle
MOVES	MOtor Vehicle Emission Simulator (EPA)
MPO	Municipal planning organization
MSA	Metropolitan Statistical Area
MSA	Metropolitan Statistical Area
MSW	Municipal solid waste
NIT	Norfolk International Terminal
NREL	National Renewable Energy Laboratory
PCAP	Priority Climate Action Plan
PDC	Planning district commission
PPA	Power purchase agreement
PPCY	Pinners Point Container Yard
RET	Retrofit
ROB	Replace on burnout
RRTPO	Richmond Regional Transportation Planning Organization
SIT	State Inventory Tool
VCEA	Virginia Clean Economy Act
VDOT	Virginia Department of Transportation
VIG	Virginia International Gateway
VMT	Vehicle miles traveled
VPA	Virgina Port Authority
WARM	Waste Reduction Model (EPA)

Introduction

PlanRVA developed this Priority Climate Action Plan (PCAP) to meet the requirements of the U.S. Environmental Protection Agency's (EPA) Climate Pollution Reduction Grants (CPRG) program. The CPRG program provides funding to states, local governments, Tribes, and territories to develop and implement plans for reducing greenhouse gas (GHG) emissions and other harmful air pollution.

CPRG Program Overview

The Inflation Reduction Act (IRA), signed into law on August 16, 2022, directs federal funding to reduce carbon emissions, lower healthcare costs, fund the IRS, and improve taxpayer compliance. The IRA contains provisions that directly or indirectly address issues related to climate change, including reduction of greenhouse gas (GHG) emissions and promotion of adaptation and resilience to climate change impacts.[1]

The CPRG program, authorized under Section 60114 of the IRA, provides $5 billion in grants to states, local governments, Tribes, and territories to develop and implement plans for reducing GHG emissions and other harmful air pollution. The program consists of two phases: planning and implementation. The planning phase provided $250 million in noncompetitive planning grants for state and local agencies to develop climate action plans (CAPs) to identify emissions reduction measures. The implementation phase provides $4.6 billion for competitive implementation grants to eligible applicants to implement GHG reduction measures identified in a PCAP, which is the first deliverable of a CPRG planning grant.

PlanRVA coordinated with the State of Virginia and the Hampton Roads and Washington, D.C. MSAs in developing this PCAP.

Box 1. Definitions

Greenhouse Gas (GHG): the air pollutants carbon dioxide, hydrofluorocarbons, methane, nitrous oxide, perfluorocarbons, and sulfur hexafluoride.

GHG Reduction Measure: policies, programs, actions, or projects that reduce GHG emissions or enhance carbon removal.

Co-Benefits: positive effects beyond the stated goal of a GHG reduction measure (e.g., improved public health outcomes, economic benefits, and increased climate resilience).

Low-Income Disadvantaged Communities (LIDACs): communities with residents that have low incomes, limited access to resources, and disproportionate exposure to environmental or climate burdens. For the purposes of this report, LIDACs were identified using the Environmental Justice Screening and Mapping Tool and the Climate and Economic Justice Screening Tool. These tools identify LIDACs by assessing indicators for categories of burden: air quality, climate change, energy, environmental hazards, health, housing, legacy pollution, transportation, water and wastewater, and workforce development. Per CPRG, Tribes are also considered LIDACs.

[1] CRS. "Inflation Reduction Act of 2022 (IRA): Provisions Related to Climate Change," October 3, 2022. https://crsreports.congress.gov/product/pdf/R/R47262

PCAP Overview and Scope

This PCAP covers the geographic area outlined in Figure 1. Richmond Metropolitan Statistical Area. The Metropolitan Statistical Area (MSA) is Census-defined and extends beyond PlanRVA's usual geography. The region also includes the following Tribes: Chickahominy, Chickahominy Eastern Division, Rappahannock, Pamunkey, and Upper Mattaponi. The state of Virginia has developed its own PCAP and PlanRVA is coordinating with state CPRG leads at the Virginia Department of Environmental Quality to align GHG reduction priorities.

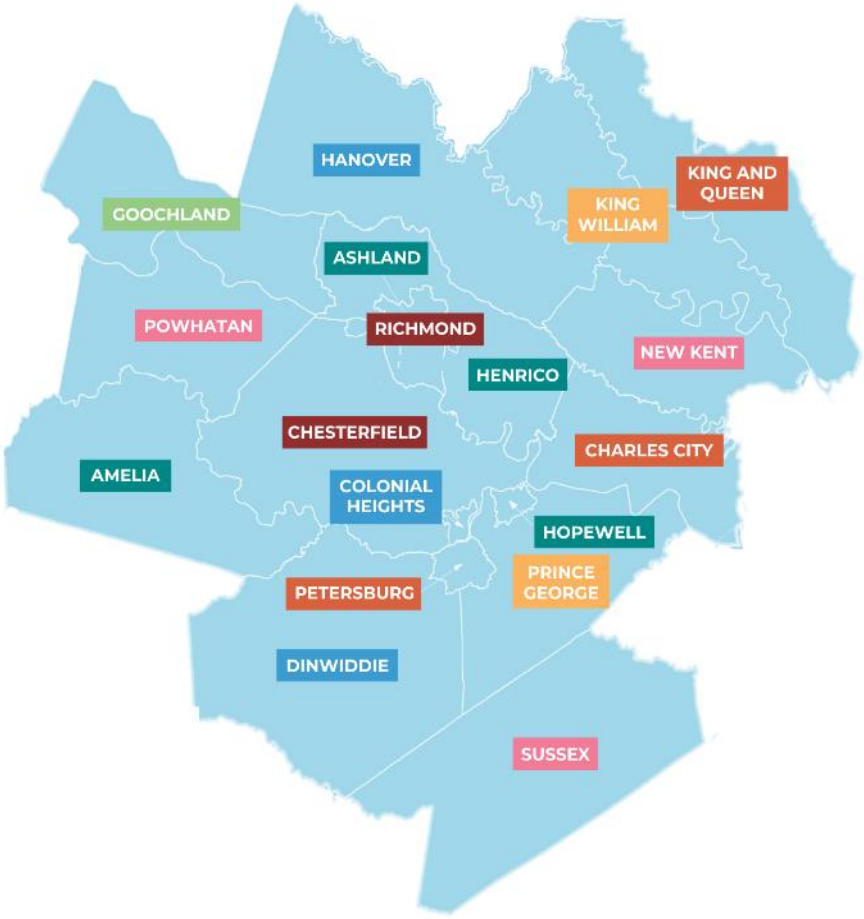


Figure 1. Richmond Metropolitan Statistical Area

This PCAP identifies high priority, ready-to-implement, GHG reduction measures that will provide significant GHG reductions and other benefits to the MSA and the communities within it. A measure being included within the MSA's PCAP is a pre-requisite for eligible agencies and organizations within it to compete for implementation grant funding in the second phase of the CPRG program. Accordingly, the measures identified in this PCAP are designed to be broad enough to encompass regional and local priorities for addressing climate pollution.

The PCAP serves as a starting point for a larger, more comprehensive climate planning effort to be conducted through 2024 and 2025 to develop the Comprehensive Climate Action Plan (CCAP).

PlanRVA has included within this PCAP the information outlined below in Table 1. In this table, the location of each piece or type of information required for the PCAP is also identified.

Table 1. Location of CPRG PCAP Requirements in this PCAP

PCAP Required Elements	PCAP Section
GHG Inventory	Simplified GHG Inventory and Appendix C. Richmond MSA GHG Inventory and BAU Projections
Quantified Priority GHG Reduction Measures	Priority Climate Action Plan Measures and Appendix D. Approaches for Quantifying GHG Reductions from PCAP Measures
Low-Income and Disadvantaged Community (LIDAC) Benefits Analysis	Richmond LIDAC Identification and Appendix B. Identification of LIDACs in Richmond MSA Climate Risks to Metropolitan Richmond's LIDACs PCAP Measure LIDAC Impacts Summary LIDAC Engagement
Benefits Analysis	Priority Climate Action Plan Measures
Review of Authority to Implement	Priority Climate Action Plan Measures
PCAP Encouraged/Not Required Elements	
GHG Emissions Projections	Appendix C
GHG Reduction Targets	Will be addressed in the CCAP
Intersection with Other Funding	Will be addressed in the CCAP
Workforce Planning Analysis	Will be addressed in the CCAP

Approach to PCAP Development: Stakeholder Engagement

During the PCAP development, PlanRVA conducted significant outreach and engagement with stakeholders and community representatives throughout the greater Richmond MSA with an emphasis on connecting with those communities most impacted by air pollution.

Specific outreach efforts included the creation of a digital public relations toolkit, email and personal outreach to an extensive list of local media (print, TV and radio, and digital), and individual outreach to more than 50 local and regional community organizations that regularly engage with local and regional communities.

Active engagement has included stakeholder phone calls and meetings; in-person "intercepts," focus groups, and conversations with residents; a detailed online survey targeting residents throughout the region; and coordination between PlanRVA and local and regional community leaders to ensure that both regional perspectives and local needs are reflected in the plan.

These activities are summarized in Table 2 below.

Table 2. Public Engagement and Outreach Summary

Date	Outreach Type	Stakeholders	Summary Activity	Summary Metrics
January 19, 2024	Outreach Email	Community and Nonprofit Organizations serving LIDACs	An initial email was sent to 55 organizations with an overview of the climate mitigation initiative and 5 specific ways to stay engaged or support the effort.	27 organizations responded with requests for more details.
January 31, 2024	Zoom Meeting	11 Community and Nonprofit Organizations	A one hour Zoom overview of the climate mitigation initiative and the five specific ways their organizations could stay engaged or support the process.	Participants expressed an interest in receiving updates going forward and in sharing the survey with their stakeholders and in the possibility of helping organize focus groups or engagement activities in the year ahead.
January 23 – February 7, 2024	Individual Meetings	9 Community and Nonprofit Organizations	Individual discussions about engagement possibilities, including focus groups and intercepts.	All organizations were interested in an active role going forward. One focus group and three intercept opportunities were initiated.
February 1 – 9, 2024	In-person intercepts	Residents of LIDACs in Richmond and Hopewell	In-person engagement of residents outside of three libraries, including a brief 5-question survey.	39 residents completed the survey.
January 19 – February 9, 2024	GHG Emissions Survey	MSA-wide communities	A survey was distributed in English and Spanish to engage the broader community, and to gather perspectives and insights on the ways in which airborne pollution is visibly impacting residents – and to gather their initial ideas on ways to mitigate pollution in their neighborhood.	More than 800 residents completed the survey, and more than 300 of them provided contact information to stay engaged in the process.
January 14 – onward	Website	MSA-wide communities	Main regional CPRG website that includes project updates, stakeholder news, and email contact. Website was also linked to the CPRG GHG Emissions Survey.	1,400 visits from users from January 14 to February 10.
December 15, February 2, and	CPRG Steering Committee Meetings	MSA Localities	Locality representatives were presented with the project plan, methodology, preliminary data, public	Members provided input and feedback on the GHG reduction measures, stakeholder

Date	Outreach Type	Stakeholders	Summary Activity	Summary Metrics
February 16, 2024			feedback results, and the draft PCAP report. Reduction measure and implementation grant ideas were solicited through active discussion.	engagement, and the PCAP report.

Stakeholder Engagement

CPRG Steering Committee. PlanRVA formed a CPRG Steering Committee to advise on GHG emissions reduction priority projects, programs, and measures. Committee members include high-level staff from localities and from neighboring planning district commissions (PDCs) with localities included in the Richmond MSA. The priority projects provided by these groups informed the measures included in this PCAP. Steering Committee meetings were held from December 2023 through February 2024. Committee members reviewed PCAP and CCAP requirements, reviewed implementation grant evaluation criteria, held discussions on prioritizing projects, programs, and measures, and informed broader stakeholder engagement activities. The Committee will continue to meet to advise on the CPRG program through 2027, when the program concludes.

Industry, Government Partners, and Stakeholders. PlanRVA met with stakeholder groups not already represented by the Steering Committee including the Central Virginia Waste Management Authority (CVWMA), Greater Richmond Transit Company (GRTC), and EPA Region 3 Regional Tribal Operations Committee along with other tribal staff. We also met with other regional grantees to coordinate the state and MSA PCAPs, including VA Department of Environmental Quality, Metro Washington Council of Governments (MWCOG), and Hampton Roads PDC (HRPDC).

Community Engagement

Identification and Initial Outreach. In the development of the PCAP, the primary focus was two-fold: to engage the broader regional population (through media awareness and survey) and to connect with community organizations most engaged in the region's LIDACs to explore ways to collaborate going forward.

PlanRVA began by developing a list of the community-based organizations (CBOs) it knew served residents in the LIDACs most impacted by transportation- and waste-related air pollution. That initial list grew to 55 organizations, each of which was contacted by email with information about the CPRG and a request to collaborate going forward. In the end, 27 organizations responded with an interest in learning more about the CPRG and in further engagement. PlanRVA hosted a virtual meeting with 11 of the organizations and met individually with 9 organizations, providing an overview of the CPRG program and discussing opportunities for immediate support for the PCAP (e.g., sharing the community survey) as well as longer-term collaboration for engagement support during the CCAP process. Additional information on these meetings and organizations can be found in Appendix A.

Website. The Climate Resilient RVA (ClimateResilientRVA.org) website was designed to provide an initial starting point for all outreach and engagement efforts. It provides basic information about the CPRG program and development of the PCAP, including local media coverage of the initiative. The website has been a critical part of the outreach efforts, providing local media and community partners with a starting place to understand the key phases of the CPRG and PCAP. From January 14 to February 10, the website received more than 1,400 visits from users. The website directed visitors to the community survey (discussed below), included a Spanish-language page, and provided a general email contact.

GHG Emissions Community Survey. PlanRVA developed an online survey to quickly engage the broader community and generate initial perspectives on the community's experiences with air pollution from transportation and waste. Over three weeks in January and February of 2024, more than 800 residents responded, representing 17 of the 18 localities. More than a third of respondents indicated a desire to remain engaged going forward. The survey was available in both English and Spanish and was well-publicized across the region through outreach and engagement efforts. Over half of the survey respondents provided specific feedback in response to being asked for "one project idea" they would like to see completed in their community "to address pollution from transportation sources or waste." Individual responses were recorded and broad themes communicated to the Steering Committee. Desiring safer and more reliable public transportation options and addressing litter and plastic pollution were common threads in the open-ended question responses.

Shorter, in-person surveys were also conducted with 39 residents during intercepts outside of three local libraries serving LIDACs in the cities of Hopewell and Richmond.

Media Outreach. The success described above was made possible in part by a robust media strategy. For the PCAP, the media outreach focused on traditional media (print, television, and radio), an increasing regional portfolio of hyper-local Internet news sites, and social media platforms. Multiple local Internet news sites were also engaged to leverage their social media connections and daily e-news mailings to connect an increasingly diverse audience of people who care deeply about what is happening in their neighborhood. News outlets that covered the community engagement process included RIC Today, Good Morning RVA, Black Virginia News, RVA Hub, and the Commonwealth Times.

Social media/digital outreach: The team invested in social media advertising to promote the website and survey to people living within the Richmond MSA. The English-language ad set resulted in 451 link clinks and 35,000 post impressions. Another Spanish-language ad set included 205 link clicks and 25,000 post impressions. Local jurisdictions within the MSA also shared information about the survey on Facebook and Instagram channels, as well as in newsletters

LIDAC Engagement

A central component of the PCAP engagement strategy involved leveraging existing relationships, building new relationships, and creating meaningful space for the voices of residents and other stakeholders to be amplified and heard to help shape initiatives that can have a tangible impact on the community. PlanRVA conducted outreach across a range of stakeholders and communities, including with the five tribes in the MSA. PlanRVA looks forward to renewed and deeper engagement and partnership opportunities with Tribes during the CCAP process.

While many of the above discussed PCAP outreach and engagement activities did not specifically target LIDACs, emphasis was placed on reaching a diverse and varied audience (e.g., through multilingual documents). To engage with LIDACs more specifically during the limited timeframe, in-person outreach was conducted near libraries serving LIDACs to supplement the online community survey. The survey was available in Spanish as well as English, and 34% of respondents reported income below statewide median income levels. Looking forward to the CCAP process, PlanRVA is committed to increased engagement with residents most impacted by air pollution and climate change in ways that are transparent, equitable, and accessible.

Continued Engagement

During the PCAP development, PlanRVA strove for inclusivity and strengthening relationships with neighboring PDCs, localities, regional authorities, Tribes, and CBOs. As indicated above, PlanRVA will build on this work during CCAP development. A main focus going forward will be working with our local partners to create meaningful spaces for high school and college-aged community members, those who live and work in the LIDACs that are most impacted by air pollution and least able to respond to climate change impacts, and the CBOs most invested in supporting the most marginalized corners of the community. By bringing these voices to the center of the conversation about emissions, climate change, and community, residents will have an opportunity to shape the changes that will improve the quality of their communities. Surfacing their concerns in ways that help address historical and systemic environmental injustices—the result of historical *de jure* and *de facto* practices and policies—is essential for moving forward together.

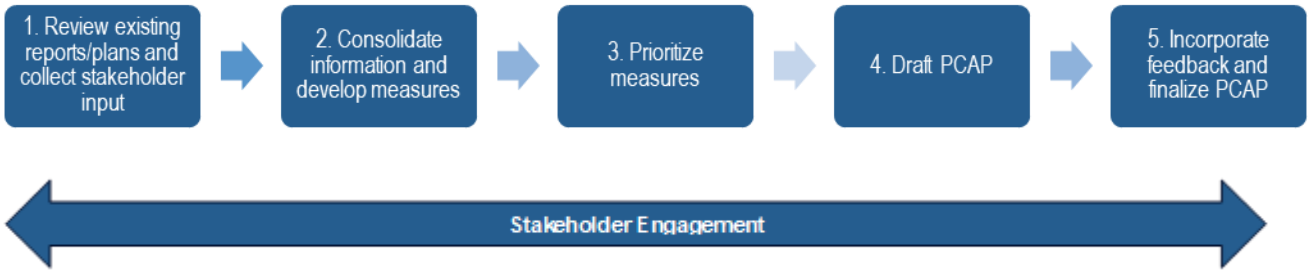
PlanRVA also plans to leverage the website to create a vital resource for everyone in the Richmond region interested in tracking activities and data related to the CCAP and broader efforts in the region to tackle climate change. The website will be updated throughout the CCAP process in 2024 and 2025 to include GHG inventory data, project-specific information, opportunities for input and feedback, and other details on the planning and implementation of this work. PlanRVA also anticipates that the website will be increasingly leveraged to drive public engagement, grow awareness around other local efforts to reduce GHG emissions, and publicize engagement events and activities that will provide the public with specific ways to engage and shape the work locally and regionally, including additional surveys. PlanRVA expects to develop one or more community surveys to support the development of the CCAP and to increasingly engage residents in a dialogue about change in their neighborhoods and communities. Listening sessions, intercepts, and collaborations with neighborhood

organizations are tools PlanRVA will likely use during CCAP development. The response to the initial PCAP survey exceeded expectations and indicates that the broader community is eager to be engaged in a discussion about GHG emissions and climate change and to help shape regional efforts to improve their communities.

Approach to PCAP Development: Priority GHG Reduction Measures

PlanRVA used a multi-step process to develop priority GHG reductions measures identified in this PCAP, as outlined in Figure 3. Stakeholder engagement activities (discussed above and below) were done continuously throughout this process.

Figure 3. Approach to developing the Richmond MSA PCAP



1. PlanRVA used multiple mechanisms to collect ideas for GHG reduction priorities across the MSA. PlanRVA reviewed existing plans and climate actions and policies across the region, held a working session with Steering Committee members, distributed a community-wide survey, and conducted calls and listening sessions with stakeholders (see Appendix A for more information). PlanRVA also created a website with an option to provide comments.[2]
2. PlanRVA compiled information from existing plans and responses from the Steering Committee and other stakeholder conversations and filtered them for relevance for the CPRG program goals. PlanRVA then grouped similar ideas by relevant sector and theme (e.g., vehicle electrification or active transportation) to form broader GHG reduction measure categories that could be readily implemented.
3. The draft list of GHG reduction measures was shared with the Steering Committee and local governments for review. Specifically, PlanRVA asked for a review and feedback to identify any potential gaps reviewers saw in line with their priorities, especially related to CPRG implementation grants. Using this feedback, PlanRVA finalized the list of GHG reduction measures presented in this PCAP. PlanRVA also coordinated with other MSAs and the state to ensure alignment where needed for potential coalition implementation grant projects.
4. After developing a consolidated list of measures and sharing for review, PlanRVA worked internally with its contractors and with other local governments and stakeholders to develop the required information for each measure, such as quantified GHG reductions, authority to implement, LIDAC benefits analysis, and other information (e.g., available funding and key implementors). Additional information on quantification of GHG reductions may be found in Appendix D.

[2] http://www.ClimateResilientRVA.org

5. PlanRVA drafted the PCAP using information from the previous steps and shared a version with the CPRG Steering Committee for review and feedback, which was incorporated into the final PCAP report.

Richmond's Climate Context

Simplified GHG Inventory

Prior to this effort, the Richmond MSA did not have a GHG inventory representing all cities and counties, nor had most localities ever inventoried their own emissions. For the PCAP, a simplified GHG inventory was completed covering key sources of emissions for the Richmond MSA. The simplified inventory sectors represent all the priority GHG reduction measures.

Looking forward to the CCAP, PlanRVA will conduct comprehensive community-wide emissions inventories covering all sectors and pollutants, including industry, electricity generation and/or use, transportation (on- and off-road), commercial and residential buildings, agriculture, natural and working lands, and waste and materials management. Other GHGs (hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride) will also be included, along with a co-pollutant analysis (e.g., fine particulate matter, nitrogen oxides, sulfur dioxide, volatile organic compounds, air toxics, etc.).

The PCAP simplified inventory assesses the GHG emissions for 2019 from the buildings, on-road transportation, ports, and waste generation sectors. A simplified 2019 inventory was also compiled for GHG emissions from local government operations. In addition to the GHG inventories, business-as-usual (BAU) projections were drafted from 2019 through 2050. Appendix C discusses the methodology for both the development of the simplified 2019 GHG inventory and the BAU GHG projections for each sector out to 2050.

The inventory and projections were prepared using the following data and resources:

- EPA's Landfill Methane Outreach Program (LMOP) Landfill and Project Database
- EPA's Facility Level GHG Emissions Data
- US Census Bureau Population Data
- Virginia State Inventory Tool (SIT) GHG Inventory
- North Carolina SIT GHG Inventory
- Port of Virginia GHG Inventory
- Municipal building emissions and fuel usage data from Henrico County
- Municipal fuel usage data from Hanover County
- Municipal fuel usage data from Chesterfield County
- Municipal building and vehicle fleet emissions data from Richmond City

Buildings. The buildings sector consists of direct fuel use emissions and indirect electricity use emissions for residential, commercial, and industrial buildings.

On-Road Transportation. The transportation sector consists of on-road mobile source emissions and electricity consumption emissions.

Off-Road Transportation (Ports). This sector consists of emissions from ocean-going vessels, cargo, and other operations at the Richmond Marine Terminal.

Waste Generation. This sector covers landfill emissions data for all facilities within the Richmond MSA.

Municipal Operations. The Municipal Operations sector consists of direct fuel use and indirect electricity use emissions from municipal buildings (including schools) as well as emissions from municipal vehicle fleets.

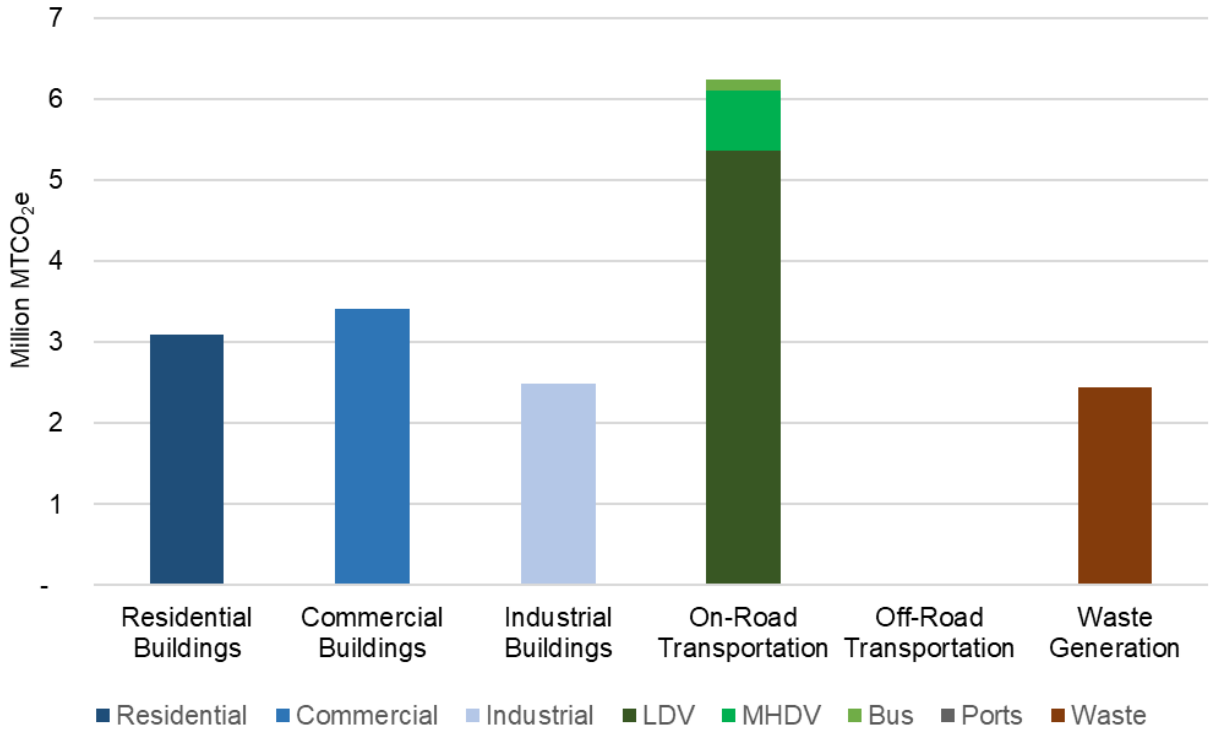
Table 3,

Figure 4, and Figure 5 below show the results of the simplified GHG inventory for the Richmond MSA across the sectors assessed in metric tons of carbon dioxide equivalent ($MTCO_2e$). Building sector emissions data are broken down by direct emissions (on-site fuel use) and emissions from purchased electricity. On-Road Transportation sector emissions data are broken down by vehicle type. The waste generation sector reflects emissions from municipal solid waste that was landfilled in 2019. GHG emissions from municipal operations are a subset of the broader community-wide emissions in the building and on-road transportation sectors and reflect GHG emissions from government, public, and school buildings and vehicle fleets. Appendix C discusses the methodology for both the development of the simplified 2019 GHG inventory and the BAU GHG projections for each sector out to 2050.

Table 3. Simplified GHG Inventory Results from the Richmond MSA

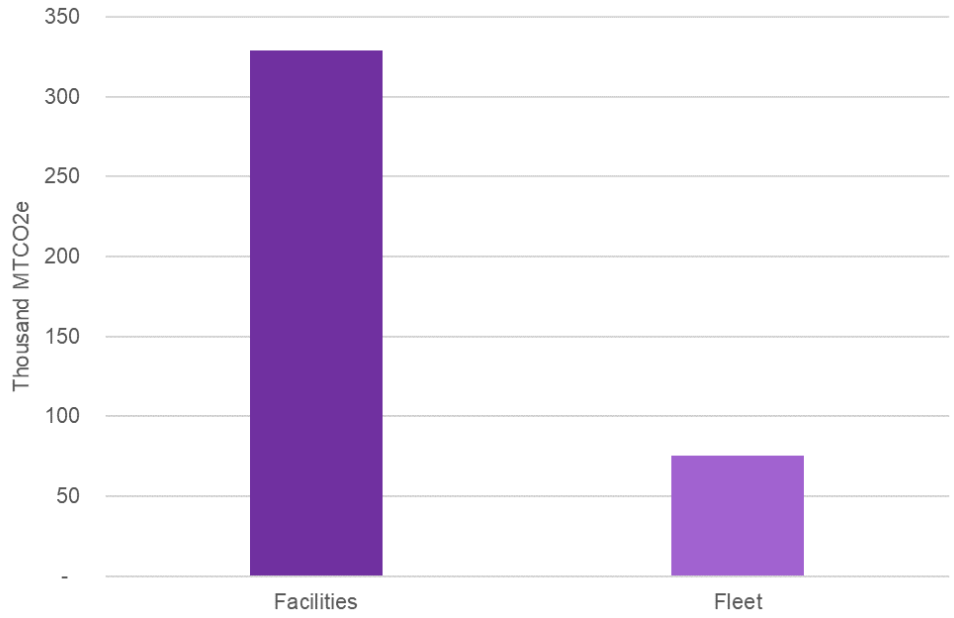
TOTAL EMISSIONS BY SECTOR ($MTCO_2e$)	2019
Total Buildings	**8,990,990**
Residential - Direct	944,510
Commercial - Direct	923,379
Industrial - Direct	1,683,599
Residential - Electricity	2,146,725
Commercial - Electricity	2,483,230
Industrial - Electricity	809,547
Total Transportation	**6,234,586**
Light Duty Vehicles	5,355,146
Medium- and Heavy-Duty Vehicles	745,571
Buses	124,267
Motorcycles	9,108
Total Ports	**10,890**
Total Waste Generation	**2,440,482**
Landfill Emissions	2,440,482
Total Emissions	**17,676,948**
Total Municipal Operations	**404,432**
Municipal Facilities	329,110
Municipal Vehicle Fleet	75,322

Figure 4. Richmond MSA Simplified Community GHG Inventory Results by Sector, 2019



Note: Emissions from ports (off-road transportation) are too small to be seen in Figure 4.

Figure 5. Richmond MSA Simplified Municipal GHG Inventory Results by Sector, 2019



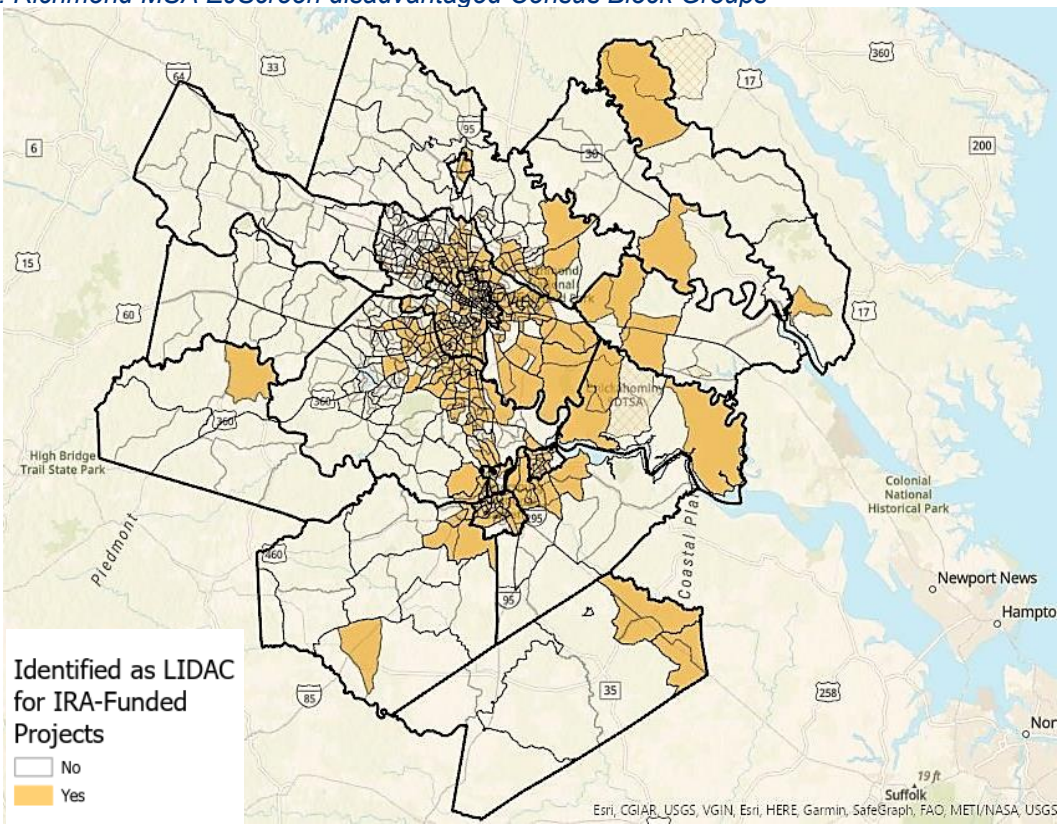
Richmond MSA LIDACs

A core component of the CPRG and much of the IRA is to provide benefits to LIDACs as these communities are particularly vulnerable to risks and impacts from climate change. Per CPRG requirements, this section identifies LIDACs in the state by Census Block ID using EJScreen (an EPA environmental justice screening tool), discusses the climate risks for LIDACs within the Richmond MSA, and presents how PlanRVA has meaningfully engaged with LIDACs in the development of this PCAP and how it will continue to engage these communities in the future.[3]

Richmond LIDAC Identification

PlanRVA utilized EJScreen to visualize and identify Census Block Groups that the EPA designates as disadvantaged in the state (see **Error! Reference source not found.**). In Richmond, 52% of the population is located within a disadvantaged Census Block Group. Out of the 890 Census Block Groups, 500 are considered disadvantaged according to EJScreen (or 56%). A full listing of the Census Block IDs that are identified as LIDACs in Richmond is included in Appendix B.

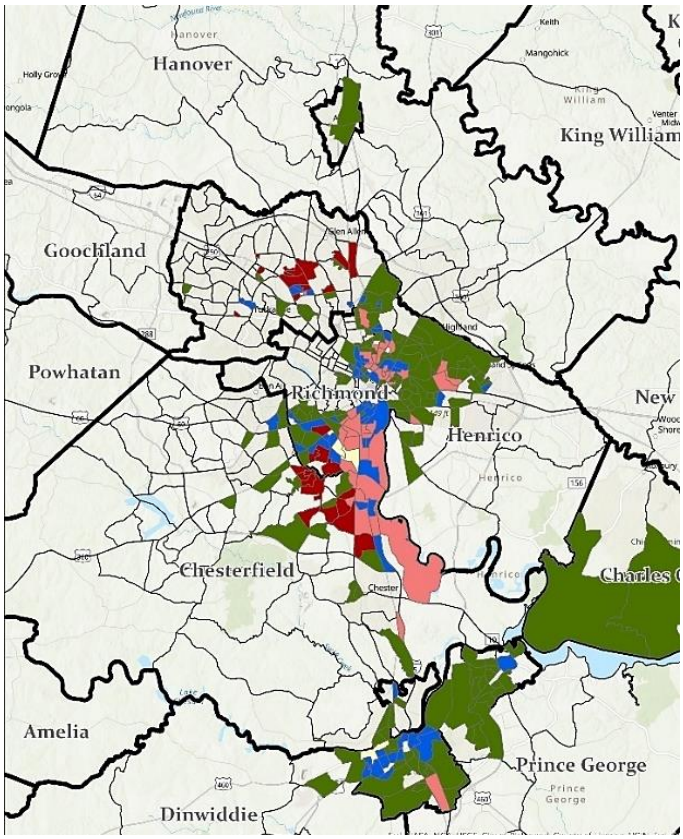
Figure 6. Richmond MSA EJScreen disadvantaged Census Block Groups



[3] The EPA defines a disadvantaged community in the following manner: 1) if it is disadvantaged according to the Climate and Economic Justice Screening Tool (CEJST); 2) if the census block is at or above the 90th percentile for any of EJScreen's Supplemental Indexes compared to the nation or state; 3) any geographic area within Tribal lands and indigenous areas as included in EJScreen.
U.S. EPA Office of Air and Radiation. "Climate Pollution Reduction Grants Program: Technical Reference Document for States, Municipalities and Air Pollution Control Agencies. Benefits Analyses: Low-Income and Disadvantaged Communities," April 27, 2023. https://www.epa.gov/system/files/documents/2023-05/LIDAC%20Technical%20Guidance%20-%20Final_2.pdf.

Because the PCAP focuses on the waste and transportation sectors, per feedback from the Steering Committee and other stakeholders (see Appendix A), Plan RVA also analyzed specific EJScreen indicators related to these sectors.

Figure 7. EJScreen Waste Disadvantaged Census Blocks in Richmond MSA, overlayed with Waste-Related Disadvantaged designations from CEJST



Using EJScreen, PlanRVA identified Census Block Groups that were specifically disadvantaged for waste-related reasons (symbolized green in Figure 7). In addition, PlanRVA overlayed waste-disadvantaged data from the Climate and Economic Justice Screening Tool (CEJST), providing a broader look at certain types of potential waste concerns, including communities with superfund or hazardous waste sites.[4] This information will help direct CCAP engagement and overall implementation efforts related to waste programs, as not all communities disadvantaged for waste-related reasons are designated as LIDACs, but they do face unique issues with potential air and water quality concerns.

As can be seen in Figure 8 below, a bivariate analysis of particulate matter 2.5µm (PM2.5) exposure and the demographic index shows that the urban center and surrounding areas of Richmond stand out as areas of concern. Particulate matter pollution comes primarily from burning gasoline and diesel in internal combustion engine vehicles. The combination of high PM2.5 exposure and the concentration of disadvantaged communities highlights an environmental justice challenge in Richmond MSA. The adverse health effects associated with prolonged exposure to PM2.5, such as respiratory issues and cardiovascular diseases, are exacerbated in these communities, where access to healthcare and resources may already be limited.

[4] EJScreen considers communities identified as disadvantaged in CEJST as one of its criteria. If a community is labeled as disadvantaged in CEJST, it is also recognized as disadvantaged in EJScreen.

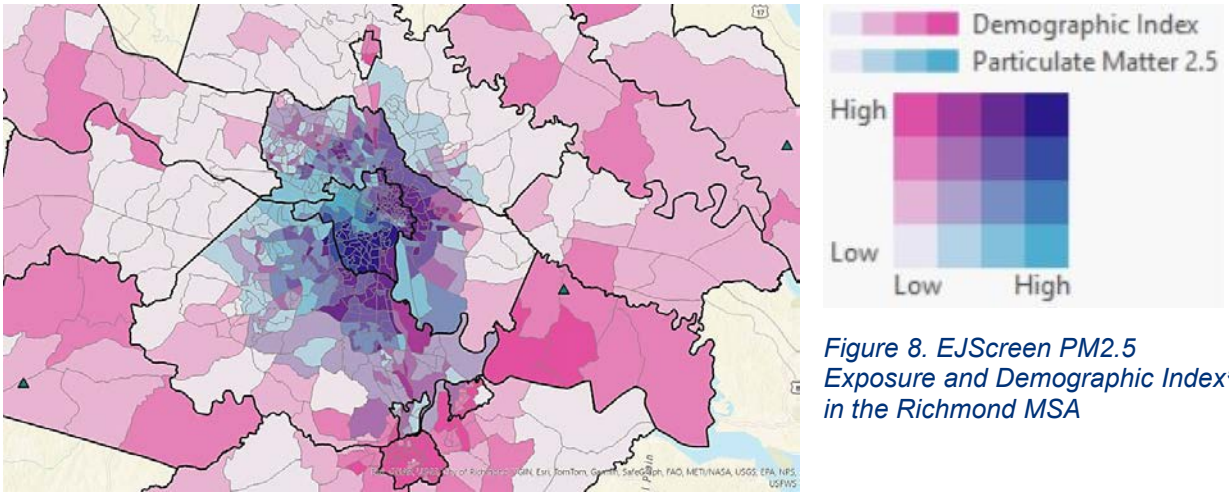


Figure 8. EJScreen PM2.5 Exposure and Demographic Index[5] in the Richmond MSA

Climate Risks to Metropolitan Richmond's LIDACs

Social systems inequitably distribute negative impacts from climate risks on Black, Indigenous, and People of Color (BIPOC) individuals and communities, low-income households, unhoused individuals, rural communities, and agricultural workers. Not only do these communities experience the most severe impacts of climate change, but they are also the least able to prepare for and respond to these impacts due to a lack of resources and socio-political power. According to a 2021 EPA analysis, racial and ethnic minorities are particularly vulnerable to climate change impacts, especially Black and African American individuals.

Due to limited access to resources, such as adequate infrastructure and insurance, minority and low-income communities are more likely to suffer the consequences of climate change with heightened exposure to climate risks. Many factors contribute to this inequality, including historical discriminatory practices in housing, education, and employment. Pre-existing health status and living

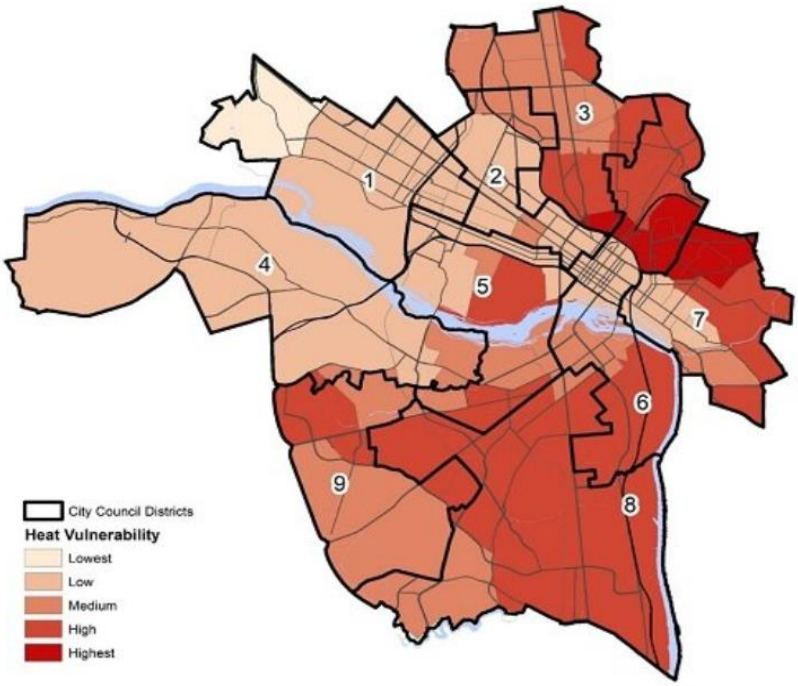
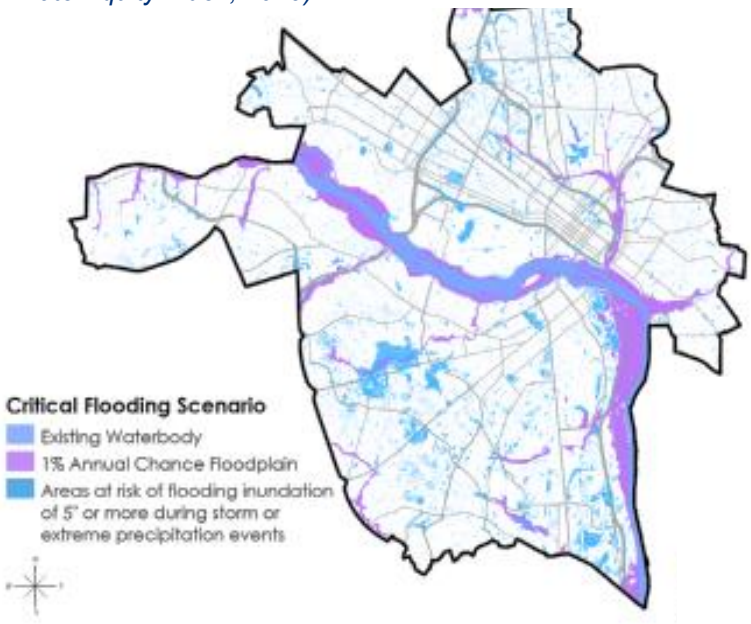


Figure 9. Heat vulnerability by census tract (RVAgreen 2050 Climate Equity Index, 2019)

[5] The Demographic Index in EJScreen is a combination of percent low-income and percent minority.

conditions are two key components of climate vulnerability that are often determined by economic power, social policies, political influence, and structural racism.

Figure 10. Map of Flood Risk by Census Tract (RVAgreen 2050 Climate Equity Index, 2019)



The Richmond MSA, like many parts of the United States, may face challenges of extreme weather events, extreme heat, flooding, sea level rise, drought, and wildfires due to climate change. However, because of the socio-economic landscape and local factors of the MSA, a closer examination is needed to identify which of these risks pose the most imminent and severe threats to disadvantaged communities. A majority of the LIDACs in the Richmond MSA are located within the City of Richmond, so it is necessary to take a close look at the city's climate risks and how they interact with disadvantaged communities. In 2022, the City of Richmond created RVAgreen 2050: an equity-centered climate action and resilience planning initiative led by the Office of Sustainability. To understand the specific risks facing Richmond, a Climate Vulnerability and Risk Assessment was conducted.

Richmond is seeing continued increases in annual average daily maximum temperatures. By 2070, annual average daily maximum temperatures may increase to as much as 77˚F under a high emissions scenario (as compared to the baseline of 68.5˚F for the 1961–1990 period).[6] There have been more and more days reaching 95˚F or higher as well. Historically, Richmond has seen 9 days per year over 95˚F. By 2100 (under a high emissions scenario), this could rise to 74 days. Future heat waves will be more intense as well.[7]

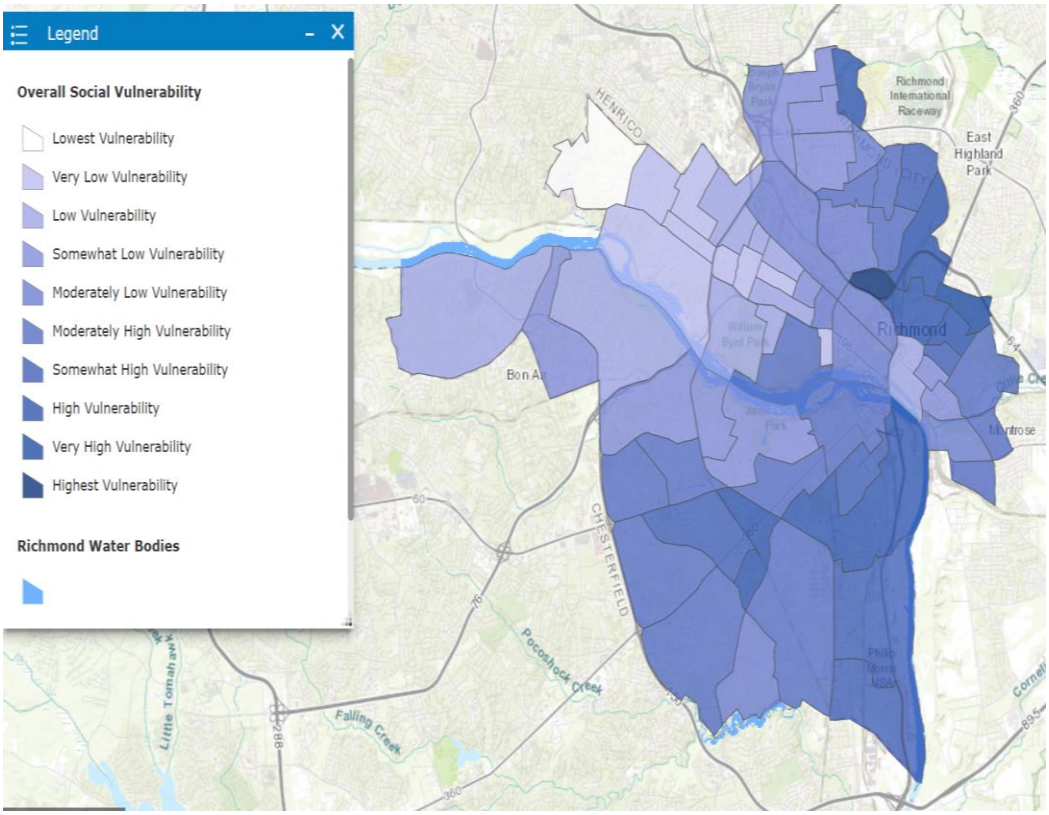
Average annual precipitation is projected to increase in the winter and spring, with winter precipitation levels increasing by 15% under a blender scenario by the 2080s.[8] The annual number of extreme precipitation events is projected to increase as well.[9] Virginia is facing sea level rise at a greater-than-average rate than the rest of the world due to post-glacial rebound, a process where melting ice sheets cause once-covered land to lift up, and land around the

[6] A high emissions scenario refers to a Shared Socio-economic Pathway (SSP) that represents the upper boundary of radiative forcing (for example, SSP5-8.5 represents a pathway with an additional radiative forcing of 8.5 W/m2 by 2100). Under a high emissions scenario, there is intensified exploitation of fossil fuel resources and a more energy-intensive global lifestyle (Böttinger, M. and Kasang, D. The SSP Scenarios. Deutsches Klimarechenzentrum.)
[7] City of Richmond. RVA Green 2050. 2022. https://www.rvagreen2050.com/virtual-resilience-hub
[8] A blended scenario refers to a scenario which uses a combination of moderate and high global emissions scenarios.
[9] Extreme precipitation events are defined as events with more than 2 inches of precipitation in 24 hours

periphery (like Virginia) to sink.[10] Since 1880, global sea levels have risen 7–8 inches, while sea levels along the Virginia coast have risen 17 inches between 1930 and 2020. By 2100, global sea level is projected to rise another 1–4 feet. Although Richmond is more inland and will thus be less impacted by sea level rise, some communities along the James River may be affected. Beyond the city, farmland and riverside properties in Prince George, Charles City, New Kent, King William, and King and Queen counties are vulnerable to sea level rise.

The city created the Climate Equity Index to understand how social and demographic factors are tied to the climate vulnerabilities described above.[11] Figure 11 shows the Index's social vulnerability map, which visualizes relative climate vulnerability (due to a combination of climate impacts, demographics, built assets, and natural resources) across Richmond's census tracts. The neighborhoods most adversely impacted by climate change risks, such as extreme heat and flooding, are the East End, Southside, and Northside. These neighborhoods are also most impacted by wealth inequity, underlying health conditions, and lack of transportation access.

Figure 11. Richmond MSA social vulnerability map by census tract from the RVAgreen Climate Equity Index



[10] Woods Hole Oceanographic Institution. 2018. Why is Sea Level Rising Faster in Some Places Along the U.S. East Coast Than Others? https://www.whoi.edu/press-room/news-release/why-is-sea-level-rising-higher-in-some-places-along-u-s-east-coast-than-others/

[11] The Index uses a list of 15 demographic variables from the CDC Social Vulnerability Index as well as an additional 24 geographic factors based on research for a total of 39 factors. These 39 factors impact an individual's or community's vulnerability to climate change – particularly heat, severe storms, and flooding.

Priority Climate Action Plan Measures

The Richmond MSA has identified seven priority, implementation-ready measures that will reduce GHG emissions in the short- and long-term. The measures were developed through the process outlined in the Approach to PCAP Development: Priority GHG Reduction Measures section. A list of CPRG project and program ideas submitted to PlanRVA is included in Appendix A, though this list is not comprehensive of all potential projects and programs that may be pursued under a measure.

The PCAP measures and the potential cumulative GHG emissions reductions for each are identified in Table 4 below, followed by an overview of implementation milestones (see Appendix D for details on the GHG reduction quantification methodology). The following sections provide an overview of potential benefits and a summary of potential impacts to LIDACs. Each priority measure is then described in detail, including the measure description, geographic coverage, key implementing agency(ies), implementation actions, authority to implement, and potential impacts to LIDACs.

Table 4. Summary of PCAP Measures and Related GHG Inventory Sector(s)

	PCAP Measure	Sector(s)	Cumulative GHG Reductions ($MMTCO_2e$)
1.	Support, incentivize, and provide assistance for the rapid adoption, equitable installation, and use of Zero-Emission Vehicles	On-Road Transportation	2025–2030: 1.08 2025–2050: 45.02
2.	Expand equitable transit access.	On-Road Transportation	2025–2030: 0.02 2025–2050: 0.67
3.	Provide and promote new and expanded opportunities to reduce vehicle miles traveled through micromobility options and connected multimodal infrastructure.	On-Road Transportation	2025–2030: 0.14 2025–2050: 1.47
4.	Reduce GHG emissions from solid waste.	Solid Waste	2025–2030: 2.29 2025–2050: 24.64
5.	Implement decarbonization strategies for municipal operations.	Local Government Operations	2025–2030: 0.42 2025–2050: 7.29
6.	Accelerate and support the deployment of energy efficiency solutions and incentivize the transition to clean energy of residential and commercial buildings	Buildings	2025-2030: 0.77 2025-2050: 6.31
7.	Reduce emissions from port operations through the adoption of low-carbon fuels, electric equipment, and operational changes.	Off-Road Transportation	2025–2030: 0.010 2025–2050: 0.031

The majority of the potential GHG reductions will occur in the long run, particularly for the waste diversion and ZEV adoption measures. However, the implementation of actions and projects across all PCAP measures will begin in the near term (i.e., pre-2030), albeit subject to available staffing, funding, and other resources. Depending on the funding available, it may take more time to ramp up actions and secure additional funding and resources for implementation. Successful implementation of the measures will require significant coordination and partnerships across all key implementing agencies/actors, and PlanRVA intends to further develop those relationship and partnerships throughout the CCAP and implementation phases

of the CPRG program. Table 5 below summarizes the general timeline for implementing the CPRG program and PCAP measures in the near-term.

Table 5. CPRG Implementation Milestone Summary

Milestone	Timeframe
2024	
Deliver PCAP to EPA, which includes stakeholder input on measures.	**March 1, 2024**
Submit CPRG Implementation Grant applications.	**April 1, 2024**
CCAP development, which will include identifying additional measures, broad engagement activities, and quantifying emission, cost, benefit, workforce, and LIDAC impacts.	**Mid–Late 2024**
2025	
Coordinate resources across jurisdictions and take initial actions across the PCAP measures where feasible.	**2025**
Finalize CCAP, which will include identifying additional measures, broad engagement activities, and quantifying emissions, cost, benefit, workforce, and LIDAC impacts, and deliver to EPA.	**Summer 2025**
2026	
Continue implementing CPRG measure actions where feasible.	**2026+**
Secure local government approval and budget for ongoing GHG reductions, in addition to seeking additional outside funding opportunities.	**2026+**
Track progress toward GHG reduction targets and other milestones, and collect data as needed to prepare the Status Report.	**2026+**
2027	
Deliver Status Report to EPA.	**Mid-2027**
Continue to implement measures and reduce GHGs at the county level and for municipal operations. Track progress across the Richmond MSA.	**2027+**
2030	
Complete initial stage of implementing PCAP actions; actual timing and specific projects implemented will depend on available staffing, funding, and other resources.	**2030+**

PCAP Measure Co-Benefits

The measures outlined in the PCAP will not only reduce GHG emissions but will also reduce co-pollutants and provide several co-benefits across the Richmond MSA region. Potential benefits include reduced noise and air pollution, physical and mental health improvements, economic development and job creation, and community capacity building.

The reduction of GHG emissions and other co-pollutants through decreased fossil fuel (e.g., coal, natural gas, and petroleum) use in vehicles and electric power generation, combined with increased waste diversion and improved landfill management practices will have near- and long-term public health and socioeconomic co-benefits for the region. In the near term, benefits

include improving indoor and outdoor air quality and reducing hazardous air pollutants, toxins, and other pollutants. Reducing these types of pollutants can immediately benefit the physical and economic wellbeing of communities. In the long term, reducing GHGs will mitigate the effects of climate change and further bolster regional public health and socioeconomic wellbeing.

The pollutants impacted by the PCAP measures include those listed in Table 6 below.

Table 6. PCAP Measures and Related Pollutant Types

Pollutant	Air Pollutant Type	Categories of Related Measures
Carbon Dioxide (CO2)	GHG	All
Hydrofluorocarbons (HFCs)	GHG	Buildings, Transportation
Methane (CH4)	GHG	All
Nitrous Oxide (N2O)	GHG	Buildings, Transportation
Carbon Monoxide (CO)	Co-pollutant: Criteria Air Pollutant	Buildings, Transportation
Lead	Co-pollutant: Criteria Air Pollutant	Buildings, Transportation
Nitrogen Oxides (NOx)	Co-pollutant: Criteria Air Pollutant	Buildings, Transportation
Particulate Matter (e.g., PM2.5)	Co-pollutant: Criteria Air Pollutant	Buildings, Transportation
Sulfur dioxide (SO2)	Co-pollutant: Criteria Air Pollutant	Buildings, Transportation
Ozone	Co-pollutant: Criteria Air Pollutant	Buildings, Transportation
Volatile Organic Compounds (VOCs)	Co-pollutant: VOCs	Buildings, Transportation
Other hazardous air pollutants (HAPs)	Co-pollutant: Air Toxics	Buildings, Transportation

Public Health Co-Benefits. Improved public health is a significant and direct co-benefit of reducing GHG and co-pollutant emissions in the region. Health risks arise from both outdoor and indoor air pollution caused by the combustion of fossil fuels, like coal, natural gas, and petroleum, and consequent release of GHGs, hazardous air pollutants (HAPs), toxins, and other pollutants. In the United States roughly 87 percent of people's lives are spent indoors, so indoor exposure to combustion pollutants, such as natural gas for cooktops or heating, has the potential for substantial health effects.[12] Exposure to co-pollutants from the combustion of coal, natural gas, and petroleum are linked to a litany of physical health concerns, including illness and premature mortality. A large body of research on the detrimental health effects of exposure to air pollution provides strong evidence that long-term exposure to ambient particulate matter (i.e., PM2.5), ambient ozone, and household air pollution contributes to premature mortality and increased risk of illness. Evidence is also growing on the association between long-term

[12] U.S. EPA. 1989. Report to Congress on indoor air quality: Volume 2. EPA/400/1-89/001C. Washington, DC.

exposure to air pollution and adverse birth outcomes, cognitive declines, and gastrointestinal inflammatory diseases. Short-term exposure to high levels of air pollution can also exacerbate asthma and cardiopulmonary symptoms.[13]

This PCAP includes measures that will directly reduce GHG and co-pollutant emissions from the combustion of fossil fuels by promoting energy efficiency, electrification, and adoption of clean energy in municipal buildings; promoting the use of zero-emission vehicles and actions to reduce vehicle miles traveled; and by promoting actions to reduce landfill emissions in the waste sector. These public health co-benefits particularly support LIDACs, which have been shown to face the highest risk of air pollution and poor transportation resources.[14] Measures in this PCAP will also improve public health by making bicycle and pedestrian transportation safer.

Economic and Workforce Co-Benefits. Implementing these PCAP measures and actions will also have several social and economic, or socioeconomic, benefits for the MSA population, particularly for LIDACs. A key co-benefit of efforts to reduce GHGs is the expansion of the clean energy workforce. The growth of clean energy technologies, such as solar installations and EV charging infrastructure, requires trained individuals who understand how to install and maintain this hardware. Clean energy jobs training, especially for individuals in LIDACs, supports the supply chain of climate infrastructure and technology while also generating jobs and economic opportunities for communities. Installation of clean energy technologies, including distributed resources (e.g., rooftop solar PV installations and battery storage), creates more redundancy in the grid and lessens the likelihood of blackouts.[15] Therefore, these investments and clean energy workforce trainings enhance climate resilience and curb the economic impact of extreme weather events.

Many of the PCAP measures address energy use in buildings and in the transportation sector. Electrifying these fossil fuel-driven sectors and enhancing efficiencies reduces the percentage of budget or income that goes toward energy costs. Electric vehicles have lower maintenance and fuel costs than internal combustion engine vehicles.[16] Efficiencies and electrification of municipal buildings and fleets reduces the amount of public funds that must be used for energy costs alone. Reducing the energy cost burden, particularly for LIDAC residents, reduces financial stress for households and businesses, and allows funds to be used elsewhere to stimulate the economy.[17]

Community Co-Benefits. In addition to creating jobs and lowering financial stress, these measures also benefit society and the economy by promoting public education and fostering a sense of community. All the measures described in this PCAP were developed through stakeholder engagement and will be built upon during the CCAP to provide public education and

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[13] Health Effects Institute. 2020. *Health Effects Institute Annual Report 2020: Valuing Science Informing Decisions.* https://www.healtheffects.org/system/files/hei-annual-report-2020.pdf
[14] Ebi, K. L., and Hess, J. J. (2020). Health Risks Due to Climate Change: Inequity In Causes And Consequences. *Health Affairs. 39*(12). https://doi.org/10.1377/hlthaff.2020.01125
[15] Stout, S., Hotchkiss, E., Lee, N., Holm, A., & Day, M. (2018). *Distributed Energy Planning for Climate Resilience.* NREL. https://www.nrel.gov/docs/fy18osti/71310.pdf
[16] U.S. DOE. 2022. Saving Money with Electric Vehicles. https://www.energy.gov/energysaver/articles/saving-money-electric-vehicles
[17] U.S. DOE. 2019. *Low-Income Household Energy Burden Varies Among States — Efficiency Can Help In All of Them*. Energy.gov. https://www.energy.gov/sites/prod/files/2019/01/f58/WIP-Energy-Burden_final.pdf

outreach to ensure community members can access climate resources. This promotes social inclusion and buy-in from community members and CBOs. Additionally, the measures include actions to expand public transit, better manage waste, and improve pedestrian and bicycle routes. These factors, as well as reduced air pollution and a healthier environment, are key to promoting social inclusion and community gathering, such as opportunities to use green spaces and gather communally outside. Therefore, these measures may improve social capital, encourage community members to engage with their community and local economy, and benefit the overall socioeconomic well-being of the Richmond MSA.

PCAP Measure LIDAC Impacts Summary

For the PCAP, PlanRVA qualitatively assessed the potential impacts on LIDACs. Table 7 below summarizes the LIDAC benefits achieved by implementing the PCAP measures. For each measure, it is critical that careful consideration be given to potential LIDAC impacts as programs or actions are designed to minimize any potential negative impacts and maximize the potential benefits to these communities.

Table 7. Summary of Potential LIDAC Benefits from PCAP Measures

LIDAC Benefits from GHG Emissions Reductions	Achieved via this PCAP Measure
Enhanced public health outcomes stemming from reductions in co-pollutants (e.g., GHGs, particulate matter, hazardous air pollutants), leading to declines in illnesses and premature mortality associated with air pollution.	✓ All Measures
Strengthened resilience to climate change events from measures that reduce GHGs and offer climate adaptation co-benefits. GHG emissions drive climate change, so reducing emissions lowers the likelihood of climate events (e.g., extreme heat) and associated risks (e.g., heat-related illness).	✓ All Measures
Greater social capital that arises when communities can enjoy public spaces safely (i.e., without air pollution), have greater access to public resources (e.g., transportation), and overall live healthier lives with improved socioeconomic well-being.	✓ All Measures
More purposeful community engagement and enhanced public awareness of climate-related projects and their outcomes.	✓ All Measures
Less noise pollution (e.g., from vehicle traffic).	✓ Measure 1 ✓ Measure 2 ✓ Measure 3 ✓ Measure 5 ✓ Measure 7
Expanded access to alternative transportation.	✓ Measure 2 ✓ Measure 3
Cost savings associated with the transition from ICE vehicles to EVs due to lower vehicle fuel and maintenance cost.	✓ Measure 1
Increased comfort and quality of space, such as a safer, healthier workplace due to reduced indoor air pollution.	✓ Measure 5 ✓ Measure 6
Establishment of high-quality employment opportunities and workforce development initiatives in LIDAC communities,	✓ Measure 1 ✓ Measure 5

LIDAC Benefits from GHG Emissions Reductions	Achieved via this PCAP Measure
prioritizing access to the clean workforce and economy for LIDAC workers and small businesses.	✓ Measure 6
Bolstered energy security through enhancements in energy efficiency and the adoption of more resilient energy generation technologies.	✓ Measure 5 ✓ Measure 6 ✓ Measure 7

PCAP Measure 1. Support, incentivize, and provide assistance for the rapid adoption, equitable installation and use of Zero-Emission Vehicles.

GHG Reduction Measure Description

Measure 1 Quantified GHG Reductions

Cumulative GHG Reductions from 2025–2030*: **1.08 MMTCO$_2$e**

Cumulative GHG Reductions from 2025–2050*: **45.02 MMTCO$_2$e**

** See*

To reduce emissions from the transportation sector, this measure focuses on accelerating the transition to electric vehicles (EVs) and developing a regional, equitable charging network. Supplemented by existing federal incentives, this measure will be supported through the creation and expansion of a robust charging network, development of incentive programs, workforce development, and other activities to encourage widespread adoption of EVs. Localities may also electrify their municipal fleets and equipment, such as school buses, public works trucks, refuse trucks, and department vehicles (see also Measure 5). Indirect co-benefits of this project, including improved public health and the creation of clean energy jobs, will spread throughout communities, with a particular emphasis on benefits to historically underserved LIDACs.

Key Implementing Agency(ies)

- **Regional Transportation Planning Organizations (TPOs).** Richmond Regional Transportation Organization (RRTPO) and Tri-Cities TPO can coordinate with PlanRVA to share best practices, align transportation goals and funding, and coordinate with other neighboring transportation networks to identify opportunities for collaboration.
- **Virginia State Government Agencies.** State government agencies such as the Virginia Department of Transportation (VDOT) and the Virginia Department of Motor Vehicles (DMV) will help coordinate the implementation of policies and programs and may be able to provide funding for infrastructure development. The Virginia DMV established the 2022 Electric Vehicle Rebate Program, which offers rebates of $2,500 for people who purchase EVs from participating dealers; this program is not currently funded.[18]
- **Utilities.** Local utilities need to be involved to ensure the electricity grid can support electrification of transportation. They can also provide incentives or assistance for charging installation and may provide specific rate incentives for EV charging. Dominion Energy has piloted similar programs in the past.

[18] Code of Virginia. 2021. Article 8. Electric Vehicle Rebate Program. § 45.2-1726. https://law.lis.virginia.gov/vacodefull/title45.2/chapter17/article8/

- **Local Government organizations.** Local governments can transition fleets to EVs supported by the adoption of green fleet policies and plans. They can devise and adopt incentives to support EV adoption, such as EV-ready building codes, and build out publicly available charging infrastructure. Local governments can also implement community-wide buying co-ops for EVs for public and private fleets as well as personal vehicles.
- **Private sector actors**. Companies can take advantage of incentives and buy/use EV and alternative fuel vehicles and build out the charging infrastructure. For example, ridesharing companies can procure and offer EVs and provide EV charging infrastructure. In addition, local businesses can coordinate with local governments to bring publicly accessible charging stations to the region.

Authority to Implement

The actions taken under this measure would be predominantly voluntary incentives. Local jurisdictions have the authority to purchase vehicles for their fleets; such purchases have already been started across the MSA. In some instances, purchasing or procurement policies may need to be adjusted to prioritize low- and zero-emissions vehicles (ZEVs). Private and personal purchasing of low emission vehicles and ZEVs does not have any statutory limitations. Local zoning, code or other policy changes may need to be made for charging infrastructure.

Implementation Activities and Milestones

Actions to implement this measure could include, but are not limited to the following:

- Update the 2013 Regional EV Infrastructure Plan (REVI).
- Create incentives and programs for EV and low-emissions vehicles. Incentives can include direct financial incentives or exemptions to certain restrictions (such as high occupancy vehicle (HOV) lane exemptions in Virginia or emissions testing exemption in Virginia).
- Develop and support regional EV and ZEV fueling infrastructure:
    - Conduct regional charging/siting analysis with contractor support and community engagement.
    - Develop incentive programs for EV chargers in multifamily, public, commercial, and rental properties, including affordable housing developments.
    - Create and implement model ordinances that mandate or incentivize clean fuel infrastructure into development and/or provide model zoning code or other policy updates. This may leverage updated requirements in Virginia's High-Performance Buildings Act (HB2001), which includes building performance standard requirements for new public buildings related to EV charging infrastructure.
    - Conduct workforce assessment to understand gaps in the labor market needed to support widespread ZEV and EV adoption. Provide training (e.g., through the Electric Vehicle Infrastructure Training Program) for installation and maintenance of EV charging and fueling infrastructure. Some of these opportunities should be focused in LIDACs to bring benefits to these communities.
    - Conduct regular analysis of the state of clean fuel infrastructure to address any gaps in charging/refueling needs that may hamper the rate of transition. Virginia

is investing in statewide EV infrastructure, a key factor in widespread EV adoption, with significant funding through the National Electric Vehicle Infrastructure (NEVI) Program, including along alternative fuel corridors within the MSA.[19]

- Leverage statewide resources such as Drive Electric Virginia, an initiative to advance EV adoption. Led by Virginia Clean Cities and partnering organizations, the program engages stakeholders to address EV adoption barriers and accelerating plug-in EV use throughout the state.[20]

- Public education and engagement for all actions included above: Education, marketing and outreach (to develop plans and implement incentives and programs), and real-time data will help accelerate the deployment of ZEVs. Targeting education and engagement efforts on LIDACs through partnering with community leaders and CBOs will help bring additional co-benefits to these populations (e.g., air pollution and health benefits, social capital, etc.).

Geographic Coverage

The initiatives outlined in this measure target the entire MSA region.

LIDAC Benefits

Air pollution from burning fossil fuels has historically been concentrated in LIDACs where community members also have reduced access to medical care and other resources due to poverty, disenfranchisement, lack of transportation, etc.[21] This is particularly true for LIDACs that are highway adjacent. Benefits for LIDACs may include improved air quality and health benefits resulting from reductions in tailpipe emissions from internal combustion engine vehicles (ICEVs), including potential reductions in new asthma cases, hospital admissions, and emergency department visits, reduced noise pollution, and reduced cost for vehicle ownership, especially as the second-hand market for EVs grows.[22] Cost barriers to EV ownership will still exist for LIDACs, so programs and incentives may be expanded or designed to help overcome these barriers.

Community members of LIDACs who are currently employed in auto industry related jobs, such as maintenance, repair, and resale, may see opportunities decline as the market transitions to primarily electric vehicles. Job training programs may be targeted at LIDACs to retain those employees in the field and prevent blue-collar LIDAC workers from being left out of the EV transition. Similarly, job training and apprenticeship programs can be targeted to support the deployment of new charging infrastructure, which requires skilled tradesfolk from many disciplines.

Additionally, with the Virginia Clean Economy Act's target for net zero emissions from the electric power sector, electric vehicles are likely to be charged with cleaner sources of electricity generation over time (e.g., solar and offshore wind). These will replace fossil fuel-fired coal and

[19] https://www.fhwa.dot.gov/environment/nevi/ev_deployment_plans/va_nevi_plan.pdf
[20] Drive Electric Virginia. About. Virginia Clean Cities. https://driveelectricva.org/about/
[21] American Lung Association. 2023. Driving to Clean Air: Health Benefits of Zero-Emission Cars and Electricity. https://www.lung.org/getmedia/9e9947ea-d4a6-476c-9c78-cccf7d49ffe2/ala-driving-to-clean-air-report.pdf
[22] Department of Energy. 2022. Saving Money with Electric Vehicles. https://www.energy.gov/energysaver/articles/saving-money-electric-vehicles

natural gas plants in the region, which contribute to poor air quality and health issues, particularly for adjacent communities.

PCAP Measure 2. Expand equitable transit access.

GHG Reduction Measure Description

To address emissions from the transportation sector, this measure aims to expand equitable access to public transit options. Improving public transit is an effective method to reduce emissions by reducing the vehicle miles traveled (VMT) from largely single-occupancy vehicles. Improving access to and the design of transit services can reduce VMT by increasing accessibility to local and regional destinations, such as housing, jobs, and goods/services.

Measure 2 Quantified GHG Reductions

Cumulative GHG Reductions from 2025–2030*: **0.02 MMTCO$_2$e**

Cumulative GHG Reductions from 2025–2050*: **0.67 MMTCO$_2$e**

** See*

Appendix D. Approaches for

Key Implementing Agency(ies)

- **Local governments and municipalities**. Local governments are responsible for land-use planning and comprehensive planning, transportation planning and transportation-related policies, and local policies and programs that may incentivize or unintentionally disincentivize public transit use and equitable access. Funding for public transit also comes in part from local governments.
- **VDOT and Virgina Department of Rail and Public Transport (VDRPT).** These state agencies will be key partners in transportation infrastructure planning, development, and operations, such as changes to roads to prioritize bus transportation along state routes. Certain road planning decisions could also induce demand for car travel, which could weaken GHG reduction progress.
- **Metropolitan Planning Organizations (MPOs)**. RRTPO and Tri-Cities MPO coordinate transportation planning for most of the Richmond MSA localities. As of January 2024, new federal rules require MPOs to set emissions reduction targets and to publish regular accounting of transportation emissions. RRTPO and Tri-Cities MPO will coordinate with PlanRVA to set a shared target that aligns with the CPRG. MPOs also prioritize transportation initiatives, craft policies for financial programming, and coordinate planning with VDOT and VDRPT, the Central Virginia Transportation Authority, and other partners.
- **Public Transportation Operators.** The GRTC Transit System provides public transit services to Richmond and parts of Chesterfield and Henrico. This includes fixed routes, rapid transit routes, and paratransit services. It also operates RideFinders, which is a regional nonprofit agency that works to reduce the number of single-occupancy vehicle trips. Petersburg Area Transit operates public transit and paratransit services in the Tri-Cities area. Other smaller operators, such as Bay Transit, provide service in the more rural portions of the region.
- **Private sector partners.** Landowners and developers may play a role in development decisions that shape the viability of transit options. Private rail companies (e.g., Amtrak) are also essential players in connecting the MSA to the broader state and region.

Authority to Implement

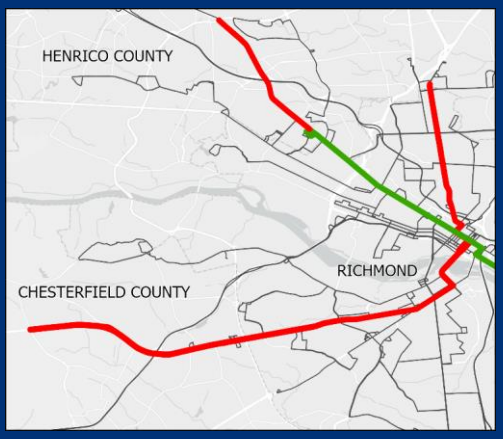
Actions related to public transportation may need approvals from regional or state transportation agencies to be implemented and will need higher levels of authority depending on the scope and scale of changes to public infrastructure. Employers also play a key role in providing company polices to allow for teleworking or incentives for transit ridership. Actions and policies that impact land use can be administered by local jurisdictions though zoning codes and potential changes, and developers can act on where to build based on these policies.

Implementation Activities and Milestones

Actions to implement this measure could include, but are not limited to the following:

- Provide improvements and enhancements in public transit service, including:
  - Expanded bus service/bus rapid transit (BRT)
  - Operational and service enhancements (such as increased route frequency and live bus tracking)
  - Bus stop improvements (such as benches and bus shelters)
  - Transit station improvements (such as mobility hubs that bring together transit, maintenance, and investments to improve reliability and quality of service)
- Assess Park-and-Ride lot locations, and place Park-and-Rides in strategic locations to provide drive-to access for the higher-speed transit services throughout the region.
  - The Virginia Department of Rail and Public Transit has conducted multiple studies and plans on transit modernization, connectedness, road needs, rural micro-transit, rail connectivity, transit equity, and more that could be leveraged to support assessments in the MSA.[23]
- Support land use policies that encourage development near high-capacity transit stations and within activity centers, including design that supports multimodal transit.
- Implement incentives that encourage use of sustainable modes, such as incentives for using transit/reduced or fare-free transit.
- Public education and engagement for all actions included above: Education, marketing and outreach (when developing project plans and implementing incentives), and real-

Box 2. Bus Rapid Transit (BRT) Project Highlight



Partners in the Richmond Region, including GRTC, the City of Richmond, Chesterfield County, Henrico County, and the RRTPO are moving forward with an expansion of the current Pulse BRT that includes a 4-mile extension of the existing Pulse route and an entirely new 16-mile North–South BRT route. The existing Pulse line is green and both BRT expansion projects are shown in red.

(Visit https://arcg.is/W0GLC0 and https://arcg.is/0vLaSW for more)

[23] Virginia DRPT. "All DRPT Studies & Reports – DRPT." Virginia Department of Rail and Public Transportation, 2024. https://drpt.virginia.gov/studies-and-reports/.

time data will help increase use of public transit options. Targeting education and engagement efforts on LIDACs through partnering with community leaders and CBOs will help bring additional co-benefits to these populations (e.g., air pollution and health benefits, social capital, etc.).

Geographic Coverage

The initiatives outlined in this measure target the entire MSA region.

LIDAC Benefits

Air pollution from the burning of fossil fuels has historically been concentrated in LIDACs where community members also have reduced access to medical care and health resources due to poverty, lack of transportation, etc.[24] This is particularly true for LIDACs that are highway adjacent. Benefits for LIDACs from reduced VMT across the region may include improved air quality and health benefits resulting from reductions in tailpipe emissions from ICEVs, including potential reductions in new asthma cases, hospital admissions, emergency department visits, and reduced noise pollution. Members of LIDACs also disproportionately rely on public transportation to reach work, school, medical facilities, and other necessary destinations. Expansion and enhancements of the public transit options may help alleviate certain barriers to educational and job opportunities.

This measure also includes transit-oriented development considerations for land use policies. Transit-oriented development historically leads to gentrification when supportive policies are not implemented to protect underserved homeowners and renters. This measure will require partnership among municipalities, transit agencies, and the development community to truly benefit LIDACs.

[24] American Lung Association. 2023. Driving to Clean Air: Health Benefits of Zero-Emission Cars and Electricity. https://www.lung.org/getmedia/9e9947ea-d4a6-476c-9c78-cccf7d49ffe2/ala-driving-to-clean-air-report.pdf

PCAP Measure 3. Provide and promote new and expanded opportunities to reduce vehicle miles traveled through micromobility options and connected multimodal infrastructure.

GHG Reduction Measure Description

This GHG reduction measure will implement projects and policies to reduce emissions in the transportation sector across the MSA by making changes to expand micromobility options (e.g., bike sharing) and active transportation infrastructure (e.g., sidewalks and bike lanes) to reduce single-occupancy vehicle travel in the region. Telework options may also be incentivized to reduce VMT and provide more flexibility.

Measure 3 Quantified GHG Reductions

Cumulative GHG Reductions from 2025–2030*: **0.14 MMTCO$_2$e**

Cumulative GHG Reductions from 2025–2050*: **1.47 MMTCO$_2$e**

** See*

Key Implementing Agency(ies)

- **Local governments and municipalities.** Localities are responsible for land-use planning and comprehensive planning, transportation planning, development and operations of transportation programs and policies. They are responsible for the design, construction, and maintenance of bike/ped infrastructure. Public Works departments are typically responsible for maintenance of bike/ped infrastructure.
- **Regional planning organizations**. PDCs and MPOs coordinate bike/ped and other micromodal transportation across jurisdictions. They also help bring nonprofit and private stakeholders into the process. Regional planning organizations evaluate and, in some cases, fund active transportation projects.
- **Virginia State Agencies.** VDOT and other state agencies will be key partners in transportation infrastructure planning, development, and operations, especially for projects that span multiple jurisdictions.
- **Private sector partners.** Private sector partners, such as land-use owners, developers, and businesses play a key role in development decisions and design that affect the viability of using alternatives to driving. Business can also implement telecommuting policies, active transportation incentives, and other policies that help manage travel demand. Building developers can incorporate amenities such as bike storage that support micromobility options. Private companies also provide micromobility options on a rental basis, either through contracts with localities or in the free market.

Authority to Implement

The actions associated with making changes to increase pedestrian and bicycle infrastructure can be administered by local jurisdictions. Policies that impact land use can similarly be administered by local jurisdictions though zoning codes and potential changes, and developers can act on where to build based on these policies. Employers also play a key role in providing company policies to allow for teleworking.

Implementation Activities and Milestones

Actions to implement this measure could include, but are not limited to the following:

- Implement infrastructure improvements to support non-motorized travel, such as roadway design that makes walking and biking safer, adding protected bicycle and pedestrian pathways like the Fall Line trail[25] (see Box 3), and adding/repairing sidewalks, and improving crosswalks.
    - On the state level, the Virginia Department of Transportation has developed a Bicycle Policy Plan in 2011 and Pedestrian Policy Plan in 2014 to advance these elements from the 2004 policy.[26,27] These are supported by implementation guidance for design and construction of active infrastructure, as well as annual reports that track improvements in bicycle and pedestrian accommodations.[28] These resources could be leveraged to support strategic improvements in the MSA region.
- Implement incentives that encourage use of sustainable modes, such as rebates for purchasing e-bikes and for employers to adopt telework and alternative transportation options (including ridesharing, public transit, biking, and walking).
- Expand/require the use of transportation planning tools (e.g., ECO-Logical) to measure the impact of projects on surrounding ecosystems and minimize environmental impacts and project costs.[29]
- Implement or expand policies that promote car/ride sharing and reducing vehicle travel, such as through reduced or eliminated parking minimums, parking pricing, and congestion pricing, as well as HOV-3 free and other policies to encourage ride sharing.
- Public education and engagement for all actions included above: Education, marketing and outreach (when developing project plans and implementing incentives), and real-time data will help increase use of public transit options. Targeting education and engagement efforts on LIDACs through partnering with community leaders and CBOs will help bring additional co-benefits to these populations (e.g., air pollution and health benefits, social capital, etc.).

Geographic Coverage

The initiatives outlined in this measure target the entire MSA region.

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[25] Read more about the Fall Line project at falllineva.org.
[26] VDOT. 2011. State Bicycle Policy Plan. https://www.vdot.virginia.gov/media/vdotvirginiagov/about/programs/biking-and-pedestrian/bike_ped_policy.pdf
[27] VDOT. 2014. State Pedestrian Policy Plan. https://www.vdot.virginia.gov/media/vdotvirginiagov/about/programs/biking-and-pedestrian/SPPP_FINAL_OnLine_LowRes.pdf
[28] VDOT. 2024. Bicycle and Pedestrian Accommodations. https://www.vdot.virginia.gov/doing-business/technical-guidance-and-support/transportation-and-mobility-planning/bicycle-and-pedestrian-accommodations/
[29] ECO-Logical is an ecosystem approach to developing infrastructure projects created by the U.S. DOT Federal Highway Administration. It provides a transportation planning framework that leverages stakeholder engagement and agency collaboration to help integrate natural resource and ecological considerations into infrastructure planning, design, review and constructure. PlanRVA is already using the ECO-Logical process for project planning.

LIDAC Benefits

Air pollution from the burning of fossil fuels has historically been concentrated in LIDACs where community members also have reduced access to medical care and health resources due to poverty, lack of transportation, etc.[30] This is particularly true for LIDACs that are highway adjacent. Benefits for LIDACs from reduced VMT across the region may include improved air quality and health benefits, resulting from reductions in tailpipe emissions from internal combustion engine vehicles (ICEVs), including potential reductions in new asthma cases, hospital admissions, emergency department visits, and reduced noise pollution. An improved active transportation system also supports more physical activity. As LIDACs have higher rates of physical inactivity due to social and structural barriers, and related chronic conditions, increased physical activity supports healthier lifestyles, improving physical and mental health outcomes and reducing medical costs.

Benefits from this measure may also include social and physical health, such as greater social inclusion, including in sharing, local, and circular economies and increased access to social and cultural activities, and promotion of exercise when engaging in active transportation. LIDACs also disproportionately suffer from lack of access to reliable transportation and have lower car ownership rates. At the same time, these communities are also less likely to have safe biking and walking routes to school or work and may have less access to micromobility options such as bikeshares. Increasing and improving micromobility opportunities may improve LIDAC

Box 3. Fall Line Project Highlight

Fall Line is a proposed 43-mile trail connecting seven localities between Ashland and Petersburg[1]. Fall Line evolved from the developing network of active transportation routes in the greater Richmond region. Several sections of the planned trail corridor have already been implemented as bike lanes, park trails, or existed in localities' comprehensive and special area plans. A natural corridor for a long-distance trail began to emerge from cooperation among the seven localities connected along the corridor that could provide opportunities for active transportation, recreation, and economic development. The localities include the Town of Ashland, Hanover and Henrico Counties, City of Richmond, Chesterfield County, City of Colonial Heights, and City of Petersburg.

Figure 12 Fall Line project route

[30] American Lung Association. 2023. Driving to Clean Air: Health Benefits of Zero-Emission Cars and Electricity. https://www.lung.org/getmedia/9e9947ea-d4a6-476c-9c78-cccf7d49ffe2/ala-driving-to-clean-air-report.pdf

access to employment and activity centers and reduce the transportation cost burden to LIDAC households.

PCAP Measure 4. Actions to reduce GHG emissions from solid waste.

GHG Reduction Measure Description

This measure is focused on reducing emissions from the disposal of municipal solid waste in landfills by diverting waste (including organic and recyclable materials) from landfills and implementing programs to reduce the unnecessary consumption of single-use plastics.

Measure 4 Quantified GHG Reductions

Cumulative GHG Reductions from 2025–2030*: **2.29 MMTCO$_2$e**

Cumulative GHG Reductions from 2025–2050*: **24.64 MMTCO$_2$e**

** See*

Key Implementing Agency(ies)

- **Local government departments of public works and/or water**. Municipal agencies oversee landfills, solid waste management and recycling contracts, wastewater treatment operations and facilities, and other waste related programs. They are empowered by the Virginia State Code to pass recycling and waste ordinances. Local governments will also provide policy implementation.
- **Regional Waste Authorities.** Central Virginia Waste Management Authority (CVWMA) will be a key implementer of alternatives to landfilling MSW and will provide policy implementation.
- **Private sector partners.** All landfills in the region are owned by private companies, and regional waste authorities contract with private companies to collect and transport municipal waste. Commercial composting and waste-to-energy facilities may also be operated by private companies and could be key partners. Owners or operators of solid waste disposal facilities, with some exceptions, shall implement a gas management plan in accordance with the gas control requirements to protect the landfill cap and prevent the migration of landfill gas into structures or beyond the facility boundary.
- **Virginia Department of Environmental Quality**. Reviews and issues permits for the construction, operation, or modification of a slide waste management facility.

Authority to Implement

The implementing authorities for this measure are county government agencies (e.g., Public Works) in partnership, where applicable, with regional waste authorities, private utilities, landfills, and composting facilities, among others. Public waste management, demonstration projects, waste-related policies, and public education campaigns can all be carried out under the existing powers of local governments. Partnerships with the private sector will be required for projects that relate to solid waste management facilities.

Implementation Activities and Milestones

Actions to implement this measure could include, but are not limited to the following:

- Increase solid waste diversion rate to at least 80% while exploring and implementing alternative options to landfilling MSW.
    - Expand existing programs or establish new ones to enable using organic waste for compost, including yard trimmings and food waste, and create/increase curbside pickup of organic waste. Provide technical assistance to regional waste authorities and local governments to determine the best programmatic option for each community, whether it be drop-off sites or curbside pickup, with a particular focus on expanded access to community members in LIDACs.
    - Invest in organics and food composting operations at existing and new solid waste facilities, including composting, mulching, and landfill facilities.
    - Enhance pre- and post-consumer organic waste programs. For example, reduce food waste by redirecting edible food to vulnerable communities.
    - Encourage and increase solid waste diversion from businesses/institutions by scaling pilot projects (see Box 4) and providing incentives.
- Conduct waste education and public service campaigns around options for waste diversion. Targeting education and engagement efforts on LIDAC through partnering with community leaders and CBOs that represent LIDACs will help bring additional benefits to these populations.
- Engage with the business community and other stakeholders to develop and enact policies to reduce the use of single-use packaging (e.g., plastic bags, plastic straws, polystyrene).
- Explore options to incentivize the expansion of landfill gas capture systems as applicable and increased monitoring of off gas from landfills. Additionally, consider options for expanded beneficial use of captured gas from landfills and anaerobic digesters.

Box 4. Hospital Recycling Pilot Program Highlight

Henrico Doctors' Hospital pilot recycling program, which was launched in 2018 and paired with an environmental education program for hospital staff, helped the hospital win the 2023 Virginia Governor's Environmental Excellence Gold Medal Award in Sustainability. With full staff participation, Henrico recycles more than 12,500 pounds of waste each month, about 6% of the hospital's total waste generated. The program has since expanded to two ambulatory surgery centers, leading to 200,000 pounds of recycled waste per year.

Geographic Coverage

The initiatives outlined in this measure target the entire MSA region.

LIDAC Benefits

Benefits for any LIDAC within the MSA located near a landfill or affiliated operations may include improved air quality and therefore health benefits, resulting from potential reductions in

landfill emissions. This can also lead to lower overall healthcare costs, fewer impacted days of work, and other economic benefits.

PCAP Measure 5. Actions to Implement Decarbonization Strategies for Municipal Operations.

GHG Reduction Measure Description

This GHG reduction measure focuses on deploying renewable and low-carbon energy resources, energy efficiency measures, and low-carbon solutions for municipal and school buildings, operations, and fleets. This measure will support existing and new clean energy, efficiency, and decarbonization efforts that demonstrate leadership by example, while also providing an additional co-benefit where these facilities serve as community and public resource centers.

Measure 5 Quantified GHG Reductions

Cumulative GHG Reductions from 2025–2030*: **0.42 MMTCO$_2$e**

Cumulative GHG Reductions from 2025–2050*: **7.29 MMTCO$_2$e**

** See Appendix D. Approaches for*

Key Implementing Agency(ies)

- **Local Government organizations**. Including all local government entities such as counties, cities, boroughs, townships, and other forms of local government as well as their respective school districts and public agencies can set goals and develop plans and policies, and update procurement policies and guidance.
- **RPOs.** In collaboration with state and local governments, PlanRVA, Crater PDC, and others can provide support and best practices to enable electricity efficiency and decarbonization of buildings and fleets. They may also develop and provide model ordinances and comprehensive plan language and provide technical assistance.
- **Utilities.** Local utilities need to be involved to ensure the electricity grid can support electrification of government operations and the expansion of renewable energy. Utilities may also provide incentives for energy saving practices and energy efficiency upgrades.

Authority to Implement

Local and regional authorities that own and operate specific facilities and fleets have the authority to undertake the actions in this measure and to apply for other funding or internally raise funds to support the project costs. To enact specific decarbonization projects, policies, and/or pilot programs, local governments may need to gain approval from a legislative body or other administrative authority that oversees budgets and/or regulations.

Implementation Activities and Milestones

Many local governments in the region are already taking action to increase the efficiency of public and school buildings and electricity their fleets. Actions to implement this measure will build upon these existing efforts and may include the following:

- Expand and/or create new programs and incentives for retrofits and upgrades to municipal and government buildings, including public schools, government buildings, and operations (e.g., building efficiency and electrification retrofits and street lighting retrofits).

  - Conduct building energy audits and develop facility-specific decarbonization plans. Integrate projects into Capital Improvement Plans (CIPs) for each locality.
  - Provide clean energy feasibility assessments at key facilities (e.g., geothermal heat pumps).
  - Leverage updated requirements in Virginia's High-Performance Buildings Act (HB2001) to create a regionwide example of a green buildings policy for localities to adopt and implement. As part of the policy, consider enacting stricter building energy efficiency goals, such as achieving certain LEED certification levels, for new municipal construction or major retrofits.The policy may also include standards for the addition of enabling infrastructure, such as new electrical systems, solar-ready roofs, or other items to support building electrification, transportation electrification, or new on-site renewable energy and battery storage systems.
  - Leverage state program resources. Virginia has supported energy efficiency efforts at state agencies and other public facilities through Virginia Energy's Energy Savings Performance Contracting Program, which allows state agencies and local government entities to enter contracts with energy service companies to reduce energy costs through efficiency measures.[31]
- Create and implement clean vehicle procurement policies.
  - Conduct fleet assessments and develop ZEV procurement plans with supporting clean fueling infrastructure siting assessments.
  - Install EV chargers and other supporting infrastructure for alternative fuel vehicles at public buildings.
  - Reduce government employee VMT.
- Utilize local renewable energy sources to meet electricity needs.
  - Install renewable energy systems and energy storage (rooftop systems or on publicly owned land).
  - Establish power purchase agreements to provide clean electricity to local government facilities, potentially aggregating demand with other local jurisdictions or large local businesses to reduce cost.
- Workforce development for all actions above: develop new programs or expanding existing ones to provide training, paid internships, and job opportunities for a clean energy workforce. Some of these opportunities should be focused in LIDACs to bring benefits to these communities.

Geographic Coverage

This measure will cover local governments and schools across the entire Richmond MSA.

LIDAC Benefits

As this measure will be carried out by cities and counties across the MSA, all LIDACs within the MSA and in neighboring regions will benefit from steps to decarbonize local government operations and reduce GHG emissions across the MSA. Reducing air pollution by decarbonizing local government operations has the co-benefit of improving the public health of

[31] Virginia Energy. Energy Savings Performance Contract. Virginia DOE. https://www.energy.virginia.gov/energy-efficiency/PerformanceContracting.shtml

individuals in LIDACs and the overall community. The reduction of indoor air pollution in public schools serving LIDAC communities particularly benefits children in LIDACs. Therefore, this measure will also lead to economic co-benefits for LIDACs as improved public health results. Furthermore, local government adoption of energy efficiency and clean energy technologies (heat pumps, ZEVs, etc.) will facilitate the expansion of the clean energy workforce. Additionally, increasing local renewable energy sources will help displace fossil fuel-fired coal and natural gas plants in the region, which contribute to poor air quality and health issues, particularly for adjacent communities.

PCAP Measure 6. Accelerate and support the deployment of energy efficient and low-carbon solutions and incentivize the transition to clean energy for residential and commercial buildings.

GHG Reduction Measure Description

This measure focuses on increasing opportunities for owners and users of all building types to access and install technologies to decrease overall energy consumption, increase energy efficiency, shift to renewable energy and energy storage systems, and reduce GHG emissions from the built environment. It covers both market rate and low/moderate income customers and private and public buildings.

Measure 6 Quantified GHG Reductions

Cumulative GHG Reductions from 2025–2030*: **0.77 MMTCO$_2$e**

Cumulative GHG Reductions from 2025–2050*: **6.31 MMTCO$_2$e**

** See*

Appendix D. Approaches for

Key Implementing Agency(ies)

- **State and Local governments.** The Virginia Department of Housing and Community Development, Virginia Department of Environmental Quality, Virginia State Corporation Commission, and other state agencies can support implementation. Relevant local government organizations can provide support and share best practices when implementing this measure.
- **Dominion Energy.** As utility provider for the MSA, Dominion Energy provides existing energy efficiency programs for ratepayers that can be expanded. In addition, Dominion Energy will be key for ensuring that the electrical grid infrastructure is able to support the electrification of processes and an increased supply of renewable energy. Per the Virginia Clean Economy Act (VCEA), Dominion Energy is required to produce 100% renewable energy by 2045.
- **Businesses, hospitals, private schools, universities, water utilities, airports, places of worship.** These entities will implement building improvements and design/build decarbonized buildings.
- **Property owners, developers, renters.** As end users, homeowners, property owners, developers, and renters can make behavior changes and decisions that affect building efficiency. While property owners and developers generally have more control over changes to and within buildings, especially at the time of new construction or major renovations, renters can also make behavior and other changes that will result in GHG reductions.
- **Non-profit organizations.** Nonprofits can conduct community engagement, education and outreach, capacity building, research on environmental and social impacts of clean energy projects, and/or developing and installing community renewable energy projects.
- **Contractors and equipment/energy service providers.** These partners provide the services and equipment to decarbonize buildings, and may include architects, engineers, energy auditors, consultants, and more. Workforce development organizations also play a key role in building the pipeline of skilled workers to serve the building sector's decarbonization needs.

Authority to Implement

Virginia law does not currently allow local governments to establish building energy performance standards (BEPS) or related policies such as energy benchmarking. Energy code implementation across the region is governed by state law, which with some variations limits local governments' ability to implement codes different from that adopted at the state level. Notwithstanding the lack of home rule in Virginia to adopt local building codes, cities and counties in the Commonwealth of Virginia have—for as long as 22 years—fashioned and implemented green building incentive programs based on tiers of BEPs and performance certifications. City and county governments within the MSA can implement clean energy projects in their own operations within their respective jurisdictions. Thus, activities within this measure can be implemented or are being implemented through existing voluntary or regulatory programs.

Implementation Activities and Milestones

Actions to implement this measure could include, but are not limited to the following:

- Create voluntary benchmarking and labeling programs for buildings.
- Conduct energy audits and site assessments. By conducting these assessments, implementers can collect information on which areas of the building inventory, if any, need additional support in achieving improved energy efficiency and decarbonization, and have the highest potential to result in energy savings.
- Incentivize net zero building development. Prioritizing low-emissions practices across the lifecycle (in construction, maintenance, and end of life) of new buildings and retrofits to existing buildings can yield more integrated emissions savings.
- Expand or create new programs and incentives for retrofits and upgrades to residential, multifamily, and commercial properties (e.g., building efficiency retrofits including window replacements, insulation, more efficient and/or electric appliances, hybrid or all-electric heat pumps or more efficient gas heat pumps).
- Plan for and address electric panel and electrical transformer upgrades in residential and commercial properties to support electrification and the addition of residential solar.
- To increase local solar adoption:
    - Map solar opportunities across the MSA to determine potential priorities and investments.
    - Incorporate community energy infrastructure needs, goals, and strategies in master plans, comprehensive plans, and small area plans.
    - Provide or promote incentives to encourage installation of solar and battery storage in the community and for battery storage, especially in new buildings.
    - Provide technical assistance and support for negotiating and navigating power purchase agreements and community solar, and examine the possibility of regional demand aggregation.

Geographic Coverage

This measure will reduce GHG emissions across the entire MSA.

LIDAC Benefits

These actions could contribute to reducing energy expenses for private and public entities. Indirect benefits include green energy jobs and training for auditors, construction workers, contractors, and other building trades such as HVAC suppliers and carpenters. Additionally, these measures may encourage infill development, removing blight from LIDACs and improving visual quality and overall, safety, and quality of life.

Retrofit programs typically benefit LIDACs in the urban core and in distressed areas. These measures may result in direct benefits including reduced energy costs from the implementation of energy efficiency measures and educational programs that influence user behavior and result in lower utility bills. The incorporation of microgrids may benefit LIDACs by providing alternative network sources for energy during high demand and increases reliability. This measure will also improve local air quality, leading to a reduction in related health impacts such as asthma.

Potential impacts or dis-benefits for business and residential lease holders include construction noise, fugitive dust, utility interruptions, and in some cases early lease termination to complete construction activities. Following construction, increased rents may be a concern.

PCAP Measure 7. Reduce emissions from port operations through the adoption of low-carbon fuels, electric equipment, and operational changes.

GHG Reduction Measure Description

This measure focuses on reducing off-road transportation GHG emissions through actions to decarbonize operations and electrifying ports. On the shoreline of ports, the measure could involve deploying shore power (electric power supplied to docked ships to reduce idling), installing renewable energy, or switching to electric forklifts and other cargo handling equipment, among other activities.

Measure 7 Quantified GHG Reductions

Cumulative GHG Reductions from 2025–2030*: **0.01 $MTCO_2e$**

Cumulative GHG Reductions from 2025–2050*: **0.03 $MTCO_2e$**

** See Appendix D. Approaches for*

Key Implementing Agency(ies)

As a state entity, the Virgina Port Authority (VPA) will be implementing this measure for its facilities across the state, in alignment with the Hampton Roads and Virgina State PCAP, in addition to its Marine Terminal facility and operations within the boundary of the Richmond MSA.

- **Virginia Port Authority:** VPA owns and /or operates (through its private operating subsidiary, Virginia International Terminals, LLC) four five general cargo facilities in Hampton Roads MSA (Norfolk International Terminals, Virginia International Gateway, Portsmouth Marine Terminal, Newport News Marine Terminal, and the Pinners Point Container Yard),and the Virginia Inland Port in Front Royal), in the Hampton Roads MSA and the Richmond Marine Terminal in the Richmond MSA.
- **Utilities:** Play a role in helping to connect and manage load and renewable energy opportunities for port operations.
- **Trade groups.** Trade groups will implement the infrastructure updates specified in this measure.
- **Private sector partners.** Private companies and landowners with property near port infrastructure may need to be engaged to coordinate land-use planning.
- **Community colleges.** The Port of Virginia works with Tidewater Community College to provide necessary training for technical operators and maintenance technicians.

Figure 14. Port of Virginia Locations

Figure 13. Richmond Marine Terminal

Authority to Implement

VPA has the authority to modify its infrastructure and acquire low-emission equipment and systems used within their facilities as described under this measure.

Implementation Activities and Milestones

VPA announced their commitment to become net zero by 2040, and in 2022, they released a sustainability report detailing their progress and future decarbonization targets.[32] This includes a goal to source all their energy from renewable sources by 2024. VPA plans to continue replacing diesel carrier shuttles with hybrid shuttles, electrifying yard tractors, developing an offshore wind energy hub, and implementing a living shoreline project.

In addition to continuing the activities described above, additional example actions for Measure 7 implementation are listed below. These actions are illustrative and not intended to be exhaustive of all actions that could be used to implement this measure.

- Source clean energy for port operations. As discussed above, VPA is on track to meet their 2024 goal of utilizing 100% renewable energy sources.
- Continue to fund the port's green operator dray truck replacement program.
- Provide programs and incentives to decarbonize ports/port electrification.
- Explore expanding barge operations to reduce VMT of port-supporting vehicles.
- Evaluate potential for the provision of shore power or alternative fuels to reduce emissions from oceangoing vessels.
- Continue replacing diesel straddle carriers with hybrid shuttle carriers.

Geographic Coverage

The areas near and around ports (the Richmond Marine Terminal) will be most impacted.

LIDAC Benefits

Within Virginia, as with many parts of the country, there is overlap between locations of ports and the location of LIDACs. LIDACs directly around the Richmond Marine Terminal will primarily be affected, in addition to those in neighboring regions that will benefit from steps to reduce emissions from port operations across the MSA, notably trucking. Through implementing this measure, benefits for LIDACs may include improved air quality and health benefits resulting from potential reductions in off-road emissions, as well as potential reductions in new asthma cases, hospital admissions, and emergency department visits and reduced light and noise pollution.[33]

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[32] The Port of Virginia. 2022. Sustainability Report: Net-Zero by 2040. https://www.portofvirginia.com/wp-content/uploads/2023/09/Port-of-VA-Sustainability-Report_2023_12pgs.pdf

[33] US EPA. “Environmental Justice Primer for Ports: Impacts of Port Operations and Goods Movement.” Overviews and Factsheets, July 31, 2019. https://www.epa.gov/community-port-collaboration/environmental-justice-primer-ports-impacts-port-operations-and-goods.

Moving Forward

CPRG Implementation Grants

Immediately following the finalization of this PCAP, state, regional, municipal, and tribal agencies and consortia are eligible to apply for CPRG competitive funding to implement the targeted measures presented within this plan. The September 20, 2023, CPRG Implementation Notice of Funding Opportunity (NOFO) sets the stage for $4.3 billion of funds that are available through a general competition, potentially resulting in individual grants ranging from $2 million to $500 million each. An additional $300 million will be available to Tribes and territories for implementation. Implementation funding applications are due April 1 and May 1, 2024, with anticipated awards of funding later in 2024.

Other CPRG Planning Grant Deliverables

Recipients of a PCAP planning grant must submit a CCAP two years after the date of the PCAP award (August 9, 2025). PlanRVA is continuing with efforts to develop a CCAP that builds off the PCAP by providing an expanded GHG analysis covering all significant sources and sinks, creating both short-term and long-term GHG emissions reduction targets and articulating a comprehensive set of measures to achieve the targets. A significant stakeholder and public engagement process will support the development of the CCAP.

Per the CPRG guidance, the CCAP will include the following:

- An updated GHG inventory for the MSA.
- BAU GHG emissions projections and an economy-wide GHG emissions reduction scenario.
- GHG reduction targets for the MSA (short and long term).
- A comprehensive list of GHG reduction measures that address economy-wide emissions. Building on the PCAP, this will include the following for each measure:
    - Quantified estimates of GHG reduction and costs,
    - Key implementing agency or agencies,
    - Implementation schedule and milestones,
    - Expected geographic location if applicable,
    - Quantified estimates of co-pollutant reductions,
    - Quantified analysis of benefits for LIDACs,
    - A review of the statutory or regulatory authority to implement the measure,
    - Identification of funding sources that have been secured for implementation,
    - Metrics for tracking progress, and
    - A workforce planning analysis.

In 2027, PlanRVA will develop and share a CPRG Status Report that will include the following:

- The implementation status of the quantified GHG reduction measures from the CCAP.
- Relevant updated analyses or projections supporting CCAP implementation.
- Next steps and future budget or staffing needs to continue CCAP implementation.

Appendix A. Stakeholder Engagement

Local Document Review of GHG Reduction Measure Input

PlanRVA conducted a review of multiple regional and local documents and pulled out 179 actions related to GHG reduction measures related to transportation, buildings, industrial, waste, agriculture and land use, local government operations, clean energy, and equity. The documents reviewed are listed below. The compiled actions were used in combination with other stakeholder feedback to develop the initial priority GHG reduction measures.

Key documents reviewed:

- Connect RVA 2045
- Connect RVA 2045 StoryMap
- Greater RVA Transit Vision Plan
- Richmond Regional Bicycle & Pedestrian Plan
- Charles City County Comprehensive Land Use Plan
- Powhatan County 2021 Comprehensive Plan
- City of Petersburg Comprehensive Plan
- Chesterfield County Comprehensive Plan
- Central Virginia Waste Management Authority Strategic Plan
- Henrico County Environmental Policy Statement
- City of Richmond Climate Equity Action Plan 2030
- Petersburg Area Transit Strategic Plan
- Richmond Master Plan 2020
- Greater RVA Transit Vision Plan: Near-Term Strategic Technical Analysis
- City of Hopewell Comprehensive Plan
- Henrico County Vision 2026

Steering Committee PCAP GHG Reduction Measure Input

During the kickoff meeting with the Steering Committee, PlanRVA held a brainstorming session to generate potential projects, programs, and actions that are priorities or areas of interest for committee members. This list informed the creation of the priority GHG reduction measures.

Project Description
E-bike incentive program
Fall Line Trail
N/S BRT expansion
Expand EV charging infrastructure
Make public transit free for all riders, permanently
Convert 10% of vehicle trips to bike/ped by 2030; 40% by 2050
Expand and Fund RVA bikeshare to the region
Bike/Ped infrastructure improvements
Invest in Public Transit
Decrease total VMT

Implement VEPGS Renewable Energy Cohort by installing solar farms
Install equipment to 3 major private industries (e.g., air scrubbers)
Relocate and modernize asphalt plant
Finalize industrial sites with utility infrastructure
Reduce or eliminate small gas-powered lawn equipment
Increase and protect urban agricultural space; develop agricultural community land trusts
Provide subsidies or rebates for agrivoltaic installations or PV installs on farm buildings
Increase agriculture soil conservation practices
Install solar shelters over shared bike path
Install solar pavers that can be trail surface
Update codes to promote solar
Convert all streetlights to LED
Install small-scale wind turbines along interstates
Plant X number of trees annually
Develop a Green Infrastructure Plan
Low-income weatherization (continue DHCD program funded by RGGI)/Retrofit homes in LIDACs
Fund roof replacements to solar-ready state
Promote solar installations through PPA model
Improve energy efficiency of and install solar on municipal buildings, school, public facilities
Eliminate SF zoning
Eliminate parking minimums
Require new homes to be EV compatible
Reduce energy burden in LIDAC
Incentivize solar installations on new buildings
Improvements to existing wastewater plants and regional connectivity
Promote circular economy (e.g., Tool libraries)
Increase recycling in health care industry
Capture methane from landfills
Reduce construction and demolition waste
Reduce food waste by redirecting edible food to vulnerable communities
Increase municipal composting
Establish zero-waste business tax credit

Community Engagement Meeting Summary

- PlanRVA hosted a Zoom call with 11 organizations (Diversity Richmond, ART180, Blue Sky Fund, Colonial Heights Food Pantry, Health Brigade, Central Virginia Waste Management Authority, Storefront for Community Design, Dominion Innovation Center, Science Museum of Virginia, The James House, Virginia LISC) to provide an overview of the CPRG and key next steps. Each of these organizations expressed an interest in staying engaged going forward and committed to sharing the GHG Emissions Survey with their stakeholders. Seven of the organizations were interested in helping to convene

focus groups or other engagement activities for their community stakeholders later in the process.

- PlanRVA met individually with nine organizations for one-on-one discussions to provide an overview of the CPRG and key next steps. These organizations—project:HOMES, Latinos in Virginia Empowerment Center, the Community Foundation for a greater Richmond, Greater Richmond Fit4Kids, The James House, Oakwood Arts, Richmond Public Library, Appomattox Regional Library, Neighborhood Resource Center of Fulton—committed to staying engaged and sharing the GHG Emissions Survey with their community stakeholders.
- Of these organizations, three immediately invited PlanRVA to engage their communities at a grassroots level. In-person intercepts were conducted outside of two Richmond Public Library branches (North Avenue and East End) and outside of the Appomattox Regional Library in Hopewell. PlanRVA engaged with 39 residents, each of whom completed a brief survey and received VISA or Amazon gift cards for their investment of time and perspective. In addition, Oakwood Arts (in Richmond's East End) scheduled an in-person focus group with their staff and student interns.
- Thirteen organizations asked to work with PlanRVA later in the spring to organize focus groups or another engagement opportunity for their staff and/or community stakeholders. These included Diversity Richmond, ART180, Colonial Heights Food Pantry, Health Brigade, Storefront for Community Design, Dominion Innovation Center, Science Museum of Virginia, The James House, project:HOMES, Latinos in Virginia Empowerment Center, the Community Foundation for a greater Richmond, Greater Richmond Fit4Kidsand the Neighborhood Resource Center of Fulton.

Community Survey Details

A detailed survey was created in both English and Spanish and well-publicized across the region through our outreach and engagement efforts. The survey was open to the public for three weeks, and 820 individuals representing 17 of the 19 localities in the Richmond MSA (including tribal residents) completed the survey. Of those, 358 respondents indicated an interest in staying engaged (providing their email and/or physical mailing address).

- 89% of survey respondents live in the region's largest localities (Richmond, Henrico, and Chesterfield).
- Just over 9% were under the age of 29. About 64% were aged 30–64, and about 28% were 65 or older.
- 85% of respondents were White or Caucasian.
- 34% of respondents reported income below median income levels.

Key themes from a series of open-ended questions in the survey included the following (*italics are direct quotes from a survey respondent)*:

The impact of transportation issues:

- Safety Concerns: *Most streets in Richmond are not safe for bike travel. Access to public transit is limited due to infrequent bus routes and bus stops without seating or shelter.*

- Lack of Public Transit and Infrastructure: *Would use public transit if it was more convenient and safer (better lighting, benches for waiting, trash/recycling receptacles).*
- Noise and Air Pollution: *The noise is disrupting my sleep at night. Several times a week between 11pm and 4am, very loud ICE vehicles wake me up as they drive by my home.*

The impact of pollution from waste:

- Air Quality and Health Concerns from Landfills: *When I first moved to Petersburg 7 years ago I woke up choking due to the landfill gases; I could not breathe. This caused me to reach out to the city, but they did not report anything to the Virginia Department of Environmental Quality.*
- Physical Hazards and Environmental Blight from Waste: *Road hazards from tire retreads on the interstate. Ninety-five is always littered with tire waste, year-round.*
- Water Pollution and Community Cleanliness: *Litter litter everywhere! I spend a lot of my time walking around picking up trash... Never is there a day where I don't find something on a walk.*

Project ideas to reduce pollution:

- **Enhanced Public Transportation Options**: A desire for more public transportation options, including increased bus routes, better bus services, and initiatives to encourage the use of mass transit to reduce individual car usage.
- **Infrastructure for Pedestrians and Cyclists**: A need for better infrastructure to support walking and biking, such as more sidewalks, bike lanes, and pedestrian-friendly development, to reduce reliance on vehicles.
- **Waste Management Improvements**: Better recycling programs, municipal composting, and education on waste reduction. A need for more frequent trash pickups and proper disposal methods for large items.
- **Greener Energy and Vehicle Options**: A shift toward EVs, including public buses, and support for alternative energy sources. This includes the installation of EV charging stations and incentives for electric car ownership.
- **Reduction of Single-Use Plastics**: A reduction or elimination of single-use plastics, suggesting bans on plastic bags and encouraging the use of recyclable or compostable materials.

Appendix B. Identification of LIDACs in Richmond MSA

County	Census Block ID	County	Census Block ID
Charles City County	510366001001	Henrico County	510411009152
Charles City County	510366001002	Henrico County	510411009201
Chesterfield County	510366003002	Henrico County	510411009211
Chesterfield County	510411001071	Henrico County	510411009213
Chesterfield County	510411001072	Henrico County	510411009214
Chesterfield County	510411002091	Henrico County	510538405001
Chesterfield County	510411002101	Henrico County	510853208041
Chesterfield County	510411003001	Henrico County	510853209021
Chesterfield County	510411004033	Henrico County	510853210011
Chesterfield County	510411004041	Henrico County	510853210013
Chesterfield County	510411004042	Henrico County	510853211001
Chesterfield County	510411004051	Henrico County	510853211002
Chesterfield County	510411004052	Henrico County	510853211003
Chesterfield County	510411004061	Henrico County	510853212011
Chesterfield County	510411004071	Henrico County	510853212012
Chesterfield County	510411004072	Henrico County	510853212013
Chesterfield County	510411004073	Henrico County	510853212022
Chesterfield County	510411004091	Henrico County	510853212023
Chesterfield County	510411004092	Henrico County	510853213001
Chesterfield County	510411004093	Henrico County	510853213002
Chesterfield County	510411004094	Henrico County	510853214011
Chesterfield County	510411004095	Henrico County	510853214021
Chesterfield County	510411004101	Henrico County	510872001061
Chesterfield County	510411005051	Henrico County	510872001062
Chesterfield County	510411005054	Henrico County	510872001063
Chesterfield County	510411005055	Henrico County	510872001064
Chesterfield County	510411005062	Henrico County	510872001251
Chesterfield County	510411005063	Henrico County	510872001252
Chesterfield County	510411005071	Henrico County	510872001253
Chesterfield County	510411005081	Henrico County	510872001254
Dinwiddie County	510411005082	Henrico County	510872001262
Hanover County	510411005101	Henrico County	510872001332
Hanover County	510411005102	Henrico County	510872001343
Hanover County	510411006001	Henrico County	510872001443
Hanover County	510411006002	Henrico County	510872001531
Hanover County	510411006003	Henrico County	510872001532
Hanover County	510411007011	Henrico County	510872003011
Hanover County	510411007012	Henrico County	510872003012
Hanover County	510411009071	Henrico County	510872003023
Hanover County	510411009072	Henrico County	510872003031

County	Census Block ID
Henrico County	510872003052
Henrico County	510872003053
Henrico County	510872004041
Henrico County	510872004042
Henrico County	510872004043
Henrico County	510872004073
Henrico County	510872004091
King and Queen County	510872004112
King William County	510872004113
New Kent County	510872004121
New Kent County	510872004122
Prince George County	510872004171
Sussex County	510872004172
Sussex County	510872004173
Sussex County	510872004174
Sussex County	510872004181
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Colonial Heights City	510872005033
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Petersburg City	510872009052
Petersburg City	510872009053
Petersburg City	510872009054
Petersburg City	510872009073
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Petersburg City	510872010011
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Chesterfield County	517308105003

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Chesterfield County	517308113003
Chesterfield County	517308113004
Chesterfield County	517600102011
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Chesterfield County	517600102021
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Hanover County	510872001233
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Sussex County	517600708041
Richmond City	517600708042
Richmond City	517600708043
Richmond City	517600709011

County	Census Block ID	County	Census Block ID
Richmond City	517600709012		

Appendix C. Richmond MSA GHG Inventory and BAU Projections

For the PCAP, PlanRVA compiled a simplified GHG inventory and associated business-as-usual (BAU) projections. The simplified GHG inventory was only compiled for sectors related to a PCAP measure. A comprehensive GHG inventory will be complete for the CCAP.

The methodology for each is summarized below, with Figure 15 and Figure 16 depicting the GHG inventory and BAU projections for the community and municipal operations.

Figure 15. Richmond MSA Community GHG Inventory by Fuel Type

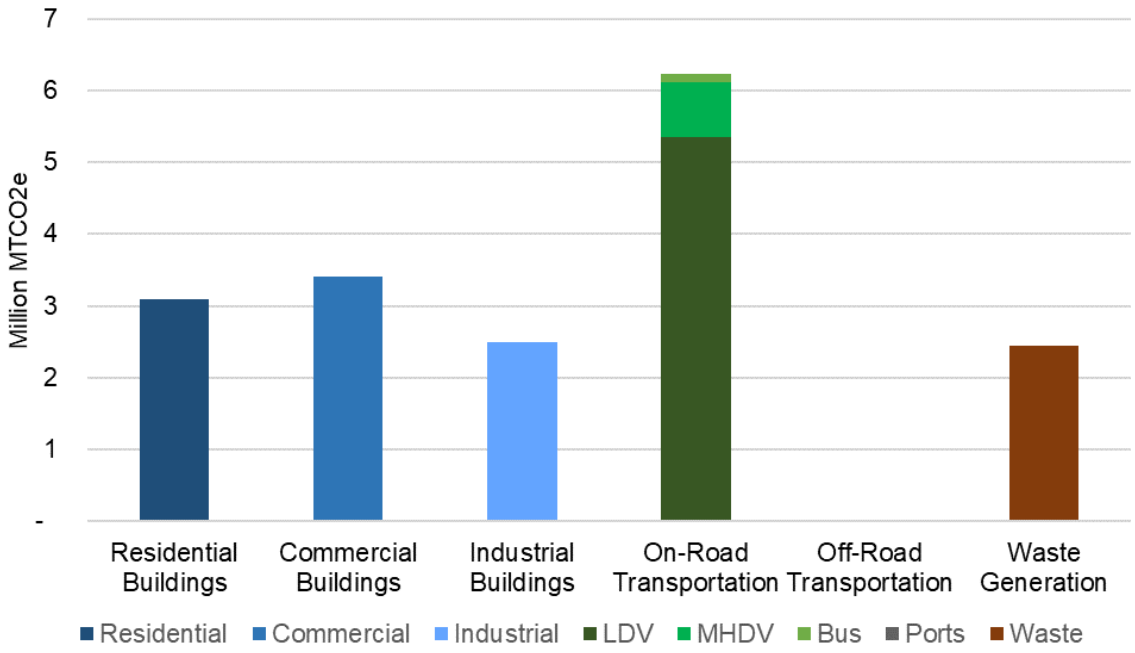
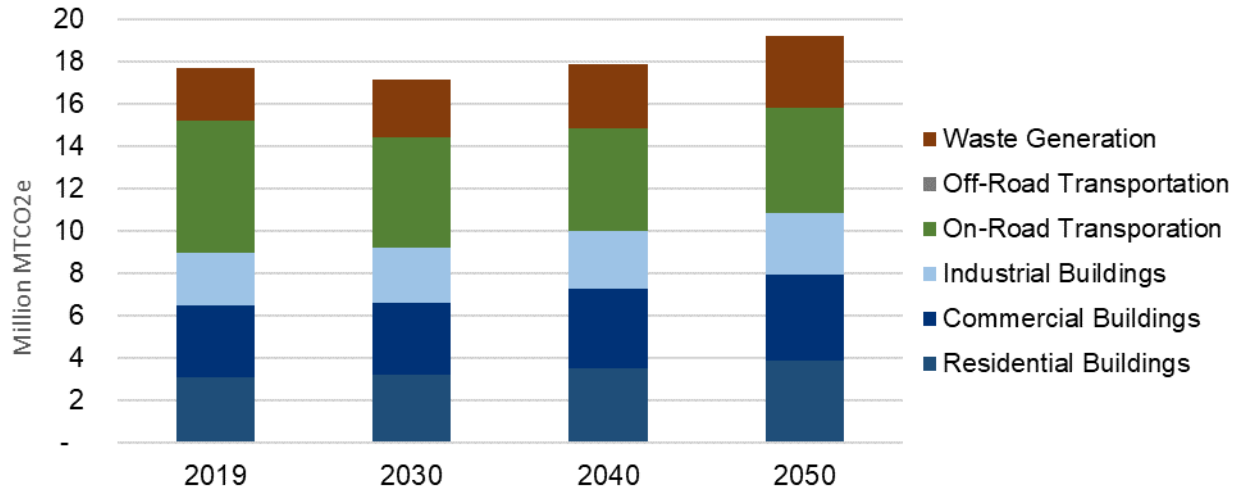


Figure 16. Richmond MSA Community GHG Inventory and BAU Projections



Buildings. PlanRVA acquired state-level building sector emissions data from energy use from EPA's SIT for residential, commercial, and industrial buildings. These state-level data were then scaled to the counties within the MSA based on a population scaling factor using the following equation:

$$County\ building\ data_{2019} = \frac{County\ population_{2019}}{Virgina\ population_{2019}} \times Virginia\ building\ data_{2019}$$

The BAU projections were compiled by growing the MSA-level building data by a rate of growth calculated from the U.S. Energy Information Administration's (EIA) Short-Term Energy Outlook. EIA's Short-Term Energy Outlook provides energy consumption by sector and source from 2019 to 2050. A yearly growth rate was applied to the 2019 inventory data to project building sector emissions from energy use through 2050.

On-Rad Transportation. PlanRVA used EPA's emissions modeling system, MOtor Vehicle Emission Simulator (MOVES), to calculate the emissions from the on-road transportation sector. MOVES has on-road vehicle projection data for vehicle population, VMT, energy consumption, and tailpipe GHG emissions by vehicle type and fuel type for ICEVs. It accounts for projected fuel efficiency improvements for ICEVs as a result of existing policies. PlanRVA ran MOVES with default settings to create the 2019 inventory and BAU projections for population, VMT, energy consumption, and emissions from on-road vehicles for each locality in the MSA. This was then scaled to 2019 VDOT data for the region to better reflect observed VMT in the MSA.

Off-road Transportation. PlanRVA developed emissions estimates for ports only for the PCAP. Ports emissions estimates were calculated in alignment with the methodology used in the statewide PCAP for Virginia that was prepared by DEQ. The 2021 U.S. Army Corps of Engineers Entrances and Clearances data was used to develop the number of ship calls in conjunction with Lloyd's Register of Ships produced by IHS Global Limited. For loads and hoteling times, the 2021 Port of Los Angeles was used. Port of Los Angeles is the like port both in ship calls and cargo movements. The 2011 Port of Virginia inventory was used to derive the in bay, RSZ and maneuver times and speeds. For ocean going vessels, the Port of Virginia ratio of calls for the various terminals was used to divide the Port of Virginia calls (and associated emissions) among the appropriate terminals. For all other sectors, the Port of Los Angeles emissions data was used and ratioed using cargo data from the U.S. Army Corps of Engineers Waterborne Cargo data for the various Virgina ports and for the Port of Los Angeles. For harbor craft, only tug movements were used. The 2021 data is used as a proxy for 2019 emissions. For the BAU, ports emissions were held constant over time.

Waste Generation. Based on data from EPA Greenhouse Gas Reduction Program Facility Level Information on Greenhouse gases Tool (FLIGHT), the Richmond MSA does not have any waste combustion facilities within its boundaries. Therefore, no emissions associated with the incineration of MSW were included in this simplified inventory. PlanRVA calculated landfill emissions for 2019 using data from EPA's LMOP. LMOP data presents annual and cumulative MSW tonnage, the total capacity of the landfill, and whether the landfill has a gas capture system. The 2019 LMOP data did not include a value for annual tons of MSW, and therefore 2021 data were used as a proxy for 2019 data. The following equation was used to calculate the emissions from each landfill, based on the EPA Waste Reduction Model (WARM) tool:

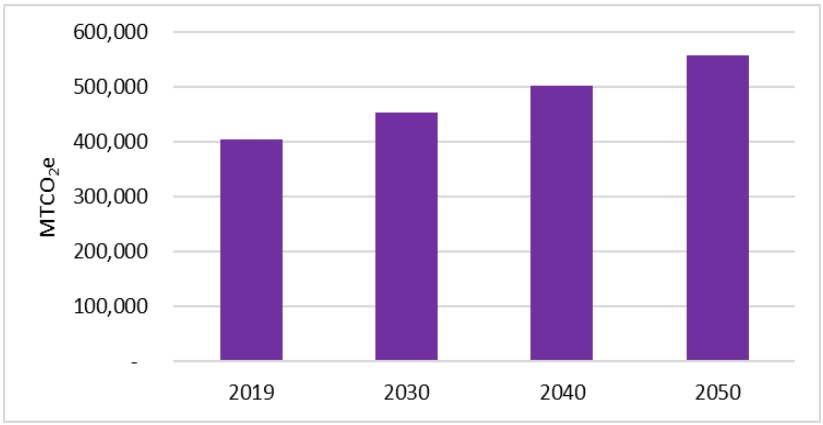
$$Emissions = MSW_{annual} \times (Methane_{EF} \times Methane_{GWP}) \times (1 - O_{rate}) \times (1 - G_{capture})$$

Variable	Value	Description
Emissions	Calculated	Annual emissions for the landfill in $MTCO_2e$.
MSW_{annual}	Retrieved from LMOP data	Annual tons of MSW buried.
$Methane_{EF}$	0.0648	Methane emission factor based on EPA WARM assumptions.
$Methane_{GWP}$	28	The AR5 global warming potential of CH_4.
O_{rate}	0.1 for landfills without gas capture; 0.2 for landfills with gas capture	Oxidation rate based on EPA WARM assumptions.
$G_{capture}$	0 for landfills without gas capture systems; 0.6 for landfills with gas capture systems	Gas capture rate based on EPA WARM assumptions.

The sum of emissions from all landfills within the Richmond MSA in 2019 was used to represent the total emissions from solid waste for 2019 for the MSA. The BAU projections were calculated using an average annual population growth rate using U.S. Census 2020 population data and 2050 population projection data from PlanRVA. The average annual growth rate through 2050 for the MSA is 1.04%.

Municipal Operations. To calculate the municipal inventory for the Richmond MSA, PlanRVA estimated the GHG emissions from municipal buildings (including schools) and from municipal vehicle fleets for the year 2019.

Figure 17. Richmond MSA Municipal Operations GHG Inventory and BAU Projections



Buildings. To estimate municipal building GHG emissions, PlanRVA used data from Henrico County.[34] The county was able to readily provide annual building electricity and fuel emissions data for all public buildings and schools. PlanRVA then extrapolated this data to the rest of the localities in the MSA using a population scaling factor. PlanRVA used the Henrico buildings emissions data as the base for the scaled approach because it was the most comprehensive municipal data inventory readily available. For Richmond City, buildings emissions data available directly from the city for 2018 were used instead of scaling the 2019 Henrico County data.

[34] Henrico Environmental Action Resource Team. "Energy Dashboard - Henrico County, Virginia." Henrico County Virginia. 2024. https://henrico.us/heart/dashboard/.

Vehicle Fleet. Similarly, to estimate municipal vehicle fleet emissions, PlanRVA used municipal vehicle fleet fuel usage information for Henrico County and then extrapolated to the rest of the MSA using a population scaling factor. Henrico County provided data for the number of diesel and gasoline gallons used for their municipal fleet for fiscal year 2023, which was used as a proxy for 2019. PlanRVA then used emissions factors from the EPA MOVES model for diesel and gasoline to estimate the GHG emissions for the municipal fleet. These data were extrapolated to the rest of the localities in the MSA using a population scaling factor. Although the Henrico fuel usage data were not available for the inventory year (2019), PlanRVA used the Henrico fuel usage data as the base for the scaled approach because it was the most comprehensive municipal inventory available throughout the localities in the Richmond MSA. For Hanover County, Chesterfield County, and Richmond City, direct fuel usage data from each municipality were used instead of scaling the Henrico County data.

BAU Projections. The BAU projections were calculated using an average annual population growth rate for each county in the Richmond MSA using U.S. Census 2020 population data and 2050 population projection data from PlanRVA.

Appendix D. Approaches for Quantifying GHG Reductions from PCAP Measures

The following is a summary of methods used for calculating emissions reductions in the Richmond MSA PCAP. In developing these values, modeling assumptions were made to determine reasonable GHG emissions reductions from the deployment of specific measures. In some cases, there may be areas of overlap for emissions reduction values between measures. For example, local government operations are a subset of the total community, and reductions for their fleets (Measure 5) are also modeled in the community-wide ZEV modeling under Measure 1. Similarly, port vehicle electrification (Measure 7) will have some overlap with broader community-wide ZEV modeling under Measure 1. The estimates provided in this PCAP reflect the implementation of each measure with all the identified actions included, to the extent data were available to support the analysis for this PCAP. Since a number of these measures cover the same activity sector, their impacts are not additive as they sometimes overlap with each other. Modeling for these measures is anticipated to be revised as part of the CCAP process.

Measure 1. Incentivize and promote the rapid adoption of electric vehicles through partnerships, technical assistance, financial incentives, and other mechanisms, and support the siting, procurement, installation, and use of charging infrastructure.

This measure models the resulting GHG emissions reduced if the Richmond MSA meets the ZEV sales targets outlined by California's Advanced Clean Cars II (ACCII) rule for light-duty vehicles (LDVs) and the Multi-State Zero Emission Medium- and Heavy-Duty Vehicle (MHDV) Memorandum of Understanding (MOU). Virginia is one of 14 states (including Washington, D.C.) that has adopted California's ACCII rule and is one of 18 states (including Washington, D.C.) that has signed the MOU. Figure 18 below shows the sales targets assumed for LDVs and MHDVs. The model uses outputs from the EPA MOtor Vehicle Emissions Simulator (MOVES4) to project baseline VMT, vehicle population, energy consumption, and Scope 1 emissions for on-road transportation in the MSA by fuel type (gasoline, diesel, ethanol (E-85), compressed natural gas, and electricity), vehicle source type, and model year.[35] Default input values were used.

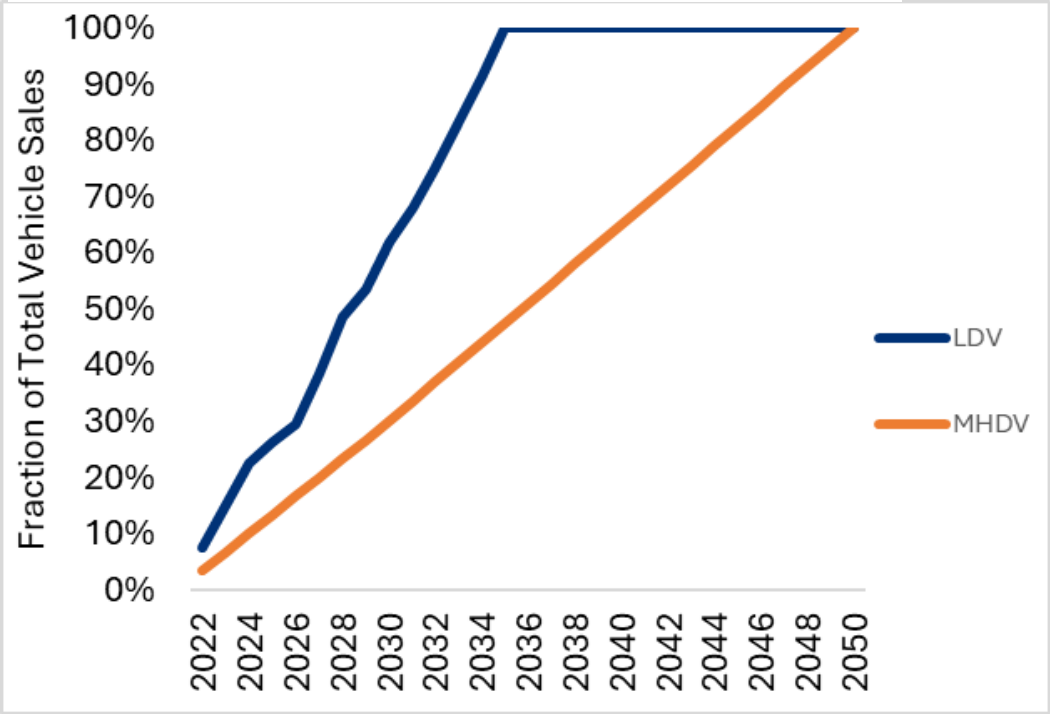
Scope 2 emissions from electricity consumption by EVs were found using the following equation:

$$Scope\ 2\ Emissions = Electricity\ Consumption \times Electricity\ Emission\ Factor \quad (1)$$

[35] U.S. Environmental Protection Agency. 2024. Motor Vehicle Emission Simulator: MOVES4 (Version 4.0.1) [Computer software]. https://www.epa.gov/moves.

The electricity emissions factor was held at 2020 EPA's Emissions and Generation Resource Integrated Database (eGRID) reported levels for the Virgina region (SRVC) through 2050 for the

Figure 18. Percent sales of vehicles that are zero-emission vehicles



baseline.[36]

To model GHG emissions reductions in the policy scenario, for each model year, a fraction of VMT was designated as fuel type "electricity" or "hydrogen" based on the ZEV sales curve. The resulting energy consumption was found using the following equation:

$$Energy\ Consumption = VMT\ \times Energy\ Efficiency, \quad (2)$$

where energy efficiency was in units of kJ/mi for battery EVs (BEVs) and fuel cell EVs (FCEVs). Implied BEV energy efficiencies from the MOVES4 baseline results were used. FCEV energy efficiencies were sourced from the California Advanced Clean Fleets (ACF) rule making.[37] Scope 1 emissions were found by reducing baseline ICEV emissions by the ZEV sales fraction. Scope 2 emissions were found using Equation (1). The grid emissions factor used for the ZEV measure reflects a cleaner grid overtime in line with state policy. The grid emissions factor projection is sourced from EIA's Annual Energy Outlook (AEO) 2023 Reference Case, which

[36] U.S. Environmental Protection Agency. 2022. Emissions & Generation Resource Integrated Database (eGRID), 2020. Washington DC: Office of Atmospheric Protection, Clean Air Markets Division. https://www.epa.gov/system/files/documents/2022-01/egrid2020_summary_tables.pdf.

[37] California Air Resources Board. 2022. Appendix G: Total Cost of Ownership Discussion Document. Advanced Clean Fleets Regulation. https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2022/acf22/appg.pdf.

includes the impact of state policy and federal tax credits for clean energy.[38] The emissions factor for the PJMD region was used for the CO_2 emission factor projection. The CO_2 emissions factor was combined with the CH_4 and N_2O EPA eGRID emission factor data for the SRVC region to estimate a CO_2e emissions factor representing the MSA.

The following additional key assumptions were made throughout the analysis:

- ZEVs exist in the vehicle fleet for the same length of time as ICEVs.
- ZEV activity/use is identical to an ICEV.
- The annual ZEV sales fraction applies to every fuel type.
  Long-haul medium and heavy-duty vehicles (MHDVs) ZEVs are modeled as FCEV and all other MHDVs ZEVs are modeled as BEV. The hydrogen supply is assumed to be 50% green hydrogen and 50% blue hydrogen.
- All LDVs ZEVs are modeled as BEVs.
- All BEV populations 2021 and earlier are EPA MOVES4 default.
- 2022 LDV ZEV share was sourced from the Alliance for Automotive Innovation.[39]
  The methodology in some cases required re-allocating MOVES4 baseline projected electric vehicle back to ICEVs. Where this was necessary, LDVs were designated as gasoline, and MHDVs were designated as diesel.

Measure 2. Actions to expand equitable transit access.

This measure models resulting VMT and GHG emissions reduced if the Richmond MSA enhances its public transit system by increasing transit service frequency, extending transit network coverage or hours, and implementing transit-supportive roadway treatments throughout the MSA. The measure assumes these strategies only result in light-duty passenger vehicle VMT reduction. The potential VMT reduction due to each of these actions was calculated based on the methodology outlined in the *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity,* a document compiled for the California Air Pollution Control Officers Association to provide methods for estimating GHG reductions resulting from various measures.[40]

Passenger vehicle VMT reduction due to transit enhancements was only modeled in counties with existing bus systems for this measure. The resulting passenger VMT reduction in each applicable county is shown in the following table. Larger reductions are possible when this measure is paired with other items such as improved transit-oriented development, congestion and/or VMT pricing, encouragement of teleworking, and other disincentives for driving, which

[38] United States Energy and Information Administration. 2023. Annual Energy Outlook 2023 Table 54. Electric Power Projections by Electricity Market Module Region: Reference Case | PJM/Dominion. https://www.eia.gov/outlooks/aeo/tables_ref.php.
[39] Alliance for Automotive Innovation. 2024. Economic Insights. https://www.autosinnovate.org/resources/insights/va.
[40] California Air Pollution Control Officers Association. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. https://www.airquality.org/ClimateChange/Documents/Handbook%20Public%20Draft_2021-Aug.pdf

are not quantified as part of this PCAP measure and will be further reviewed as part of the CCAP process.

Strategy Name	2030 VMT Reduction	2050 VMT Reduction	Applicable Counties
Increase Transit Service Frequency	-0.016%	-0.031%	City of Richmond, Henrico, Petersburg city, Colonial Heights, Hopewell city
	-0.0078%	-0.016%	Chesterfield, Goochland, Hanover
Extend Transit Network Coverage or Hours	-0.042%	-0.084%	City of Richmond, Henrico
Implement Transit-Supportive Roadway Treatments	0.0025%	-0.0050%	City of Richmond, Henrico, Petersburg city, Colonial Heights, Hopewell city
	-0.0012%	-0.0025%	Chesterfield, Goochland, Hanover

Where calculation input data from specific plans were not available, conservative estimates were made for each transit strategy based on the maximum input value listed in the *Handbook.*

The following additional key assumptions were made throughout the analysis:

- VMT reductions apply only to passenger vehicles.
- VMT reductions are taken from the baseline discussed in Measure 1.
- Maximum VMT reductions are achieved by 2050 and half of the maximum reductions are achieved by 2030.
- Results in counties with partial bus service coverage were reduced 50% compared to counties with full coverage.
- Additional transit statistics were sourced from the Federal Highway Administration.[41]

Measure 3. Provide and promote new and expanded opportunities to reduce vehicle miles traveled through micromobility options and connected multimodal infrastructure.

This measure models resulting VMT and GHG emissions reduced if the Richmond MSA enhances its micromobility infrastructure by improving pedestrian networks, expanding bike networks, and implementing an electric bikeshare program throughout the MSA. The measure assumes these strategies only result in light-duty passenger vehicle VMT reduction. The potential VMT reduction due to each of these actions was calculated based on the methodology outlined in the *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity,* a document compiled for the

[41] U.S. Department of Transportation. National Household Travel Survey: 2017 Survey. Federal Highway Administration. n.d. https://nhts.ornl.gov/.

California Air Pollution Control Officers Association to provide methods for estimating GHG reductions resulting from various measures.[42]

Passenger vehicle VMT reduction due to micromobility enhancements was modeled for all counties in the MSA. The resulting passenger VMT reduction across the MSA is shown in the following table. Larger reductions are possible when this measure is paired with other items such as improved transit-oriented development, congestion and/or VMT pricing, encouragement of teleworking, and other disincentives for driving, which are not quantified as part of this PCAP measure and will be further reviewed as part of the CCAP process.

Strategy Name	2030 VMT Reduction	2050 VMT Reduction
Provide Pedestrian Network Improvement	-0.25%	-0.50%
Expand Bikeway Network	-0.0097%	-0.019%
Implement Electric Bikeshare Program	N/A	-0.0055%
Parking Pricing	-3.0%	-3.0%

Where calculation input data from specific plans were not available, conservative estimates were made for each micromobility strategy based on the maximum input value listed in the *Handbook*. The following additional key assumptions were made throughout the analysis:

- VMT reduction only applies to passenger vehicles.
- VMT reductions are taken from the baseline discussed in Measure 1.
- Maximum VMT reductions are assumed to be achieved in 2050. Half of maximum reductions are achieved by 2030, except for electric bikeshare which is assumed to be implemented after 2030, and parking pricing which is assumed to be fully implemented by 2030.
- Additional micromobility statistics were sourced from the Federal Highway Administration.[43]

Measure 4. Actions to reduce GHG emissions from solid waste.

To estimate potential GHG reductions from Measure 4, a diversion rate was applied to the BAU projections for MSW tons buried in landfills. Starting from MSA current diversion rates of about 58% in 2019, the diversion rate was grown to 80% by 2050, in line with CVWMA's stated goal. This resulted in cumulative emissions reductions from the BAU of 2.29 $MMTCO_2e$ (million metric tons CO_2e) 2025–2030 and 24.64 $MMTCO_2e$ 2025–2050.

GHG Reduction Quantification Summary	Units	2019	2030	2050
Annual Measure Diversion Rate	%	58.4%	66.0%	80.0%

[42] California Air Pollution Control Officers Association. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. https://www.airquality.org/ClimateChange/Documents/Handbook%20Public%20Draft_2021-Aug.pdf
[43] U.S. Department of Transportation. National Household Travel Survey: 2017 Survey. Federal Highway Administration. n.d. https://nhts.ornl.gov/.

Total MSW Tons Created Annually	Tons	10,096,050	11,309,826	13,902,739
MSW Tons Buried After Diversion	Tons	4,203,322	3,840,476	2,780,548
Emissions Under Measure Scenario	MTCO2e	2,440,482	2,229,811	1,614,408
BAU Emissions	MTCO2e	2,440,482	2,733,884	3,360,660

Measure 5. Actions to Implement Decarbonization Strategies for Municipal Operations.

Since most localities in the MSA do not have GHG reduction goals in place for their operations, a target of reaching net zero emissions by 2050 was used to estimate the potential GHG reductions of fully implemented in the actions in Measure 5. This aligns with both the state goal of reaching economy-wide net zero emissions by 2050 (as set forth in the Virginia Clean Economy Act of 2020) and the City of Richmond's community-wide goal to achieve net zero GHG emissions by 2050. This resulted in cumulative emission reductions from the BAU of 0.42 $MMTCO_2e$ 2025–2030 and 7.29 $MMTCO_2e$ 2025–2050.

GHG Reduction Quantification Summary	Units	2019	2030	2050
GHG Reduction Goal Modeled	%	N/A	30%	100%
BAU Municipal Operation GHG Emissions	$MTCO_2e$	404,432	453,054	556,922
Measure Scenario GHG Emissions	$MTCO_2e$	404,432	317,138	0

Measure 6. Accelerate the Deployment of Energy Efficiency Solutions and Decarbonization of Residential and Commercial Buildings

This measure models GHG emission reductions achieved through building energy efficiency upgrades, replacement of fossil fuel-fired heating, hot water, and cooking equipment with heat pump and induction technologies, and reductions from achievement of increased distributed solar adoption.

Buildings Approach

Building energy use and building emission projections are based on energy consumption from electricity, natural gas, fuel oil, and propane in existing residential (single-family, multifamily, and mobile homes) and commercial buildings (office, food service, school, hotel, healthcare, retail, and warehouse). The base year and projections for energy consumption in existing buildings are built from the 2022 AEO, which represent projected energy user prior to the passage of the Inflation Reduction Act.[44] AEO data were scaled to the Richmond MSA counties by scaling AEO census level data with the ResStock and ComStock building models of North American building stock with county-level resolution.[45,46]

ICF's CO_2Sight™ platform and Distributed Energy Resources Planner (DER Planner) model were used to quantify the change in energy consumption from existing buildings under an accelerated electrification scenarios for heating, ventilation, and air conditioning (HVAC) as well as Water Heating and Cooking, and a High scenario for building envelope implementation. DER Planner is a bottom-up model that is built upon the best practice principles for potential

[44] "Annual Energy Outlook 2023 - U.S. Energy Information Administration (EIA)." March 16, 2023. https://www.eia.gov/outlooks/aeo/index.php.
[45] "ResStock Analysis Tool." n.d. Accessed February 19, 2024. https://www.nrel.gov/buildings/resstock.html.
[46] "ResStock Analysis Tool." n.d. Accessed February 19, 2024. https://www.nrel.gov/buildings/resstock.html.

modeling outlined by the National Action Plan for Energy Efficiency (NAPEE) in their Guide for Conducting Energy Efficiency Potential Studies.[47] DER Planner, informed by stock CO_2Sight measures data, has the capabilities to model various energy efficiency, electrification, and building envelope measures in selected building types. The model uses key inputs such as equipment stock, participation rate curves, and energy change per measure and estimates potential savings from applying efficient measures available for each building type and end-use. Given the efficient technologies available, this quantifies how much energy could be reduced. To compute total savings potential, the model runs all permutations combining savings per measure unit, expected measure penetration, and total number of measure units (or total eligible stock) by all adoption types (replace on burnout (ROB) and retrofit (RET)).[48]

Building characteristics and energy use data for modeling buildings under the selected scenario were derived from ResStock and ComStock datasets provided by the National Renewable Energy Laboratory (NREL). These datasets integrate large public and private data sources statistical sampling, detailed sub-hourly building simulations, and high-performance computing. By synthesizing multiple sources into a single resource, these data allow for a granular understanding of the housing and commercial stock and the impacts of building technologies in different communities and businesses. The ResStock and ComStock energy use data are calibrated to match the AEO dataset.

As an input into DER Planner, each measure has participation (or technology adoption curves) connected to them. A range of factors can impact whether new efficiency technologies are adopted. This approach builds from NREL's Electrification Future Study, from which many of the adoption curves are provided, and through the adoption curves accounts for changes in costs, supporting infrastructure, ownership and availability, health and sustainability (including policies) and other factors that could influence technology adoption.[49] Adoption curves are also provided from the implementation energy efficiency programs and informed by expert judgement. For ease of use, users can select prepopulated groupings of participation curves to match the types of energy change they want to model.

Key Assumptions

- Modeled high scenario for Building Envelope measures meaning high building envelope work and deep energy retrofits
- Modeling accelerated electrification scenarios for HVAC measures and Water Heating and Cooking measures meaning a large amount of electrification will occur
- BAU emissions factors (2019 eGRID held flat)
- Measure emissions factors (2019 eGRID changed based on 2023 AEO Reference Case)

Data Sources

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[47] U.S EPA. "Guide for Conducting Energy Efficiency Potential Studies."2007. https://doi.org/10.2172/1219674.
[48] Measures' adoption type definitions: ROB or "replace on burnout" implies that the technology will be adopted when the previous technology needs to be replaced. RET or "retrofit" implies that the technology is adopted before the previous technology needs to be replaced.
[49] "Electrification Futures Study: A Technical Evaluation of the Impacts of an Electrified U.S. Energy System." n.d. Accessed February 19, 2024. https://www.nrel.gov/analysis/electrification-futures.html.

- ComStock and ResStock data sets
- EPA's ENERGYSTAR Equipment performance thresholds
- Various state's Technical Reference Manual
- NREL's Electrification Future Study
- DOE's equipment purchasing profiles
- PNNL's Building Retuning materials
- EPA's GHG Emission Factors Hub
- Electric Grid Emission Factor Projections, AEO 2023
- EPA eGRID, 2019

Distributed Solar Approach

Emissions reductions from renewable energy were projected through the forecasted adoption of rooftop solar systems in the MSA. The total technical potential for rooftop solar was aggregated from Project Sunroof's estimates of the technical potential in each of the counties and cities in the MSA.[50] To determine an adoption rate, the most aggressive 2050 adoption scenario from NREL's Storage Futures Study (20%) was applied to the total technical potential.[51] For the MSA territory in Virginia, existing rooftop solar capacity assumptions were sourced from PJM's 2023 Load Forecast for the DOM zone and then grown to meet the assumed 2050 level.[52]

To calculate the kWh of solar output, the analysis used the capacity factor for residential solar from NREL's annual technology baseline corresponding to the geography of the MSA. The incremental growth in solar output from current levels, multiplied by grid emissions factors, resulted in the potential avoided emissions from rooftop solar.

Key Assumptions

- Constant technical potential per building over time
- Constant ratio of commercial to residential rooftop solar capacity
- No incremental rooftop PV installation beyond existing in BAU case
- Linear growth of PV installations between 2023 and 2050 in PCAP Policy Case
- BAU emissions factors (2019 eGRID held flat)
- PCAP Policy emission factors (2019 eGRID grown based on 2023 AEO Reference Case)

Data Sources

- Storage Futures Study: Distributed Solar and Storage Outlook: Methodology and Scenarios (2021), NREL
- 2023 Load Forecast, PJM (2023)
- Project Sunroof data explorer, (June 2019), Google
- Annual Technology Baseline, Residential PV (2023), NREL
- Electric Grid Emission Factor Projections, AEO 2023 Reference Case
- EPA eGRID, 2019

[50] Google. "Project Sunroof". Accessed Feb 13, 2024. https://sunroof.withgoogle.com/
[51] NREL. "Storage Futures Study." https://www.nrel.gov/analysis/storage-futures.html
[52] https://www.pjm.com/-/media/library/reports-notices/load-forecast/2023-load-report.ashx

Measure 7. Reduce emissions from port operations through the adoption of low-carbon fuels, electric equipment, and operational changes.

The GHG reduction calculations represented for ports target specific potential projects at select port facilities and locations. These include a set number of equipment and system upgrades and replacements for forklifts, vans, cruisers, shuttles, pickups, buses, and battery systems. As a state entity, the VPA will be implementing projects for its facilities across the state, not just for its facilities and operations within the boundary of the Richmond MSA. As such, both the Hampton Roads MSA and Virginia State PCAPs measures related to ports are complementary to this measure.

The project list for the Richmond port operations includes electrifying the following vehicles/equipment:

- 10 utility tractor rigs (UTRs)
- 6 top pick container handlers
- 9 pick-up trucks
- 1 specialty vehicle
- 2 mobile harbor cranes
- 5 light-duty, 2 medium-duty, and 1 heavy-duty forklift
- 5 Level 2, 28 Level 3, and 3 Level 4 EV charging stations
- 1 medium-sized battery storage system

To estimate the potential GHG emission reductions from **vehicle electrification**, EPA's GHG equivalency formula was used for passenger vehicles as well as port-wide average fleet fuel consumption to estimate annual CO_2e based on the amount of gasoline consumed. The EPA's GHG equivalency formula for passenger vehicles (using averages for VMT and MPG) based on CO_2e per gallon of gasoline shows:

8.89 × 10-3 metric tons CO_2/gallon gasoline × 10,746 VMT car/truck average × 1/22.9 miles per gallon car/truck average × 1 CO_2, CH_4, and N_2O/0.993 CO_2 = 4.20 metric tons CO_2e/vehicle /year

The Port's calculation utilized their fleet wide per vehicle fuel consumption average in place of the VMT*MPG numbers that the EPA's formula utilizes to generate average fuel consumption nationwide for passenger vehicles.

To estimate the potential GHG emission reductions from the **battery storage** system, the usage of the battery was estimated in terms of annual avoided grid electricity consumption. The emissions from that avoided electricity use were calculated using an emissions factor projection created using eGRID data and information on the local utility, Dominion Energy. The EPA eGRID region SRVC was used for a starting grid emissions factor. Dominion's Integrated Resource Plan and grid decarbonization target from the Virginia Clean Economy Act were then used to create an emissions factor projection for the region.

To estimate the potential GHG emission reductions from the **electrification of port equipment**, EPA's Diesel Emissions Quantifier tool was used to calculate CO_2 and NO_x, which were used to

calculate CO_2e.[53] Assumed all equipment would be free of tailpipe emissions in 2040 according to the Port's net-zero goal of 2040. Fuel usage/usage hours as well as engine years and other inputs came from internal fleet data for Richmond and knowledge of normal use.

[53] https://cfpub.epa.gov/quantifier/index.cfm?action=user.account

PRIORITY CLIMATE ACTION PLAN

For the Virginia Beach-Norfolk-Newport News, VA-NC Metropolitan Statistical Area

March 1, 2024

Prepared by the Hampton Roads Planning District Commission to meet the requirements of the U.S. Environmental Protection Agency's (EPA) Climate Pollution Reduction Grant (CPRG) program.

Disclaimer & Acknowledgements

The Hampton Roads Planning District Commission (HRPDC) developed this Priority Climate Action Plan (PCAP) to meet the requirements of the U.S. Environmental Protection Agency's (EPA) Climate Pollution Reduction Grant (CPRG) program. The CPRG program provides funding to states, local governments, tribes, and territories to develop and implement plans for reducing greenhouse gas emissions and other harmful air pollution.

This PCAP was developed by staff from the HRPDC and its contractor ICF with support and input from:

- Localities and communities across the Virginia Beach-Norfolk-Newport News, VA-NC Metropolitan Statistical Area (MSA)
- Virginia Port Authority (VPA)
- Hampton Roads Sanitation District (HRSD)
- Southeastern Public Service Authority (SPSA)
- Virginia Department of Environmental Quality (DEQ)

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CPRG Steering Committee

- Olivia Askew, City of Hampton
- Brian Ballard, NAVFAC Mid-Atlantic
- Thomas Ballou, Virginia DEQ
- Nicole Benson, City of Chesapeake
- Tammie Clary, Town of Smithfield
- Michele DeWitt, City of Williamsburg
- Michael Ervin, Albemarle Commission
- Julia Gales, City of Newport News
- Megan Hale, City of Norfolk
- Alleyn Harned, Virginia Clean Cities
- Vince Maiden, Virginia State Energy Office
- Brett Malone, Virginia Tech Corporate Research Center
- Julie Manzari, Dominion Energy
- Tyla Matteson, York River Group Sierra Club
- Kevin Parker, HRSD

- Jennifer Privette, City of Newport News
- Brian Smith, Hampton Roads Transit
- Matt Smith, Hampton Roads Alliance
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- Mark Podolinsky, City of Virginia Beach
- Jennifer Privette, City of Newport News
- Amy Ring, Isle of Wight County
- Jo Anna Ripley, James City County
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- Scott Smith, City of Hampton
- Carol Steele, Gloucester County

HRPDC also expresses its sincere gratitude to its Community Advisory Committee and the multiple other stakeholders across the Hampton Roads MSA that contributed to this process.

CONTENTS

Abbreviations

Abbreviation	Full Name
ACCII	Advanced Clean Cars II
ACEEE	American Council for an Energy Efficient Economy
ACF	Advanced Clean Fleets
AEO	Annual Energy Outlook
AFV	Alternate fuel vehicles
BAU	Business-as-Usual
BEV	Battery electric vehicles
BIPOC	Black, Indigenous, and People of Color
BMP	Best management practices
CAC	Community Advisory Committee
CCAP	Comprehensive Climate Action Plan
CEJST	Climate & Economic Justice Screening Tool

Abbreviation	Full Name
CMAQ	Congestion Mitigation and Air Quality
COMET	Carbon Management & Emissions tool
CPRG	Climate Pollution Reduction Grant
DEQ	Department of Environmental Quality
DER	Distributed Energy Resources
DERA	Diesel Emissions Reduction Act
DHCD	Department of Housing and Community Development
DOT	Department of Transportation
ECH	Empty container handlers
EE	Energy efficiency
EIA	Energy Information Administration
EJ	Environmental justice
EPA	Environmental Protection Agency
ERP	Elizabeth River Project
ESL	English as a Second Language
EV	Electric vehicle
EVSE	Electric vehicle supply equipment
FCEV	Fuel cell electric vehicles
FEMA	Federal Emergency Management Agency
FLIGHT	Facility-Level Information on Greenhouse gases Tool
GHG	Greenhouse gas
GRP	Gross Regional Product
GWP	Global warming potential
HAP	Hazardous air pollutants
HFC	Hydrofluorocarbon
HIEE	Housing Innovations in Energy Efficiency
HRPDC	Hampton Roads Planning District Commission
HRSD	Hampton Roads Sanitation District
HRT	Hampton Roads Transit
HRTPO	Hampton Roads Transportation Planning Organization
HUD	Housing and Urban Development
HVAC	Heating, ventilation, and air-conditioning

Abbreviation	Full Name
ICEV	Internal combustion engine vehicle
IIJA	Infrastructure Investment and Jobs Act
ILA	International Longshoremen Association
IRA	Inflation Reduction Act
IRS	Internal Revenue Service
LDV	Light Duty Vehicles
LIDAC	Low-income, disadvantaged communities
LMOP	Landfill Methane Outreach Program
LULUCF	Land Use, Land-Use Change and Forestry
MHDV	Medium- and Heavy-Duty Vehicle
MOU	Memorandum of Understanding
MSA	Metropolitan Statistical Area
MSW	Municipal solid waste
NAACP	National Association for the Advancement of Colored People
NEVI	National Electric Vehicle Infrastructure
NIT	Norfolk International Terminals
NOAA	National Oceanic and Atmospheric Administration
NREL	National Renewable Energy Laboratory
NSU	Norfolk State University
OSBM	Office of State Budget and Management
PACE	Property assessed clean energy
PCAP	Priority Climate Action Plan
POV	Port of Virginia
PPA	Power Purchase Agreements
PPCY	Pinners Point Container Yard
PRM	Primary Recyclable Materials
PV	Photovoltaic
RAISE	Rebuilding American Infrastructure with Sustainability and Equity
RET	Retrofit
RFP	Request for Proposal
ROB	Replace on burnout
RSWMP	Regional Solid Waste Management Plan

Abbreviation	Full Name
SCC	State Corporation Commission
SIT	State Inventory Tool
SPSA	Southeastern Public Service Authority
UTR	Utility tractor rigs
VaNLA	Virginia Natural Landscape Assessment
VCEA	Virginia Clean Economy Act
VDOT	Virginia Department of Transportation
VIG	Virginia International Gateway
VMT	Vehicle miles traveled
VOC	Volatile organic compounds
VPA	Virginia Port Authority
VPPSA	Virginia Peninsulas Public Service Authority
VPSA	Virginia Peninsulas Public Service Authority
WARM	Waste Reduction Model
ZEV	Zero emissions vehicle

1. Executive Summary

This document is the PCAP for the Virginia Beach-Norfolk-Newport News, VA-NC Metropolitan Statistical Area (Hampton Roads MSA) and is the first deliverable for the MSA under the EPA CPRG program.

The HRPDC has a strong interest in improving resiliency to flooding and sea level rise and in promoting cleaner air and water for its residents. Therefore, HRPDC submitted an application, workplan, and budget to the U.S. EPA for a CPRG planning grant under the Inflation Reduction Act (IRA). The planning grant was used to develop a Hampton Roads MSA-wide PCAP and will be used to develop a Comprehensive Climate Action Plan (CCAP) and a subsequent Status Report.

The PCAP: The PCAP identifies immediately impactful, cost-effective actions and projects that target priority greenhouse gas (GHG) emissions source sectors and can be implemented to reduce GHG and co-pollutant emissions in the near-term. This plan includes a simplified GHG inventory developed using downscaled state-level data and publicly available datasets such as in the EPA MOVES tool. Descriptions and analysis of priority GHG reduction measures included in the plan were identified through stakeholder input. Under the conditions of the CPRG planning grant, the PCAP has been developed and submitted to the EPA by the deadline of March 1, 2024. The following seven priority GHG reduction measures were identified as part of this PCAP:

- **Measure 1:** Create programs to support and incentivize a transition to clean energy, including onsite renewable energy, energy storage system deployment, and fuel switching.
- **Measure 2:** Reduce energy consumption and increase building decarbonization through programs to support, incentivize, and install energy efficiency and electrification measures.
- **Measure 3:** Develop an electric vehicle (EV) procurement plan and electric vehicle supply equipment (EVSE) deployment strategy to support the adoption of EVs.
- **Measure 4:** Reduce vehicle miles traveled and support alternative modes of transportation through bike/pedestrian infrastructure investments.
- **Measure 5:** Reduce emissions from port operations through the adoption of low-carbon fuels, electric equipment, and operational changes.
- **Measure 6:** Reduce GHG emissions through improved equipment efficiencies, increased methane capture at waste and wastewater facilities, and organic waste diversion.
- **Measure 7:** Increase opportunities for carbon sequestration through tree planting, protecting, and restoring high-carbon coastal habitats, wetlands, and forest lands.

The CCAP: The CCAP is a longer-term plan that identifies strategies to reduce GHG and co-pollutant emissions that aligns with statutory goals and requirements for reducing these emissions in an efficient and environmentally responsible manner. This plan will cover all source sectors in an MSA-wide GHG inventory and will provide substantial outreach and input opportunities, with a specific intention to engage with traditionally disadvantaged communities. The CCAP will be developed and submitted to the EPA no later than two years after the award of the planning grant (summer-fall 2025).

The Status Report: The Status Report is a document that will be developed by HRPDC to report on CCAP progress. The Status Report will be delivered in 2027 and will include:

- The implementation status of the quantified GHG reduction measures from the CCAP.
- Relevant updated analyses or projections supporting CCAP implementation.
- Next steps and future budget or staffing needs to continue CCAP implementation.

The main goal of the Status Report is to provide updates on the CCAP's progress and access future needs of the project. The report will highlight successes and challenges throughout the project and act as a checkpoint for HRPDC.

2. Introduction

The IRA, signed into law on August 16, 2022, directs federal funding to reduce carbon emissions, lower healthcare costs, fund the Internal Revenue Service (IRS), and improve taxpayer compliance. The IRA contains eight titles, each with some provisions that directly or indirectly address issues related to climate change, including reduction of U.S. GHG emissions and promotion of activities for adaptation and increasing resilience to climate change impacts.[1] The IRA provides billions of dollars in grant and loan programs for a range of clean energy and climate action programs.

The CPRG program, authorized under Section 60114 of IRA, provides $5 billion in grants to states, local governments, tribes, and territories to develop and implement ambitious plans for reducing GHG emissions and other harmful air pollution. The program consists of two phases: planning and implementation. The planning phase provides $250 million in noncompetitive planning grants for state and local agencies to develop PCAPs to identify emissions reduction measures. The implementation phase provides $4.6 billion of competitive grant funding for eligible applicants to implement GHG reduction measures identified in an applicable PCAP developed under a CPRG planning grant.

Definitions for Common Terms

- **Greenhouse Gas (GHG) Emissions:** Per EPA's CPRG planning guidance, GHGs are limited to the air pollutants carbon dioxide (CO_2), hydrofluorocarbons (HFCs), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).
- **GHG Reduction Measure:** Per EPA's CPRG guidance, implementable actions that reduce GHG emissions or enhance carbon removal. Measures that enhance "carbon removal" are those that increase the removal of carbon dioxide from the atmosphere through, for example, the uptake of carbon and storage in soils, vegetation, and forests. Such measures may include actions related to management of lands in their current use, or as lands are converted to other uses.
- **Benefits (air quality):** Improvements in air quality (e.g., criteria air pollution and air toxics) due to a GHG reduction measure.
- **Co-Benefits:** Positive effects beyond the stated goal of a GHG reduction measure (e.g., improved public health outcomes, economic benefits, increased climate resilience).
- **Low Income Disadvantaged Communities (LIDACs):** Historically marginalized communities that have fewer socioeconomic resources and less capacity to adapt to climate change. These communities face disproportionately high economic, social, and health disadvantages that are often associated with environmental racism and systemic oppression.

[1] CRS. 2022. *Inflation Reduction Act of 2022 (IRA): Provisions Related to Climate Change*. https://crsreports.congress.gov/product/pdf/R/R47262.

The HRPDC is the designated lead organization for the Virginia Beach-Norfolk-Newport News, VA-NC Metropolitan Area's (MSA's) participation in the CPRG planning phase and led the development of this PCAP. HRPDC coordinated closely with the lead organization for the Virginia state-level CPRG planning grant, Virginia DEQ, to align priorities and engage with stakeholders.

HRPDC conducted region-wide stakeholder outreach as part of this PCAP development, including soliciting project ideas from localities, hosting a special meeting of its Community Advisory Committee, and disseminating a survey for locality staff, community-based organization representatives, and committee members. These engagement efforts helped to identify priority sectors and GHG reduction actions, and they informed HRPDC's understanding of the benefits and impacts most important to its regional community. Additionally, these engagement efforts served as a basis to establish further and more meaningful engagement with the public, with attention to low-income, disadvantaged communities (LIDACs) that will take place during development of the CCAP. These stakeholder outreach and engagement efforts are detailed in Section 2.

Purpose and Scope of the PCAP

The PCAP seeks to identify innovative and high impact projects to reduce GHG and other air pollutant emissions in the near-term in Hampton Roads. By identifying regional priorities for climate action efforts, the PCAP sets the stage for its first CCAP effort which will be initiated in Spring 2024. Per HRPDC's approved workplan, the geographic scope of this PCAP is the Hampton Roads MSA (the Virginia Beach-Norfolk-Newport News, VA-NC Metropolitan Area), along with Southampton County and the City of Franklin, which is shown in Figure 1.

Figure 1: HRPDC-covered jurisdictions that are within and outside of the Hampton Roads MSA

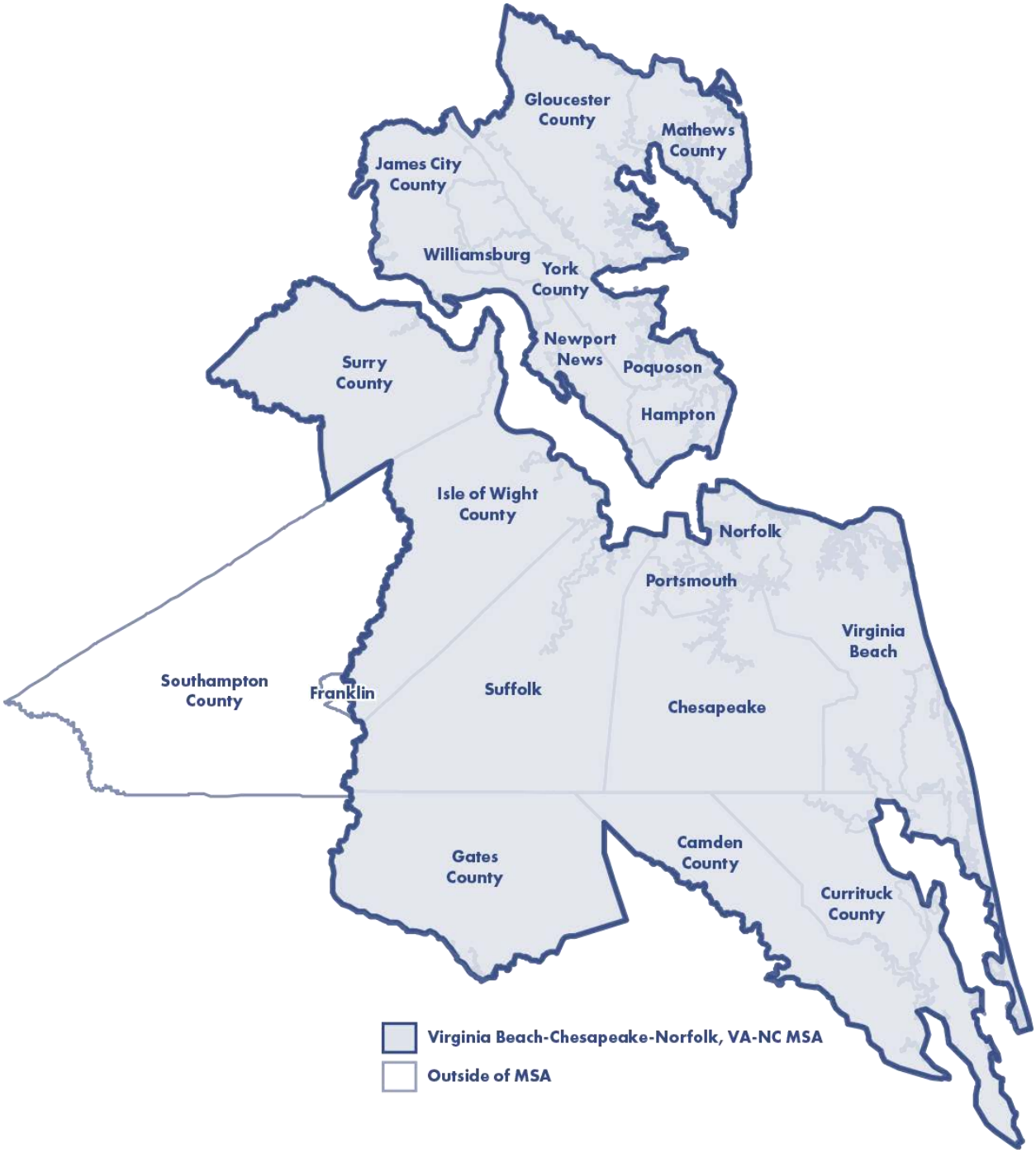


Table 1 summarizes the information included in this PCAP, in line with EPA CPRG planning guidance.

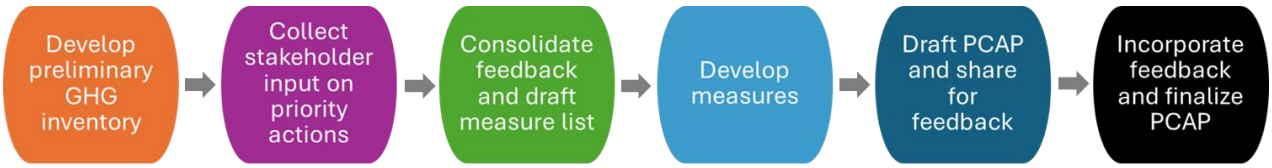
Table 1: Overview of HRPDC's PCAP

PCAP Required Element	PCAP Section
GHG Inventory	Section 4
Priority Quantified GHG Reduction Measures	Section 5
Benefits Analysis	Section 5
Review of Authority to Implement	Measure-specific information in Section 5
Low Income Disadvantaged Communities Benefits Analysis	Sections 3 (engagement with LIDACs), 4 (identification of LIDACs & discussion of climate risks to LIDACs) and 5 (LIDAC benefits for each measure)
GHG Emissions Projections	Some projections were included in reduction quantification (Appendix B). Refined projections to be included in the CCAP
GHG Reduction Targets	Not included, to be included in the CCAP
Workforce Planning Analysis	Not included, to be developed further in the CCAP process
Intersection with Other Funding	Section 4 and measure-specific information in Section 5

Approach to PCAP Development

HRPDC used a multi-step process to set priorities and develop information for the priority measures identified in this PCAP, as outlined in Figure 2.

Figure 2: Process for developing the Hampton Roads MSA's PCAP



Step 1. HRPDC developed a simplified GHG inventory, based on downscaled state inventory data and on-road transportation data from the EPA MOVES4 model, to determine key sectors and sources for immediate emission reduction measures. HRPDC chose this approach because, while some localities within the MSA have GHG inventory and locally based data, access to this type of data was inconsistently available across the MSA. This is the first GHG inventory developed for the MSA region and will be expanded upon for the CCAP.

Step 2. HRPDC sought input from local governments within the MSA planning region, regional MSA organizations, Virginia DEQ, and other stakeholders. This input was collected via group meetings and discussions, one-on-one meetings, a LIDAC survey, and email communications. Within this step, HRPDC sought priority project and action ideas to reduce GHG emissions in the MSA.

Step 3. HRPDC compiled and reviewed the ideas gathered from stakeholders in Step 2 and grouped them by relevant GHG inventory sector. HRPDC identified themes among the ideas and reviewed them to ensure relevance to the CPRG program goals. HRPDC then grouped similar ideas to form the broader priority GHG reduction measures that are presented in this PCAP.

Step 4. After developing a consolidated list of measures and sharing with stakeholders for review, HRPDC worked internally and with local governments and other stakeholders to develop the required information for each priority GHG reduction measure. In parallel, HRPDC analyzed data and collected other non-measure-specific information to support this PCAP, such as using EPA's EJ Screen and the Climate & Economic Justice Screening Tool (CEJST) to identify LIDACs in the MSA and better understand their demographics and risks.

Step 5. HRPDC prepared this PCAP using the gathered and developed information and shared the draft PCAP for feedback with stakeholder committees.

Step 6. HRPDC reviewed the feedback and comments and incorporated edits to finalize the PCAP.

Limitations of this PCAP

As the CPRG program represents the first regional climate planning effort for the Hampton Roads MSA, there was limited existing climate data available for incorporation in this plan. The condensed PCAP timing also did not allow for the full extent of outreach, engagement, and analysis typical of HRPDC's planning efforts. As a result, this PCAP required drawing heavily on existing work, publicly available regional and statewide datasets, and streamlined engagement approaches. More detailed and robust engagement and data collection will be conducted as a part of the CCAP development.

3. Stakeholder Engagement

As the lead organization for the Virginia Beach-Norfolk-Newport News, VA-NC MSA, HRPDC recognizes the importance of engaging with many entities in the PCAP and CCAP processes. To support engagement efforts, two key stakeholder committees were created to guide the CPRG process: a Steering Committee and a Technical Advisory Committee.

Government, Stakeholder, and Public Engagement

Steering Committee: Members of the Steering Committee include local representation of Hampton Roads localities to provide local context and advise on measures and strategies to be incorporated in the PCAP. The committee will continue to be involved through the CCAP process.

Technical Advisory Committee: The participants in the Technical Advisory Committee include industry experts and local and regional planning professionals in land use, transportation, climate, and energy. Members provide local context and advise on measures and strategies to be incorporated in the PCAP. The committee will continue to be involved through the CCAP process.

The Hampton Roads Community Advisory Committee (CAC) was also engaged. The CAC includes 30 representatives from Hampton Roads' member jurisdictions and services who act as an advisory committee to the HRPDC and the Hampton Roads Transportation Planning Organization (HRTPO)

boards. The CAC ensures that the voices and perspectives of the public are received and considered in planning processes.

Media coverage to the general public will be included throughout the CCAP process. Coverage by local news station WHRO has begun. The HRPDC will continue to invite reporters to committee meetings and share social media posts. Appendix A includes an article from October 4, 2023 announcing HRPDC's climate planning effort: "*State and local officials are making new climate action plans to slash emissions"* written by Katherine Hafner.

Additional engagement with state agencies, other Virginia MSAs, and stakeholders was also done to support the PCAP. Table 2 shows a record of all stakeholder meetings that occurred as part of the PCAP process.

Table 2: PCAP Stakeholder Meetings

Date	Meeting Description	Type of Entity Engaged
June 1, 2023	HRPDC Regional Environmental Committee	Stakeholder
September 20, 2023	Presentation to the Sierra Club	Stakeholder
September 25, 2023	Virginia state/MSA coordination (DEQ, MWCOG, PlanRVA, HRPDC)	State & other MSAs
August 21, 2023	Virginia state/MSA coordination (DEQ, MWCOG, PlanRVA, HRPDC)	State & other MSAs
October 18, 2023	One-on-one stakeholder meeting (HRSD)	Stakeholder
October 23, 2023	Virginia state/MSA coordination (DEQ, MWCOG, PlanRVA, HRPDC)	State & other MSAs
November 1, 2023	Chief Administrative Officers committee of HRPDC	Stakeholder
November 27, 2023	Virginia state/MSA coordination (DEQ, MWCOG, PlanRVA, HRPDC)	State & other MSAs
November 28, 2023	State of Transit Meeting	Stakeholder
November 29, 2023	CPRG Technical Committee	Committee
December 2023	Email communication with Virgina Department of Energy on potential weatherization measures	Stakeholder
December 2023	Email communication with SPSA on potential waste measures	Stakeholder
December 1, 2023	CPRG Steering Committee	Committee
December 11, 2023	One-on-one stakeholder meeting (Department of Housing & Community Development [DCHD])	Stakeholder
December 12, 2023	One-on-one stakeholder meeting (Dominion)	Stakeholder
December 18, 2023	CPRG Steering Committee	Committee
December 19, 2023	One-on-one stakeholder meeting (Virginia Energy Efficiency Council)	Stakeholder
December 20, 2023	CPRG Technical Committee	Committee
December 20, 2023	One-on-one stakeholder meeting (Project HOMES)	Stakeholder
December 28, 2023	One-on-one stakeholder meeting (VA Tech Center)	Stakeholder

January 3, 2024	CPRG Technical Committee	Committee
January 4, 2024	CPRG Steering Committee	Committee
January 4, 2024	One-on-one stakeholder meeting (Port of VA)	Stakeholder
January 11, 2024	CAC	Community
January 17, 2024	CPRG Technical Committee	Committee
January 19, 2024	CPRG Steering Committee	Committee
February 6, 2024	CPRG Joint Steering & Technical Committee	Committee
February 21, 2024	CPRG Technical Committee	Committee
February 22, 2024	CPRG Steering Committee	Committee

LIDAC Engagement

Community engagement is key to ensuring that all community members can benefit from GHG reduction measures, especially in LIDACs that have limited infrastructure to support communication or have faced historic disinvestment and underrepresentation.

The Hampton Roads MSA partners identified stakeholder groups to engage across all measures. During the PCAP process, HRPDC conducted engagement to help identify key LIDAC stakeholders and points of contact and began building more robust engagement channels for climate action work. Stakeholder mapping efforts were conducted in January and February of 2024, as part of a CAC meeting and via a survey that was sent to CPRG committee members (Steering, Technical, and Community Advisory).

From the LIDAC survey, over a three-week period, 22 responses were received from organizations throughout the MSA. The questionnaire report, including all comments, is included in Appendix A Community Engagement Information.

Six focus areas were included in the survey: Transportation and Mobility, Community Resilience, Buildings and Infrastructure, Energy (electricity generation), Waste, Recycling and Composting, and Agriculture, Natural, and Working Lands. The focus area of Transportation and Mobility was ranked as highest importance followed by Community Resilience, then Buildings and Infrastructure. Within these focus areas, climate change resiliency, reducing energy consumption, and climate change impact on LIDAC communities are top areas of concern. Overall, the participants emphasized the importance of engaging members of LIDACs in meaningful ways, ensuring that input is included in the CCAP, and communicating how the plans will positively impact their neighborhoods. Comment themes included:

- Prioritize expanding clean transportation modes and EV infrastructure
- Increase funding for weatherization, retrofits, and solar installations in LIDACs
- Increase public education and create broader public awareness
- Apply efficient electrification in LIDAC residential areas as well as public buildings
- Tree canopy restoration

Questionnaire respondents identified community groups that they are in communication with and will help HRPDC engage more extensively during the CCAP process. These groups range from

neighborhood organizations and advocacy groups to municipal departments and local chapters of regional or national organizations. A preliminary list includes:

- American Council for Energy Efficient Economy
- Bon Secours Hospital
- Butterfly Village
- Chesterfield Heights Civic League
- Craddock community in Portsmouth
- Deep South Center for Environmental Justice
- Eastern Branch community in Norfolk
- Eastern Virginia Medical School
- Elizabeth River Project
- Emory University Hercules Research Project
- Environmental Defense Fund
- ForKids
- Friends of Indian River
- Georgia Institute of Technology
- Healthy Portsmouth
- Hampton Roads ECO District
- Hampton City Neighborhood Services Department
- Hampton Roads Community Action Program
- Ingleside Civic League
- Interfaith Power and Light
- James City County Neighborhood Development
- Justice40 Accelerator
- Justice40 Network Hub
- Lambert's Point in Norfolk
- National Association for the Advancement of Colored People (NAACP)
- National Environmental Justice Institute
- Norfolk Diversity Equity and Inclusion, Housing and Community Development, and Neighborhood Services Departments
- Norfolk State University
- Old Dominion University: Institute for Coastal Adaptation and Resilience (CAR)
- Park Place in Norfolk
- People's Solar Power Initiative
- Portsmouth Office of Social Services
- Portsmouth Health Department
- Sierra Club – Chesapeake Bay
- Sierra Club – York River
- Sierra Club – Virginia Chapter
- Solar United Neighbors
- Southern Alliance for Clean Energy
- Southern Environmental Law Center
- University of Maryland Climate and Environmental Justice Initiative
- University of Virginia
- United Civic League of Cavalier Manor
- U.S. Department of Energy National Renewable Energy Laboratory
- Virginia Organizing
- Virginia Environmental Justice Collaborative
- Virginia Beach City Council, School Board and General Assembly

- Virginia Beach Tea Party
- Virginia Wesleyan University

Future CCAP Engagement

During PCAP development, HRPDC strived for inclusivity and building relationships with sister agencies, localities throughout the MSA, industry partners, and community groups representing LIDACs. HRPDC will continue to broadly engage the public during the development of the CCAP, with a focus on addressing environmental justice concerns and supporting historically underrepresented and overburdened communities. HRPDC will use the responses of the LIDAC survey distributed to the technical and steering committees and the CAC to inform the CCAP Community Engagement Plan and will continue to seek input from a diverse audience.

Furthering the initial engagement performed for the PCAP, development of the CCAP will provide an opportunity for active community engagement that solicits input and feedback on proposed programs, projects, and measures. Goals for CCAP community engagement are:

1. Collaborate with key stakeholders throughout Hampton Roads to inform the plan with priority projects and programs for implementation funding eligibility.
2. Meaningfully engage LIDAC members in the CCAP development.
3. Inform and create awareness of the CCAP process with the public throughout Hampton Roads.

4. Climate Work and Context for Hampton Roads

Simplified GHG Inventory

Prior to this effort, the Hampton Roads MSA did not have a GHG inventory at the MSA level. A simplified GHG inventory was developed, focusing on the key sectors of Energy (Residential & Commercial), Transportation (including ports), Waste, and Sequestration. The simplified inventory covers all the priority GHG reduction measures and was prepared using the following data and resources:

- EPA's Landfill Methane Outreach Program (LMOP) Landfill and Project Database
- EPA's Facility-Level GHG Emissions Data
- U.S. Census Bureau Population Data
- Virginia State Inventory Tool (SIT) GHG Inventory
- North Carolina SIT GHG Inventory
- Port of Virginia GHG Inventory
- HRSD Landfill Data

Key sectors covered by the simplified inventory include Energy, Transportation Waste & Wastewater, and Land Use, Land-Use Change and Forestry (LULUCF).

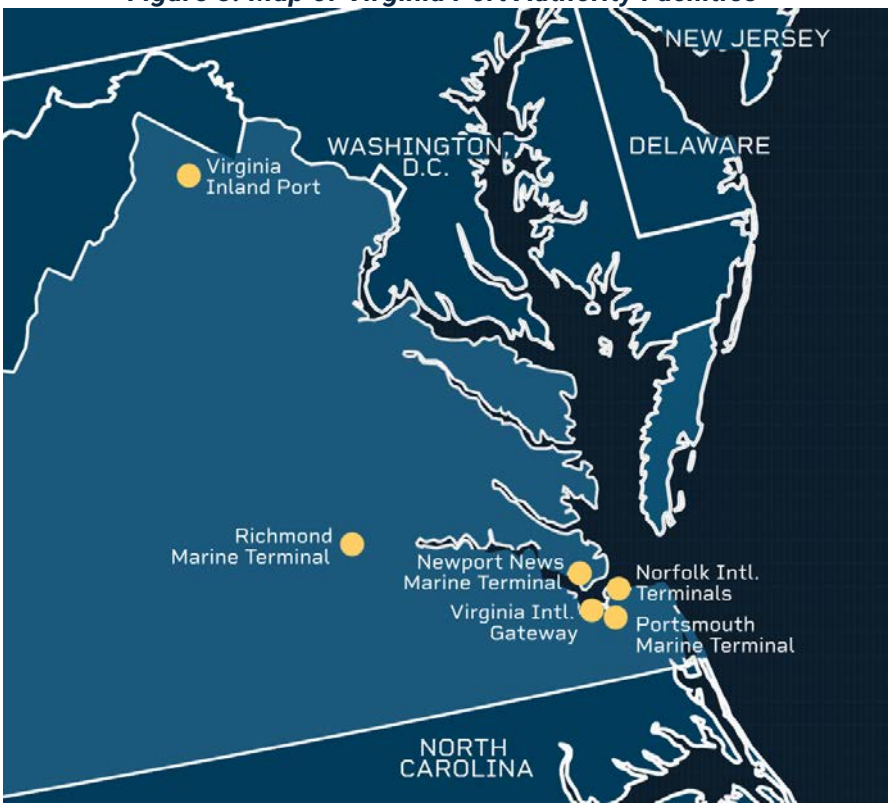
Energy

The energy sector consists of emissions from electricity generation proportional to consumption, fossil fuel combustion, and stationary energy combustion used to power buildings, including all sectors (i.e., residential, commercial, and industrial). Public buildings are included within these sectors depending on their use.

Transportation

The transportation sector consists of both on-road and offroad mobile source emissions and electricity consumption from transportation sources. The Hampton Roads MSA is also home to a major seaport, which has numerous facilities (Figure 3).

Figure 3: Map of Virginia Port Authority Facilities



Waste & Wastewater

This sector covers emissions both from solid waste facilities such as landfills and waste combustion along with governmental and industrial wastewater facilities.

Land Use, Land-Use Change and Forestry

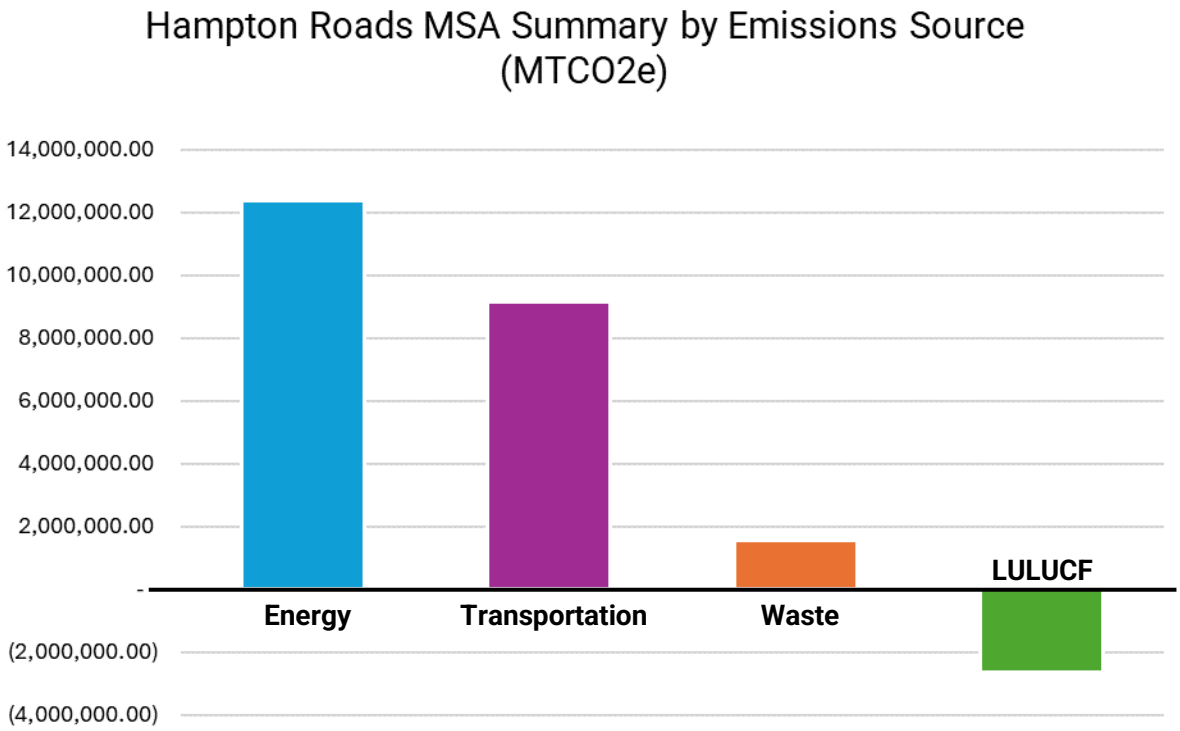
LULUCF represents the net carbon flux from vegetation and other land use. Sequestration of carbon from these sources offset emissions from other sectors, reducing net emissions in the MSA each year.

Table 3 and Figure 4 show the results of the simplified GHG inventory for the Hampton Roads MSA across all sectors analyzed.

Table 3: Simplified GHG Inventory Results from the Hampton Roads MSA

TOTAL EMISSIONS BY SOURCE ($MTCO_2e$)	2019
Total Energy	**12,359,426**
Residential	4,259,861
Commercial	4,661,097
Industrial	3,438,468
Total Transportation	**9,135,675**
Heavy-Duty Vehicles (HDV)	2,187,109
Light Duty Vehicles (LDV)	5,698,517
Motorcycles	37,166
Buses	137,455
Ports	1,075,428
Total Waste	**1,549,624**
Landfill Emissions	1,165,388
Waste Combustion	211,155
Wastewater Emissions	173,081
Total LULUCF	**(2,660,299)**
Urban Trees	(743,539)
Forest Lands: Forest Fires	4,581
Settlement Soils	4,917
Agricultural Soils	274,915
Landfilled Scraps	(62,934)
Forest Land Remaining Forest Land	(1,947,891)
Land Converted to Forest Land	(190,348)
Total Emissions	**20,384,426**

Figure 4: Simplified GHG Inventory Results by Sector



Appendix B discusses the methodology both for the development of the simplified GHG inventory and for estimated GHG reductions for the proposed priority GHG reduction measures.

Current Climate Goals, Programs, Plans and Policies

Many regions and communities within the Hampton Roads MSA and key infrastructure assets are vulnerable to changing climatic conditions, particularly regarding flooding and sea level rise. Local and regional bodies have also developed climate action and related planning and funding initiatives. To date, HRPDC has developed a Green Infrastructure Plan and a Coastal Resiliency Program that includes actions to address regional challenges related to flooding and sea level rise.

Lying within Virginia, the Hampton Roads MSA is covered by state-level climate goals, such as those included in Senate Bill 94, establishing statewide GHG emissions reduction goals across Virginia's economy that reach net-zero emissions by 2045, and the clean energy goals in the Virginia Clean Economy Act of 2020 (VCEA). In alignment with the VCEA, Virginia has also passed a number of recent bills to support equitable climate actions, including Clean Cars Act (House Bill 1965) and the Environmental Justice Act, all of which affect GHG emissions in the Hampton Roads MSA as they continue to come into effect. Several statewide efforts to plan for and fund increased climate resilience investments may also be applicable to the MSA region, including:

- Virginia Coastal Resilience Master Plan[2]
- Virginia Department of Conservation and Recreation: Guidance for Local Floodplain Ordinances[3]
- Virginia Strategy for Safeguarding Species of Greatest Conservation Need from the Effects of Climate Change[4]
- Funding mechanisms such as the Community Flood Preparedness Fund and the Resilient Virginia Revolving Fund[5]

With a few counties in North Carolina, the Hampton Roads MSA is also covered by Executive Order 80: North Carolina's Commitment to Address Climate Change and Transition to a Clean Energy Economy and the climate goals therein.

LIDAC Climate Risks

Hampton Roads MSA LIDACs

A core component of the CPRG and much of the IRA through the Justice40 Initiative is to ensure that benefits from climate action are experienced by LIDACs as these communities are particularly vulnerable to risks and impacts from climate change. This section discusses climate risks for LIDACs within the Hampton Roads MSA and highlights how HRPDC has engaged with these communities and stakeholders to date via other planning processes. Additional details about LIDAC engagement to date are described in Section 3, and Appendix A details plans for future engagement with LIDACs. Per CPRG requirements, LIDACs within the MSA are identified by Census Block ID using EPA's EJScreen tool and the CEJST.[6]

LIDAC Identification

HRPDC identified LIDACs within the MSA area using EJScreen to visualize Census Block Groups that the EPA designates as disadvantaged and by using CEJST and its indicators of qualifying characteristics (i.e., factors such as health considerations, housing and income, legacy pollution, etc.) for Census tracts within the MSA. Figure 5 shows these LIDAC census block groups in the Hampton Roads MSA, as identified by EJ Screen while Figure 6 shows these LIDAC Census tracts in the Hampton Roads MSA, as identified by CEJST, highlighting them in blue. A full list of LIDAC Census tract IDs can be found in Appendix C.

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[2] Commonwealth of Virginia. 2021. *Virginia Coastal Resilience Master Plan Phase 1*. https://www.dcr.virginia.gov/crmp/plan.
[3] Virginia DCR. 2023. *Floodplain Management Regulations and Ordinances*. https://www.dcr.virginia.gov/dam-safety-and-floodplains/fpordnce.
[4] Virginia DWR. 2024. *Virginia's Strategy for Safeguarding Species of Greatest Conservation Need from the Effects of Climate Change.*. https://dwr.virginia.gov/wildlife/wildlife-action-plan/safeguarding-species-from-climate-change/.
[5] Virginia DCR. 2024. *Community Flood Preparedness Fund Grants and Loans*. https://www.dcr.virginia.gov/dam-safety-and-floodplains/dsfpm-cfpf.
[6] The EPA defines a disadvantaged community in the following manner: 1) if it is disadvantaged according to the Climate and Economic Justice Screening Tool (CEJST); 2) if the census block is at or above the 90th percentile for any of EJScreen's Supplemental Indexes compared to the nation or state; 3) any geographic area within Tribal lands and indigenous areas as included in EJScreen. Taken from: U.S. EPA Office of Air and Radiation. "Climate Pollution Reduction Grants Program: Technical Reference Document for States, Municipalities and Air Pollution Control Agencies. Benefits Analyses: Low-Income and Disadvantaged Communities," April 27, 2023. https://www.epa.gov/system/files/documents/2023-05/LIDAC%20Technical%20Guidance%20-%20Final_2.pdf.

Figure 5: LIDAC Census block groups in the Hampton Roads MSA, as identified by EJScreen

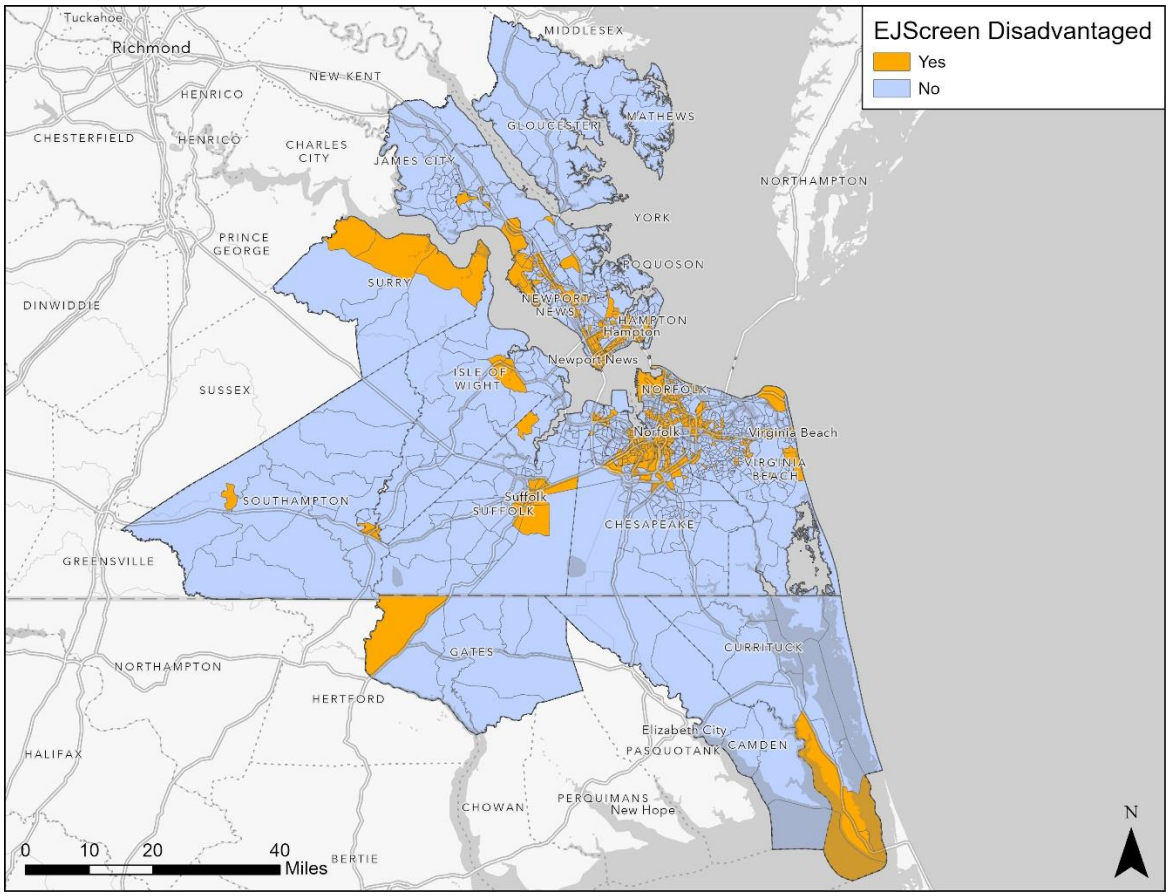
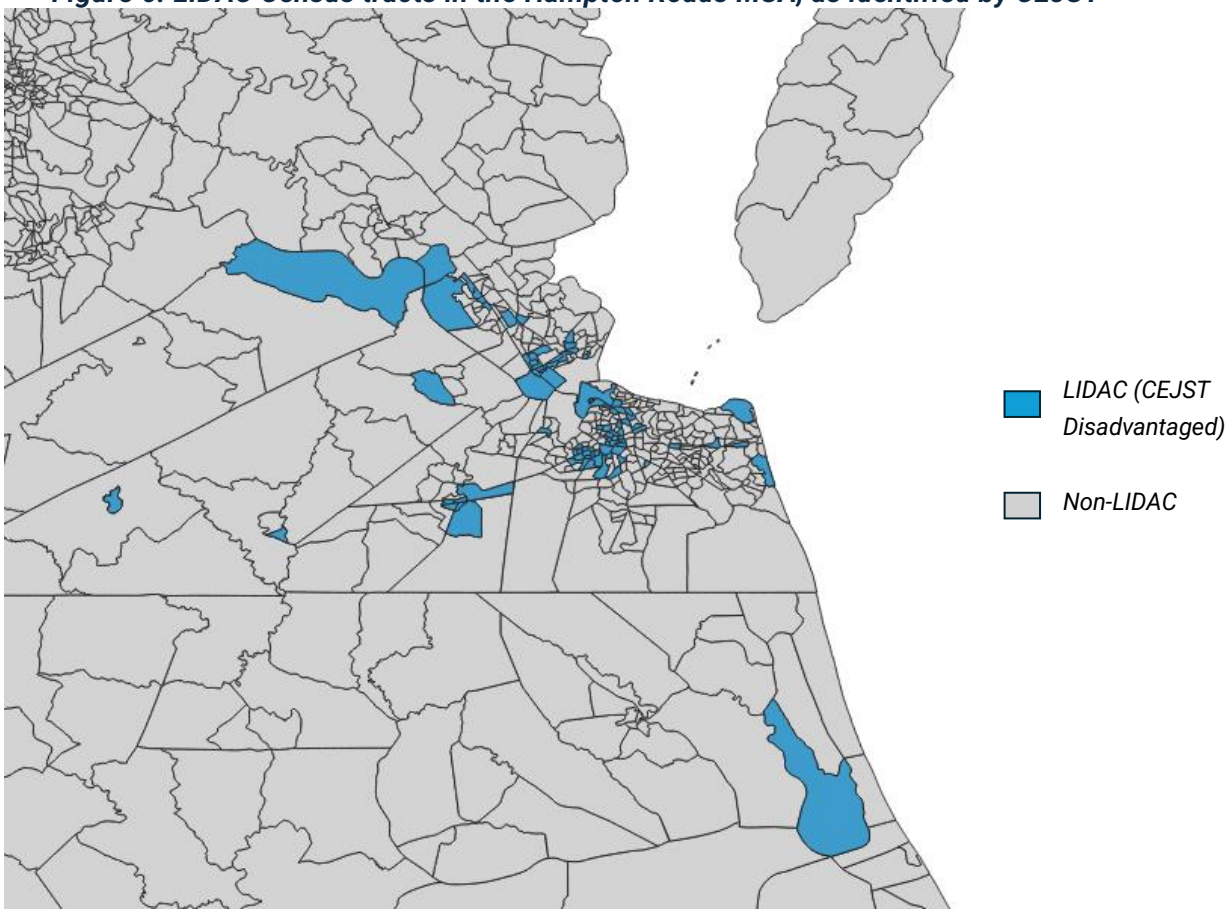


Figure 6: LIDAC Census tracts in the Hampton Roads MSA, as identified by CEJST



Climate Impacts and Risks to LIDACs

The climate risks most prevalent in the U.S. include extreme weather events (hurricanes, extreme rainfall, etc.), extreme heat and urban heat island effects, flooding, sea level rise, drought, and wildfires. Social systems inequitably distribute negative impacts from these climate risks on BIPOC (Black, Indigenous, and People of Color) individuals and communities, low-income households, unhoused individuals, rural communities, and agricultural workers.[7] Not only do these communities feel the most severe impacts of climate change, but they are often also the least able to prepare for and respond to said impacts due to a lack of resources and socio-political power. According to a 2021 EPA analysis, racial and ethnic minorities are particularly vulnerable to climate change impacts, especially Black and African American individuals.[8]

Minority and low-income communities are more likely to suffer the consequences of climate change due to heightened exposure to climate risks and inaccessibility to resources, such as adequate infrastructure and proper insurance. Many factors contribute to this inequality, including historical discriminatory practices in housing, education, and employment. Pre-existing health status and living

[7] U.S. Global Change Research Program. 2023. *Ch. 20. Social systems and justice. In: Fifth National Climate Assessment*. https://doi.org/10.7930/NCA5.2023.CH20

[8] EPA. 2021. *Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts. U.S. Environmental Protection Agency, EPA 430-R-21-003.* www.epa.gov/cira/social-vulnerability-report

conditions are two key components of climate vulnerability – components which, in the United States, are often determined by economic access, social policies, political influence, and structural racism.[9]

The most prevalent climate risks and their potential impacts include:

Extreme Heat. Exposure to extreme heat can cause heat exhaustion, heat stroke, and can contribute to deaths from a range of cardiovascular diseases such as heart attacks and strokes. Between 2004 and 2018, an average of 702 people died annually of heat-related deaths in the United States (though this is likely underreported). Older adults, young children, people of color, outdoor workers, those with poorer health, and low-income individuals are more at risk of heat-related death. Additionally, higher temperatures will lead to increased energy demand and higher energy costs. Individuals belonging to LIDACs will be less able to afford these increased costs, thus exacerbating heat-related health risks.[10]

Extreme Weather Events (Hurricanes, Extreme Rainfall, Etc.). Extreme rain events will likely increase in frequency and intensity throughout the century. This will cause more intense flooding, harming primarily households without homeowners or renters' insurance or that cannot afford the necessary infrastructure repairs. In addition to flooding, heavy precipitation can cause landslides, which can further damage infrastructure. Flooding can also impact human health by increasing mold production and exposure to waterborne diseases, particularly affecting those in poor living conditions and lacking access to safe and reliable drinking water.[11] Impacts from these storms will continue to be felt most significantly in densely populated areas along tidal rivers.

Sea Level Rise. Sea level rise will cause severe flooding, damaging infrastructure. Underserved and minority communities may be unable to afford the costs of repairing damages or relocating if their homes become completely inundated. American Indian individuals are more likely to live in areas at risk for future inundation.[12] Additionally, saltwater intrusion from sea level rise can make drinking water unsafe for coastal communities, leading to dangerous impacts on health.[13]

Drought. Drought can contribute to water scarcity, causing major food insecurity and threatening farming livelihoods. Food insecurity leads to hikes in food prices and potentially civil unrest and mass migration. All of these impacts will be felt most strongly by minority and low-income communities.[14]

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[9] Patnaik, A., Son, J., Feng, A., Ade, C., 2020. *Racial Disparities and Climate Change.* https://psci.princeton.edu/tips/2020/8/15/racial-disparities-and-climate-change

[10] EPA, 2023. Climate Change and Heat Islands. https://www.epa.gov/heatislands/climate-change-and-heat-islands#:~:text=When%20people%20are%20exposed%20to%20extreme%20heat%2C%20they,attacks%2C%20strokes%2C%20and%20other%20forms%20of%20cardiovascular%20disease.

[11] EPA. 2021. *Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts. U.S. Environmental Protection Agency, EPA 430-R-21-003.* www.epa.gov/cira/social-vulnerability-report

[12] EPA. 2021. *Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts. U.S. Environmental Protection Agency, EPA 430-R-21-003*. www.epa.gov/cira/social-vulnerability-report

[13] Shammi, M., Rahman, M., Bondad, S.E., Bodrud-Doza, M., 2019. *Impacts of Salinity Intrusion in Community Health: A Review of Experiences on Drinking Water Sodium from Coastal Areas of Bangladesh.* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6473225/

[14] U.S. Global Change Research Program. 2023: *Ch. 11. Agriculture, food systems, and rural communities. In: Fifth National Climate Assessment*. https://doi.org/10.7930/NCA5.2023.CH11

Prevalent Climate Risks within the Hampton Roads MSA

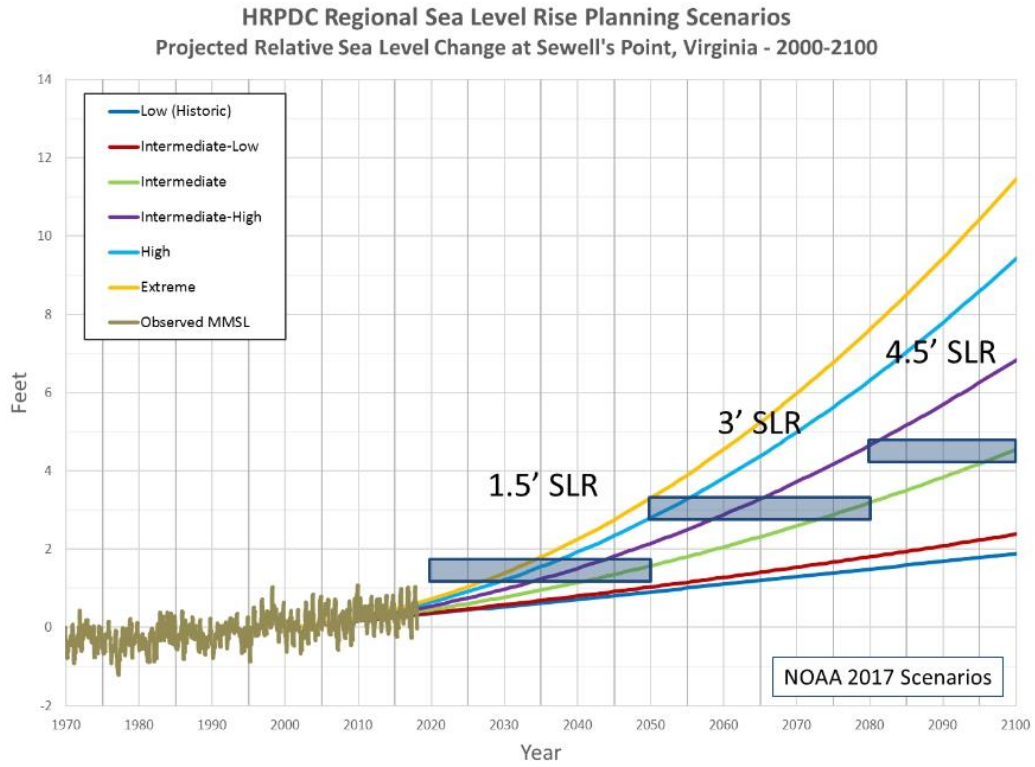
Within the Hampton Roads MSA, the most prevalent climate risks are extreme heat, extreme precipitation, storms, and sea level rise. Average temperatures in Virginia have already risen over 1.5° F since the beginning of the 20th century. The number of days over 95°F is projected to drastically increase.

Since 2000, average annual precipitation in Virginia has increased slightly. Summer precipitation was above average during the 2015–2020 period. Annual precipitation is projected to increase across Virginia by 5–10%, as is the frequency and intensity of extreme precipitation events (defined as days with two or more inches of precipitation), threatening the Hampton Roads MSA. The 5-day maximum precipitation (the maximum amount of rainfall occurring within five consecutive days) is currently 148.9 mm; by 2050, this is projected to increase to 159.8 mm under a high emissions scenario.[15] The area is also susceptible to hurricanes and storms, which are expected to increase in severity in the future. Because the region has a low-lying geography, flooding will be a significant risk.[16]

Sea level rise is happening more rapidly along Virginia's coast, much of which is in the Hampton Roads MSA, than in other coastal areas because the land is sinking. Since 1927, sea level has risen 18 inches along the Virginia coast, causing an increase in the extent of the coastal floodplain and tidal floods associated with nuisance-level impacts.[17] The National Oceanic and Atmospheric Administration (NOAA) projects that mean sea level could rise by 0.75 to 1.67 feet between 2000 and 2040 and by 1.25 to 3.25 feet between 2000 and 2060.[18] In fact, Hampton Roads has the second largest U.S. population center at risk of sea level rise. Over 400,000 homes in Virginia are at risk for storm surge, most of which are in identified disadvantaged communities in the Hampton Roads region. Acknowledging this risk, HRPDC developed a Sea Level Rise Planning and Policy Approach in 2018 to provide recommendations to localities to incorporate sea level rise scenarios into planning, engineering, and design efforts.[19] HRPDC's identified sea level rise planning scenarios are shown in Figure 7.

[15] ICF Consulting, proprietary ClimateSight Analysis. 2024.
[16] Hampton Roads PDC. 2010. *Climate Change in Hampton Roads.* https://research.fit.edu/media/site-specific/researchfitedu/coast-climate-adaptation-library/united-states/east-coast/virginia/McFarlane-et-al.-2010.-CC-Impacts-in-Hampton-Roads-Phase-1.pdf
[17] NOAA Tides and Currents https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=8638610
[18] Global and Regional Sea Level Rise Scenarios for the United States, https://oceanservice.noaa.gov/hazards/sealevelrise/sealevelrise-tech-report.html
[19] Hampton Roads PDC. 2018. *HRPDC Sea Level Rise Planning Policy and Approach.* https://www.hrpdcva.gov/uploads/docs/05A_Attachment%20-%20HRPDC%20Sea%20Level%20Rise%20Planning%20Policy%20and%20Approach%20-%20Adopted%20101818.pdf

Figure 7: HRPDC Regional Sea Level Rise Planning Scenarios



Together, HRPDC and HRTPO have also identified 2023 legislative priorities establishing dedicated funding sources for flood prevention projects and establishing a state structure for coordination on flooding in as 2023 legislative priorities.

Several cities in the Hampton Roads MSA have higher rates of poverty, unemployment, and housing insecurity than the rest of the state of Virginia. Statewide, the average poverty rate is 10.6%. In Norfolk, Hampton, Newport News, and Portsmouth, the poverty rate is over 15%. Furthermore, there are huge racial disparities; in Norfolk (where the poverty rate reaches almost 19%), the average annual income of white adults is twice as much as that of Black adults. Hampton Roads also lags behind the rest of Virginia when it comes to housing security. In Portsmouth, 17% of residents are severely cost-burdened (meaning over 50% of their income is spent on housing), and 21% in Norfolk, while the state average is 12.5%. Additionally, 7,660 cost-burdened renters in Norfolk are Black and 4,110 are white, even though the area is majority white. Unemployment is also higher in Hampton Roads compared to the state average.[20]

Residents of LIDACs along with low-income, housing insecure, and unemployed communities outside of LIDACs in Hampton Roads will be at far greater risk from the climate hazards listed above. For example, extreme heat can lead to numerous heat-related illnesses and health issues. Since 2015, there has been an increase in heat-related hospital visits. Unhoused people and those who work outside will be more exposed to rising temperatures, leading to declines in health. Additionally, people

[20] WHRO. *New Data Tool Shows Socioeconomic Inequities Around Hampton Roads*. https://whro.org/news/local-news/20066-new-data-dashboards-show-socioeconomic-inequities-around-hampton-roads

in rural areas may not be able to access cooling centers, leaving them more exposed. A 2022 study found that while 65% of Virginians have convenient access to a cooling center, less than 7% of Virginians living below the federal poverty level do. Locations of cooling centers highlight the disparities between wealthier, urban areas and lower-income, rural areas.[21]

Many low-income and minority communities are located close to toxic waste sites, such as the Superfund sites in the MSA including the four sites in Portsmouth, four in York, three in Suffolk, and one each in Chesapeake, Newport News, Norfolk, and Virgina Beach. As climate change increases the risk of storms, the likelihood of a toxic waste site being compromised and leaking rises as well. This could lead to a whole host of health problems for nearby residents, including respiratory illness and cancer.[22] Flooding introduces microbial and chemical loads in surface waters, negatively impacting the health of residents. Flooding in LIDAC communities will introduce a slew of health issues, including mental health problems for those repeatedly exposed.[23] These health impacts are particularly consequential as healthcare for low-income and unemployed people is unstable and often inaccessible altogether.[24]

Sea level rise is a major threat to low-income and disadvantaged communities as well. Currently, expected damages from flooding in the Hampton Roads MSA in a given year are around $12 million; with an increase of 0.5 meters, damages could go up to $50 million annually and $100 million annually with an increase of 0.75 meters. LIDACs often lack the resources to compensate for infrastructure damages and loss due to flooding.

A 100-year storm event would also severely hurt the Gross Regional Product (GRP) of the Hampton Roads economy. Without sea level rise, a 100-year storm event would cause the GRP to decline $611 million, but with a sea level rise of 0.5 meters the GRP would decline over $1 billion, and over $2 billion with a rise of 0.75 meters.[25] Economic hits will impact everyone in the region; however, LIDACs are less able to recover from economic challenges.

Review of Available Public Climate Funding Sources

There are significant state and federal funding opportunities available that Hampton Roads localities and HRPDC can request or apply for to support climate actions in the region. State and federal funding

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[21] Allen M, Hoffman J, Whytlaw JL, Hutton N. 2022. *Assessing Virginia cooling centers as a heat mitigation strategy*. doi: 10.5055/jem.0671. PMID: 35792811.

[22] University of Virginia. 2021. *A Path Toward Environmental Equity in Hampton Roads*. Sampaio_Gabriel_A_Path_Toward_Environmental_Equity_in_Hampton_Roads (3).pdf

[23] University of Virginia. 2023. *Impacts of Sea Level Rise and Flooding on Low-Income Communities in Hampton Roads, Virginia.* bing.com/ck/a?!&&p=76cb6cfb584fad66JmltdHM9MTcwNjgzMjAwMCZpZ3VpZD0yYjFkNjdlMy0wNzE1LTZkNmUtMjVkNi03NDg3MDZkNzZjZjMmaW5zaWQ9NTE4NQ&ptn=3&ver=2&hsh=3&fclid=2b1d67e3-0715-6d6e-25d6-748706d76cf3&psq=Impacts+of+Sea+Level+Rise+and+Flooding+on+Low-Income+Communities+in+Hampton+Roads%2c+Virginia&u=a1aHR0cHM6Ly9saWJyYWV0ZC5saWIudmlyZ2luaWEuZWR1L2Rvd25sb2Fkcy9kNTA0cm00NHc_ZmlsZW5hbWU9Qm93bWFuX0FuZHJld19TVFNfUmVzZWFyY2hfUGFwZXIucGRm&ntb=1

[24] U.S. Department of Health and Human Services. Nd. *Poverty.* https://health.gov/healthypeople/priority-areas/social-determinants-health/literaturesummaries/poverty#:~:text=Unmet%20social%20needs%2C%20environmental%20factors,for%20people%20with%20lower%20incomes.&text=For%20example%2C%20people%20with%20limited,for%20expensive%20procedures%20and%20medications.

[25] William & Mary Law School. 2016. "The Cost of Doing Nothing: A Sea Level Rise Synopsis for the Hampton Roads Region." Virginia Coastal Policy Center. https://law.wm.edu/news/stories/2016/documents/Summary%20Costs%20of%20Doing%20Nothing%20and%20Final%20Hampton%20Roads%20SLR%20Report.pd

allocated to and administered by states is a key component of climate action, including but not limited to climate and energy related components of the IRA and the Infrastructure Investment and Jobs Act (IIJA). There are many federal formula funding opportunities under the IRA and IIJA that are being administered by Virginia and subgranted to localities that Hampton Roads could utilize for regional climate action. Examples of these include:

- Assistance for Latest and Zero Building Energy Code Adoption
- Carbon Reduction Program
- Energy Efficiency and Conservation Block Grant
- High Efficiency Electric Home Rebate Program
- Home Energy Performance-Based, Whole-House Rebate Program
- Surface Transportation Block Grant Program

The MSA has received direct federal funding appropriations for initiatives related to transportation and energy. Hampton Roads Transit (HRT) received funds to upgrade transit facilities to prepare for transit fleet electrification. The Transportation District Commission of Hampton Roads developed several federal legislative and public policy priorities in alignment with these federal funding opportunities, including supporting regional multi-model infrastructure and services, fleet and infrastructure electrification, and addressing transportation systems gaps for underserved, overburdened, or disadvantaged communities. [26] Virginia businesses, residents, and local governments are also eligible for federal tax incentives, primarily in the form of income and investment tax credits for various clean energy and emission reduction technologies. These typically reduce tax liability based on a percentage of project cost, up to defined dollar limits.

There are several funds created through Virginia state legislation to support decarbonization initiatives in the region, including the Hampton Roads Regional Transit Program and Fund, managed by the Hampton Roads Transportation Accountability Commission. Hampton Roads has received other state grants supporting climate actions, including the Growth and Opportunity for Virginia grant program, recently awarded to Hampton Roads for a demonstration site for clean energy transition to green hydrogen. Localities in Hampton Roads can also apply for grant programs funded by the state such as the Department of Forestry's Virginia Trees for Clean Water. Localities are also taking steps to identify other strategies to fund climate action, such as through PACE (property assessed clean energy) to allow for financing of renewable energy by commercial, nonprofit, and multifamily properties.

Current Gaps in Action and Funding

As described above, there are a significant number of funding opportunities available, particularly for actions related to energy efficiency, renewable energy, and building and transportation electrification. However, some gaps remain, particularly for the industrial and commercial sectors, and the MSA is evaluating the currently available funding opportunities to leverage grant programs and continue to fill gaps in local and state funding with federal funds. HRPDC will continue to coordinate closely with

[26] Hampton Roads Transit. Nd. *Transportation District Commission of Hampton Roads Federal Legislative and Public Policy Priorities 2022-2023.* 2023-federal-legis-priority.pdf (gohrt.com)

localities, regional partners, and the state to identify funding opportunities that can flow to initiatives in Hampton Roads and deliver regional benefits.

5. Priority Climate Actions

The priority GHG reduction measures developed by HRPDC target the energy, buildings, transportation, ports, waste and wastewater, and natural and working lands (such as forestry and wetlands) sectors. These measures are designed not only to directly reduce GHG emissions and improve air and water quality, but also to provide other benefits including:

- Improving public health;
- Creating safer and more reliable infrastructure;
- Generating workforce development opportunities; and
- Reducing costs for governments, organizations, and community members.

These additional benefits are discussed in the following section.

Benefits and Co-Benefits Analysis

The initiatives outlined in this PCAP will contribute to achieving local, state, and national climate objectives while reducing co-pollutants, such as criteria air pollutants and hazardous air pollutants, that adversely affect the Hampton Roads MSA and its environment. Decreasing fossil fuel (i.e., coal, natural gas, petroleum, propane) use in buildings, vehicles, and electric power generation, in addition to more clean and efficient industrial practices, will lower emissions and generate environmental, public health, and socioeconomic advantages. In the short term, the reduction of co-pollutants will enhance both indoor and outdoor air quality, diminishing hazardous air pollutants, toxins, and other harmful substances. The immediate alleviation of these pollutants can positively impact the physical and economic wellbeing of communities. In the long run, the reduction of GHGs will mitigate the impacts of climate change. The pollutants reduced by the following PCAP measures are outlined in Table 4.

Table 4: Air Pollutants and GHGs Reduced by PCAP Measures

Type of Pollutant	Categories of Related Measures
Carbon Dioxide	Energy, Transportation, Waste
Carbon Monoxide	Energy, Transportation
Methane	Energy, Transportation, Waste
Sulfur Dioxide	Energy, Transportation
Nitrogen Oxides	Energy, Transportation
Volatile Organic Compounds	Transportation
Sulfur Hexafluoride	Energy, Transportation
Particulate Matter (e.g., PM2.5)	Energy, Transportation
Heavy Metals	Energy, Transportation
Nitrous Oxide	Energy, Transportation
Hydrocarbons	Transportation
Other Hazardous Air Pollutants (HAPs) and air toxics	Energy, Transportation

These co-pollutants are also described throughout the PCAP Measures section. The co-benefits, detailed below, impact all communities where programs and projects related to the PCAP measures may be implemented.

Public Health Benefits

Reducing GHG and co-pollutant emissions has and will continue to have profound implications for public health of residents of the Hampton Roads MSA. The combustion of fossil fuels contributes to outdoor and indoor air pollution which, in turn, poses significant health risks. In the United States, roughly 87% of people's lives are spent indoors, so indoor exposure to combustion pollutants, such as natural gas for cooktops or heating, has the potential for substantial health effects.[27] In instances of long-term exposure, these health effects can include premature mortality, adverse birth outcomes, cognitive decline, and gastrointestinal inflammatory disease. Short-term exposure can lead to asthma and respiratory symptoms.[28]

Furthermore, the adverse health impacts extend to climate impacts such as extreme heat events. Nearly two-thirds of the U.S. population resides in areas susceptible to health risks related to extreme heat, including heat-related illnesses and cardiovascular conditions. See Section 3 for more information on climate-related risks, particularly for LIDACs.

Socioeconomic Benefits

The implementation of the priority GHG reduction measures in this PCAP can bring significant socioeconomic advantages, especially among LIDACs. One major shift will be increased high-quality energy related jobs to the state as it builds renewable energy infrastructure. The development of clean energy technologies, such as energy efficiency upgrades to buildings, solar installations, and EV charging infrastructure, necessitates skilled individuals proficient in installing and maintaining such hardware. Offering clean energy job training, especially within environmental justice communities, both supports resilient and clean infrastructure and generates economic opportunities.

Clean energy can be developed to improve grid resilience (e.g., through battery storage), reducing the risk of blackouts and promoting energy independence.[29] Consequently, these investments mitigate the economic and physical impact of extreme weather events.

GHG emissions contribute to more frequent and severe extreme weather events, resulting in substantial financial costs and economic impacts. Reducing greenhouse gas emissions over the long term can help lessen occurrences of events like extreme precipitation and storms. This, in turn, can prevent additional costs such as higher insurance premiums, expenses for repairing structural damage, and losses in crops and natural resources. The reduction of extreme weather events also alleviates costs related to medical bills and premature deaths. In 2022 alone, the U.S. faced 18

[27] U.S. EPA. 1989. *Report to Congress on indoor air quality: Volume 2. EPA/400/1-89/001C.* https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=9100LMBU.TXT
[28] Health Effects Institute. 2020. *Health Effects Institute Annual Report 2020: Valuing Science Informing Decisions.* https://www.healtheffects.org/system/files/hei-annual-report-2020.pdf
[29] NREL. 2018. *Distributed Energy Planning for Climate Resilience.* https://www.nrel.gov/docs/fy18osti/71310.pdf

extreme weather and climate events costing over $1 billion, making the reduction of these costs crucial for individual, community, and overall economic wellbeing.[30]

Electrifying and decarbonizing energy end-use sectors and enhancing efficiency through properly designed measure implementation can offer financial relief to individuals and businesses, especially for low-income and disadvantaged residents. Energy efficiency retrofits will lower overall household energy use, therefore lowering energy bills. This reduction in energy cost burden eases financial stress for households and businesses, allowing resources to be redirected to better individual economic situations and stimulate the economy.

Additionally, the PCAP measures promote and require public education, community engagement, and social inclusion. Actions to implement measures – such as enhanced multi-modal transportation options – foster social capital, encourage community engagement, and contribute to the overall socioeconomic wellbeing of Hampton Roads residents.

Implementation Schedule

Table 5 depicts a proposed timeline of milestones for implementation of the PCAP measures, which are described later in this section. Note that this timeline is subject to change as measures will be undertaken where feasible and when funding is available.

Table 5: Proposed Timeline

Milestone	Timeframe
2024	
Deliver final PCAP to EPA, which includes stakeholder input on measures	**March 1, 2024**
CPRG Implementation Grant Deadline	**April 1, 2024**
Identify key actions to take under each measure	**Throughout 2024**
2025	
Coordinate resources across jurisdictions and take initial actions across the PCAP measures	**Early 2025**
Estimate GHG emissions reductions from measure actions	**Early 2025**
Estimate LIDAC benefits from measure actions	**Early 2025**
Deliver final CCAP to EPA	**May 1, 2025**
2026	
Continue implementing measure actions	**Early 2026**
Implement pilot programs and short-term strategies for GHG reductions	**Mid 2026**
Secure approval and budget for ongoing GHG reductions	**Mid-late 2026**
2027	
Deliver Status Report to EPA	**Mid-2027**
Continue to implement measures and reduce GHGs; Track progress across the MSA	**2027 onward**

[30] NOAA. 2023. *2022 U.S. billion-dollar weather and climate disasters in historical context.* https://www.climate.gov/news-features/blogs/beyond-data/2022-us-billion-dollar-weather-and-climate-disasters-historical

PCAP Measures

HRPDC, with input from key stakeholders, has identified seven priority measures that are implementation ready and will reduce GHG emissions in the short-term. The measures were developed through the process outlined in Section 2. The PCAP measures, and the relevant GHG inventory sectors for each, are identified in Table 6. The following section describes each priority measure in detail.

Table 6. Summary of PCAP Measures and Related GHG Inventory Sector(s)

PCAP Measure	GHG Sector(s)
Measure 1: Create programs to support and incentivize a transition to clean energy, including onsite renewable energy, energy storage system deployment, and fuel switching.	Energy
Measure 2: Reduce energy consumption and increase building decarbonization through programs to support, incentivize, and install energy efficiency and electrification measures.	Energy
Measure 3: Develop an EV procurement plan and EVSE deployment strategy to support the adoption of EVs.	Transportation
Measure 4: Reduce vehicle miles traveled and support alternative modes of transportation through bike/pedestrian infrastructure investments.	Transportation
Measure 5: Reduce emissions from port operations through the adoption of low-carbon fuels, electric equipment, and operational changes.	Ports, Transportation
Measure 6: Reduce GHG emissions through improved equipment efficiencies, increased methane capture at waste and wastewater facilities, and organic waste diversion.	Waste & Wastewater
Measure 7: Increase opportunities for carbon sequestration through tree planting, protecting, and restoring high-carbon coastal habitats, wetlands, and forest lands.	LULUCF

Measure 1.

Create programs to support and incentivize a transition to clean energy, including onsite renewable energy, energy storage system deployment, and fuel switching.

Facilitating the transition to clean energy is a key priority for the MSA. This measure emphasizes fostering a shift toward clean energy solutions, encompassing onsite renewable energy, energy storage system deployment, and fuel switching. Each local government within the MSA will lead the development of actions to implement this measure within their jurisdiction. Implementing these actions in public operations and in public facilities can set an example for the surrounding community to adopt renewable energy, storage, and alternative fuels. This measure will result in public health benefits such as improved air quality, as well as increased employment opportunities in the clean energy sector.

Additional information about the actions to support this measure can be found in the City of Norfolk's Climate Action Plan and the VCEA.

Progress to Date and Future Activities and Milestones

The Hampton Roads Regional Economic Development Strategy identified developing offshore wind and other coastal energy solutions as a priority for diversifying the economy of the MSA.[31]

Municipalities in the MSA have begun supporting this action. The City of Norfolk has established solar energy expansion goals in its Climate Action Plan, has achieved SolSmart gold-level designation, and provides a website with numerous solar resources.[32] Additionally, the Hampton Roads Alliance partnered with Xodus Group and BW Research to conduct a major offshore wind supply chain study for the Hampton Roads area in Virginia. The project pinpointed Hampton Road's supply chain assets and uncovered any gaps, helping the Alliance in its efforts to support the U.S. offshore wind industry in Hampton Roads and identify key opportunities for economic expansion. Locality level and distributed energy generation efforts will work in concert with the renewable energy portfolio standards in the VCEA and will increase renewable energy generation and use throughout the Hampton Roads MSA.

HB 1919 authorized Virginia localities to establish local green banks to promote the investment in clean energy technologies and provide financing for clean energy technologies.[33]

In support of activities under this measure, Virginia launched SolSmart, a no-cost technical partner program, with support from the Solar Foundation to bring solar-specific resources and technical assistance to localities across Virginia, including those in the Hampton Roads MSA.[34] Virginia also established a shared solar program in 2020, which provides customers of Dominion Energy Virginia (all of the MSA region is in Dominion Energy service territory) the opportunity to participate in shared solar projects. Localities within the MSA have also made progress on solar deployment efforts.

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[31] Hampton Roads PDC. 2021. *Regional Economic Development Strategy*. https://www.hrpdcva.gov/library/view/348/regional-economic-development-strategy-(reds)/
[32] City of Norfolk. Nd. *Solar Resource Webpage*. Solar | City of Norfolk, Virginia - Official Website
[33] Virginia's Legislative Information System. 2021. *HB 1919 Local green banks; authorizes a locality, by ordinance, to establish.* https://lis.virginia.gov/cgi-bin/legp604.exe?211+sum+HB1919
[34] Virginia Energy. 2021. *SolSmart. Virginia DOE*. https://www.energy.virginia.gov/renewable-energy/SolSmart.shtml

Examples include the adoption of a solar energy policy by the City of Chesapeake that was recently updated in 2022. The policy "promotes the installation and use of accessory solar energy systems by designating them a permitted use in all of the City's zoning districts."[35] Solar installations have also been added to five schools and two administrative buildings in Newport News, while the City of Williamsburg is planning of installing solar panels on municipal buildings. The City of Norfolk has also installed solar panels on two fire stations and is in the permitting process for installation on a closed landfill.[36] Additionally, the City of Hampton has also added clean energy solutions to its draft Energy Assurance Plan.

In addition to continuing the activities described above, the following potential example actions are considered for Measure 1 implementation. These actions are illustrative and not intended to be exhaustive of all actions that could be used to implement this measure.

- **Install renewable energy and energy storage systems**. Renewable energy could include onsite solar or micro-wind turbines on residential, commercial, and industrial buildings. Public buildings (including HRSD/wastewater facilities) can lead by example to encourage other constituents throughout the MSA to also adopt clean energy improvements.

- **Set regional goals for local implementation of renewable energy and energy storage systems.** Regional goals can establish a feasible timeline for the implementation of solar panels on public, residential, and commercial buildings.

- **Develop materials to assist localities in adopting policies to streamline permitting for renewable energy systems in support of clean grid targets in VCEA.** Regional planning organizations can provide tools to localities to expedite and streamline the permitting process for utility-scale solar and storage systems.

- **Support education and workforce development programs for clean energy and buildings.** Such programs should emphasize engaging LIDAC communities in the growing clean energy workforce.

- **Identifying potential opportunities for hydrogen production and use as an alternate fuel**. Produced hydrogen could end up supporting numerous sectors in decarbonization planning.

Geographic Coverage

As this measure will be carried out by cities, counties, and substate government agencies across the MSA, all areas within the MSA and in neighboring regions will benefit from steps to decarbonize the regional energy supply. The actions within this measure are focused on the entire MSA area. The overall measure is specific to the MSA and not meant to encompass a broader or smaller geographic area.

[35] City of Chesapeake. 2022. *City of Chesapeake Solar Energy Policy.* Solar-Energy-Policy-Update-PDF (cityofchesapeake.net)
[36] City of Norfolk. 2022. *Campostella Landfill Redevelopment Proposal.* www.norfolk.gov/5667/Compostella-Landfill-Redevlopment-Propo

Quantified GHG Reductions ($MTCO_2e$)

PCAP Measure	GHG reductions (MTCO2e), 2025-2030	GHG reductions (MTCO2e), 2025-2050
Create programs to incentivize a transition to clean energy, including onsite renewable energy, energy storage system deployment, and fuel switching.	314,807	1,582,098

Details about the GHG reduction calculations approach are provided in Appendix B.

Benefits

Increasing clean and renewable energy will lead to reduced emissions of CO, NOx, SO_2, PM, and other air toxics and pollutants, such as ozone.

LIDAC Benefits

As this measure will be carried out by cities, counties, and substate government agencies across the MSA, all LIDACs within the MSA will benefit from steps to decarbonize the energy supply, local government operations fuel uses, and reduce GHG emissions across the MSA.

This measure may result in environmental benefits for LIDACs, where air pollution has historically been concentrated. Public health benefits can result from improved air quality. Active engaging with LIDACs will be needed to ensure that renewable energy improvements are located in and directly benefit these communities. Additional economic benefits may result from employment opportunities in the clean energy industry that will likely be realized. Increased resilience will also result where energy storage measures and distributed/on-site solar are implemented. Other benefits to members of LIDAC communities may include reduced utility bills through access to more efficient energy and energy infrastructure.

Renewable energy training workforce training programs could also be developed to specifically engage LIDACs in the growing clean energy workforce.

Implementation Considerations

Key Implementing Agency(ies)

- **Local governments and municipalities.** State and local government agencies such as the Virginia Department of Energy and North Carolina Department of Environmental Quality's State Energy Office can provide implementation support and share best practices for the transition to renewable energy.

- **Dominion Energy.** Dominion Energy, the electric utility for the MSA, will be key for ensuring that the electrical grid infrastructure is able to support the electrification of processes and an increased supply of renewable energy. Per the VCEA, Dominion Energy is required to produce 100% renewable energy by 2045.

- **Community-based organizations** such as Solar United Neighbors can increase awareness of solar opportunities and support customers interested in solar projects.
- **Private sector partners.** Private sector partners such as engineers, installers, and maintenance personnel will be needed for successful implementation of renewable energy projects.

Authority to Implement

City and county governments within the MSA can implement clean energy projects in their own operations within their respective jurisdictions. This measure falls under the local governments' regulatory authority to protect public health and welfare.

Intersection with Other Funding

Potential funding sources to support implementation of this measure are shown in the table below.

Program/Grant Name	Funding Source
Energy Efficiency and Conservation Block Grant	Federal – Formula
State Energy Program	Federal – Formula
Greenhouse Gas Reduction Fund	Formula – Competitive

Potential Metrics

Potential metrics to measure progress under this measure are listed below.

Output metrics:

- kW of renewable energy installed on government property
- kW of renewable energy installed on residential and commercial buildings

Outcome metrics:

- New workers in the clean energy workforce
- Percent increase in renewable energy usage
- Percent in public building energy needs met by renewable energy

Measure 2.

Reduce energy consumption and increase building & facility decarbonization through programs to support and incentivize energy efficiency and electrification measures.

Energy used in the building sector for heating, cooling, and electricity accounts for a significant portion of GHG emissions in the Hampton Roads MSA. This measure will implement projects and policies to promote energy efficiency and clean energy supply to buildings in the Hampton Roads MSA. Managers of public buildings can lead the implementation of this measure by establishing energy reduction goals and by installing energy efficiency improvements and beneficial electrification infrastructure. This leadership can encourage residential and commercial building owners to implement the same actions, and building owners can share best practices for operation to improve energy efficiency.

Each local government within the MSA will lead the development of actions to implement this measure within their jurisdiction. The benefits of increasing energy efficiency and decarbonizing the energy used in commercial buildings will include improved air quality and decreased GHG emissions, which will result in improved public health. There will be a particular emphasis on sharing the benefits of policies with LIDACs. This measure covers all buildings including residential and commercial buildings, along with industrial facilities, schools, and local government/agency buildings.

Progress to Date and Future Activities and Milestones

Certain municipalities in the MSA have already made progress regarding this measure. For example, in 2019, the City of Norfolk set targets in the City Climate Action Plan to reduce municipal building energy usage by 5% per year to achieve a 45% reduction by 2030 and to reduce overall building energy use citywide by 3% per year to achieve a 30% reduction by 2030.[37] The City of Norfolk also participates in the United States Department of Energy's Better Buildings Challenge and has committed to reducing energy in 127 buildings by 20% by 2032.[38] Additionally, the City of Norfolk and the City of Virginia Beach both participate in Commercial Property Assessed Clean Energy (C-PACE) program uses low-cost financing mechanisms to support energy efficiency improvements.[39] [40] Virginia also has state programs supporting activities under this measure that localities within the MSA can utilize. The Housing Innovations in Energy Efficiency (HIEE) fund, administered by the Department of Housing and Community Development (DHCD), provides capital for energy efficiency upgrades to both new and existing housing.[41]

Virginia enacted the High-Performance Buildings Act in 2021 to drive more efficient, resilient, and future-proof buildings.[42] The law updated the building performance standards for state/public buildings by adding EV charging and infrastructure and utility metering requirements and created new

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[37] City of Norfolk. 2019. *Mayor's Advisory Commission on Climate Change Mitigation and Adaptation Climate Action Plan.* https://www.norfolk.gov/DocumentCenter/View/56485/Mayors-Advisory-Commission-on-Climate-Change-Mitigation-and-Adaption-Climate-Action-Plan-2019?bidId=

[38] U.S. Department of Energy Better Buildings. N.d. *City of Norfolk*. https://betterbuildingsolutioncenter.energy.gov/parters/city-norfolk-va

[39] Virginia PACE Authority. 2024. *Local Programs*. https://virginiapace.com/local-programs/

[40] WTKR. 2023. *Virginia Beach joins program for commerical energy efficiency improvements*. https://www.wtkr.com/news/virginia-beach-joins-program-for-commercial-energy-efficiency-improvements

[41] Virginia DHCD. Nd. *Housing Innovations in Energy Efficiency. Virginia DOE*. https://www.dhcd.virginia.gov/hiee

[42] Code of Virginia. 2012. § 2.2-1183. Article 8. High Performance Buildings Act. § 2.2-1182. Definitions. https://law.lis.virginia.gov/vacodefull/title2.2/chapter11/article8/

building performance standards for local governments. Virginia has also supported energy efficiency efforts at state agencies and other public facilities through Virginia Energy's Energy Savings Performance Contracting Program, which allows state agencies and local government entities to enter contracts with energy service companies to reduce energy costs through efficiency measures.[43] In June 2021, the program celebrated over $1 billion in cumulative energy savings across the Commonwealth. To date the City of Virginia Beach and Virginia Beach City Schools have participated in the program and other localities in the Hampton Roads MSA could pursue future participation.

Additionally, numerous LED lighting conversions have been completed in facilities and streetlights across the MSA, notably in Suffolk, Virginia Beach, Norfolk, Poquoson, York County, Williamsburg, and Hampton. The City of Newport News recently established a new Green Building Design policy, and the Norfolk Green Fund has a revolving loan fund that has been established to support departmental efforts to complete energy efficiency projects. Some localities such the Cities of Norfolk and Hampton have also begun conducting energy audits of city facilities. Additionally, municipalities have been working with Dominion and using the Department of Energy's Weatherization Assistance Program to provide technical assistance to low-income households for installing retrofits.[44]

In addition to continuing the activities described above, the following example actions are considered for Measure 2 implementation. These actions are illustrative and not intended to be exhaustive of all actions that could be used to implement this measure.

- **Develop benchmarking, operations, and maintenance resources that can be used by public agencies and localities.** These could include sharing of best practices and/or development of sample ordinances.

- **Lead by example.** Make public building efficiency and electrification upgrades to encourage residential and commercial building owners to make upgrades to their buildings. Buildings could also cover HRSD facilities, landfills, and other public facilities.

- **Provide resources to incentivize building energy code updates for new commercial and residential buildings.** This could include financial resources, sample building code language, or other resources where appropriate.

- **Develop performance standards.** Energy efficient performance standards and best practices for all new public facilities can be implemented to reduce emissions.

- **Provide rebates or other support for building energy improvements for private buildings, including commercial, residential, and industrial sectors.** This could include expanding access to C-PACE and other financing programs throughout the MSA.

[43] Virginia Energy. 2021. *Energy Savings Performance Contract.* Virginia DOE. https://www.energy.virginia.gov/energy-efficiency/PerformanceContracting.shtml

[44] HRClimateHub. Nd. *Efficiency and HVAC advice*. https://www.hrclimatehub.org/energy-efficiency/efficiency-and-hvac-advice/

- **Transition streetlights to LED and install LEDs in other facilities and buildings.** This includes retrofitting city buildings with LED lighting; energy efficient appliances and boiler; and heating, ventilation, and air-conditioning (HVAC) control systems.

Geographic Coverage

As this measure will be carried out by Cities and Counties across the MSA, all areas within the MSA and in neighboring regions will benefit from steps to increase energy efficiency and decarbonize energy supply in buildings across the MSA. The actions within this measure are focused on the entire MSA area. The overall measure is specific to the MSA and not meant to encompass a broader or smaller geographic area.

Quantified GHG Reductions ($MTCO_2e$)

PCAP Measure	GHG reductions (MTCO2e), 2025-2030	GHG reductions (MTCO2e), 2025-2050
Reduce energy consumption and increase building decarbonization through programs to support and incentivize energy efficiency and electrification measures.	456,399	5,143,558

Details about the GHG reduction calculations approach are provided in Appendix B.

Benefits

Reduced use of combustion fuels on site (e.g., natural gas, propone) will have localized indoor and outdoor air quality benefits (e.g., reduced emissions of PM2.5, CO, SO_2, and NO_X). Transitioning to electric equipment may result in increased emissions from electricity generation (e.g., $PM_{2.5}$, CO, SO_2, NO_X, VOCs, ozone), but this may be offset through the use of clean and renewable generating resources (see Measure 1).

LIDAC Benefits

As this measure will be carried out by Cities and Counties across the MSA, all LIDACs within the MSA and in neighboring regions will benefit from steps to improve energy efficiency and decarbonize buildings across the MSA. All LIDAC Census tracts (per the 2010 U.S. Census) in the MSA will be impacted by this measure (Source: CEJST). A list of the LIDAC Census tract IDs is found in Appendix C.

This measure provides health and economic benefits to LIDACs. Clean energy improvements such as energy efficiency can reduce utility bill costs and thus decrease energy burden[45] (which is especially relevant to LIDACs). Additionally, increasing energy efficiency reduces the need for energy production from power plants, thereby reducing associated air pollution in overburdened communities, leading to public health benefits. It may also increase the number of employment opportunities available to LIDACs, as jobs in installing and maintaining clean energy improvements will increase.

[45] Energy burden- the percent of household income spent on home energy bills.

Implementation Considerations

Key Implementing Agency(ies)

- **State and local government agencies.** The Virginia Department of Housing and Community Development, Virginia Department of Environmental Quality, Virginia State Corporation Commission, North Carolina Department of Environmental Quality, North Carolina Utilities Commission, and other state agencies can support implementation. Relevant local government organizations (such as the Department of Public Works) in the Virginia Beach and Norfolk areas can provide support and share best practices when implementing this measure.

- **Dominion Energy.** The utility provider for the MSA, Dominion Energy provides existing energy efficiency programs to ratepayers that could be expanded.

- **Property owners.** Individual property owners may choose to voluntarily improve their building envelopes and adopt new technologies to improve energy efficiency.

- **Private sector partners.** Private sector partners such as contractors and equipment manufacturers service providers can partner to provide the skills and equipment needed to retrofit buildings.

Authority to Implement

Local governments have the authority to install energy efficiency projects on their own buildings. However, to enact specific energy efficiency projects, policies, and/or pilot programs, local governments may need to gain approval from additional regulatory and budgetary agencies as needed.

Intersection with Other Funding

Potential funding sources to support implementation of this measure are shown in the table below.

Program/Grant Name	Funding Source
Energy Efficiency and Conservation Block Grant	Federal- Formula
State Energy Program	Federal- Formula
Greenhouse Gas Reduction Fund	Federal- Competitive
Green and Resilient Retrofit Program	Federal
Weatherization Assistance Program	Federal- Competitive
National Electric Vehicle Infrastructure Formula Program	Federal- Formula

Potential Metrics

Potential metrics to measure progress under this measure are listed below.

Output metrics:

- Number of public buildings retrofitted
- Square footage of public buildings retrofitted
- Amount of money spent on resources to incentivize building energy code updates for new commercial and residential buildings
- Number of heat pumps installed
- Number of higher efficiency HVAC systems installed
- Number of residential units that receive energy efficiency and/or electrification measures
- Number of residential homes, units, or commercial buildings in LIDACs that receive energy efficiency and/or electrification retrofits or upgrades

Outcome metrics:

- MWH energy use reduced
- Money (in dollars per year) saved on utility bills
- GHG emissions reduced

Measure 3.

Develop EV procurement plans and EVSE deployment strategies to support the adoption of EVs.

On-road transportation is a significant source of GHG emissions in the Hampton Roads MSA. To reduce these emissions, this measure focuses on fostering the widespread adoption of EVs through the development of a regional charging network and the procurement of EVs. As part of this measure, public agencies can lead by example by procuring electric vehicles for government fleets, including school buses, public works trucks, and maintenance vehicle, and for public transit fleets, thus demonstrating the viability of EVs to residents and local businesses.

Widespread use of EVs would also require an expanded network of fast and reliable EV charging stations to support charging demand. Therefore, this measure includes the planning and deployment of EV charging infrastructure. Expanded markets for biofuels, and for other alternative/zero emissions fuels such as hydrogen are also included to promote fuel switching for vehicle types that are harder to electrify.

The benefits of this program may include improved air quality and increased opportunities for employment in EV deployment. Many of the counties in the Hampton Roads MSA lie within Virginia, which has zero emissions vehicle (ZEV) adoption standards that require manufacturers to increase the proportion of EVs available for sale, which may help scale EV deployment.

Progress to Date and Future Activities and Milestones

Numerous localities in the MSA have already begun investments in EVs and EVSE, and this measure would support and expand such actions. HRT operates six electric public buses.[46] Additionally, as of December 2023, there were 261 EV Charging stations in Hampton Roads, including some constructed by James City County, Newport News, and York County. Virginia Beach and Norfolk had the highest number of EV charging stations out of the cities in the MSA. One of the strategies identified in the City of Norfolk's Climate Action Plan focused on encouraging businesses to adopt EVs and develop EV charging infrastructure.[47] Locality efforts to fund additional EV and charging infrastructure include the City of Hampton's application to the DOT's Charging and Infrastructure Grant program and Gloucester County's application with Bay Transit to support an EV charging station.

Virginia is investing in statewide EV infrastructure, a key factor in widespread EV adoption, with significant funding through the National Electric Vehicle Infrastructure (NEVI) Program, including along alternative fuel corridors within the MSA, such as Interstate 64. The Commonwealth provides several incentives to residents and public agencies related to EVs and alternative fuels. The Congestion Mitigation and Air Quality Improvement (CMAQ) program offers up to $10,000 to state agencies and local governments for the incremental cost of new or converted alternate fuel vehicles (AFVs).[48] The Virginia Department of Motor Vehicles established an Electric Vehicle Rebate Program

[46] Hampton Roads Transit. 2024. *HRT is Modernizing with Advanced EV Technology*. https://gohrt.com/2021/05/hrt-goes-electric/
[47] City of Norfolk. 2019. *Mayor's Advisory Commission on Climate Change Mitigation and Adaptation.* https://www.norfolk.gov/DocumentCenter/View/56485/Mayors-Advisory-Commission-on-Climate-Change-Mitigation-and-Adaption-Climate-Action-Plan-2019?bidId=
[48] Virginia Clean Cities. 2024. *CMAQ Vehicle Fuel Conversion Incentive Program.* https://vacleancities.org/reports-2/cmaq-incentive-program/

in 2022 effective until 2027 that offers rebates of $2,500 for residents who purchase EVs, new or used, from participating dealers.[49] However, the program has not been funded by the General Assembly.[50]

In addition to continuing the activities described above, the following example actions are considered for Measure 3 implementation. These actions are illustrative and not intended to be exhaustive of all actions that could be used to implement this measure.

- **Plan for and map of optimal locations for EVSE on commercial corridors, shelters, evacuation routes, etc**. This map could show both public and private property areas of interest.
- **Develop goals for agency and locality fleets and transit for EV procurement.** These goals could be based on current vehicle turnover policies and operational requirements.
- **Identify opportunities for paired deployment of renewable energy systems and EVSE at public facilities.**
- **Make investments to meet turnover and charging goals, including the purchase of EVs and EVSE for use by local agencies.**
- **Support broader EV adoption and explore opportunities for public use of EVSE.** Expansion to the regional charging network could be targeted for public fleet use and for use by private residents.

Geographic Coverage

As this measure will be carried out by Cities and Counties across the MSA, all areas within the MSA and in neighboring regions will benefit from steps to deploy EVs across the MSA. The actions within this measure are focused on the entire MSA area. The overall measure is specific to the MSA and not meant to encompass a broader or smaller geographic area.

Quantified GHG Reductions ($MTCO_2e$)

PCAP Measure	GHG reductions (MTCO2e), 2025-2030	GHG reductions (MTCO2e), 2025-2050
Develop an electric vehicle (EV) procurement plan and electric vehicle supply equipment (EVSE) deployment strategy to support the adoption of EVs.	1,571,396	58,727,298

Details about the GHG reduction calculations approach are provided in Appendix B.

Benefits

This measure will improve air quality through reduced emissions of nitrogen oxides (NOx), volatile organic compounds (VOCs), fine particle pollution (PM2.5), and sulfur dioxide (SO_2) as a result of transition away from fossil fuel based internal combustion engines. When paired with clean and

[49] Code of Virginia. 2021. *Article 8. Electric Vehicle Rebate Program. § 45.2-1726*. https://law.lis.virginia.gov/vacodefull/title45.2/chapter17/article8/
[50] Virginia Energy. 2021. *Sustainable Transportation.* https://energy.virginia.gov/renewable-energy/Transportation.shtml

renewable electricity, air pollution benefits will be amplified. According to a study from the American Lung Association, potential improvements in air quality as a result of Advanced Clean Cars II and a non-combustion power grid could result in health benefits of $25 billion, 2,340 avoided premature deaths, 60,600 avoided asthma attacks, and 299,00 avoided lost days of work.[51]

LIDAC Benefits

As this measure will be carried out by Cities and Counties across the MSA, all LIDACs within the MSA and in neighboring regions will benefit from steps to deploy a strategy to support the adoption of EVs across the MSA. A list of the LIDAC Census tract IDs is found in Appendix C.

Benefits for LIDACs within the MSA may include improved air quality resulting from potential reductions in vehicular emissions, especially as public transit fleets and buses transition to EVs, as well as potential health improvements including reductions in new asthma cases, hospital admissions, and emergency department visits. Additional benefits could include reduced noise pollution and reduction in fuel use by disadvantaged communities, particularly for LIDACs that are highway adjacent. Job training programs could also be focused in LIDACs to support the deployment of new charging and fueling infrastructure installation and maintenance; but these benefits may be balanced out by the potential decline in existing jobs for internal combustion engine maintenance.

Cost barriers to accessing EVs and ZEVs still exist for LIDACs, so programs and incentives may be expanded or designed to help overcome these barriers.

Implementation Considerations

Key Implementing Agency(ies)

- **Dominion Energy.** Engaging with the utility for the MSA will be important to ensure electrical grid stability and reliability to support increased electric loads from electrification.
- **Regional planning organizations.** Regional planning organizations can coordinate the implementation of EVSE network plans
- **State and local government organizations.** Organizations such as the North Carolina Department of Transportation and Virginia Department of Transportation can use federal funding to build EV charging networks and implement community-wide buying co-ops for EVs for public and private fleets as well as personal vehicles.
- **Private sector partners.** Private businesses and landowners can partner in adopting EVs and building publicly accessible charging stations on their land.

Authority to Implement

Local governments within the MSA have the authority to implement projects, per this measure, within their respective jurisdictions. This measure falls under the local governments' regulatory authority to

[51] American Lung Association. 2023. *Driving to Clean Air: Health Benefits of Zero-Emission Cars and Electricity*. https://www.lung.org/getmedia/9e9947ea-d4a6-476c-9c78-cccf7d49ffe2/ala-driving-to-clean-air-report.pdf

protect public health and welfare. To enact specific decarbonization projects, policies, and/or pilot programs, local governments may need to gain approval from a legislative bodies or other administrative authority that oversees budgets and/or regulations.

Intersection with Other Funding

Potential funding sources to support implementation of this measure are shown in the table below.

Program/Grant Name	Funding Source
Clean Energy Vehicle Tax Credit	Federal
Previously Owned Vehicle Tax Credit	Federal
Clean Commercial Tax Credit	Federal
Alternative Fuel Vehicle Refueling Property Tax Credit	Federal
NEVI Formula Program	Federal
Charging and Fueling Infrastructure Grants	Federal
Diesel Emissions Reduction Program	Federal
Clean Heavy-Duty Vehicle Program	Federal

Potential Metrics

Potential metrics to measure progress under this measure are listed below.

Output metrics:

- Number of new fast chargers installed
- Number of EVs purchased for public fleets

Outcome metrics:

- Percent of new vehicles sales that are EVs
- Percentage of government fleets that are EVs

Measure 4.

Reduce vehicle miles traveled and support alternative modes of transportation through bike/pedestrian infrastructure investments.

This measure aims to reduce vehicle miles traveled (VMT) by enabling access to alternative modes of transportation such as bicycle and pedestrian trails. Updates to infrastructure such as changes to roadway design, implementation of priority bus/transit lanes, and the creation and maintenance of pedestrian and bicycle pathways.

Progress to Date and Future Activities and Milestones

The HRTPO published the 'Regional Active Transportation Plan'[52] in 2020 and the 'Transportation Improvement Program 2024-2027'.[53] The Regional Active Transportation Plan identified the following recommendations to improve multimodal transportation in the MSA: adopting 'Complete Streets Policies', improving pedestrian and cyclist safety, and designating half-mile zones around school buildings for pedestrian infrastructure.

Additionally, the Birthplace of America Trail is a planned multi-use that will connect the Virginia Capital Trail with the South Hampton Roads Trail in Eastern Virginia, aiming to be a significant piece of active transportation infrastructure in the Hampton Roads MSA.[54] Planning and preliminary design for the trail has been conducted as has initial community outreach. Construction of the trail extension has not yet begun. Gloucester, VA is also developing a multimodal path along Main Street that is currently under development. Additionally, the City of Hampton has also received $13 million from Federal Emergency Management Agency (FEMA) and $4 million from VDOT for trail maintenance and development.

The state provides several resources and policies supporting the advancement of alternative modes across Virginia. In 2004, Virginia adopted a Policy for Integrating Bicycle and Pedestrian Accommodations, which provides a framework for VDOT to accommodate bicyclists and pedestrians in the planning, funding, design, construction, operation, and maintenance of Virginia's transportation network.[55] VDOT also developed a Bicycle Policy Plan in 2011 and Pedestrian Policy Plan in 2014 to advance these elements from the 2004 policy.[56,57] These are supported by implementation guidance for design and construction of active infrastructure, as well as annual reports that track improvements in bicycle and pedestrian accommodations.[58]

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[52] Hampton Roads TPO. 2020. *Linking Hampton Roads: A Regional Active Transportation Plan.* Linking Hampton Roads: A Regional Active Transportation Plan | Active Transportation | Transportation Planning | Hampton Roads Transportation Planning Organization - The Heartbeat of Hampton Roads (hrtpo.org)
[53] Hampton Roads TPO. 2023. *Transportation Improvement Program FY 2024-2027.* Final FY 24-27 TIP (fliphtml5.com)
[54] Newport News. Nd. *UPC #121108 Birthplace of America Trail – Yorktown Rd SUP (From Chelsea Place to NN Park).* Project Status - City of Newport News (nnva.gov)
[55] VDOT. 2004. *Policy for Integrating Bicycle and Pedestrian Accommodations.* https://www.vdot.virginia.gov/media/vdotvirginiagov/about/programs/biking-and-pedestrian/bike_ped_policy.pdf
[56] VDOT. 2011. *State Bicycle Policy Plan.* https://www.vdot.virginia.gov/media/vdotvirginiagov/about/programs/biking-and-pedestrian/bike_ped_policy.pdf
[57] VDOT. 2014. *State Pedestrian Policy Plan*. https://www.vdot.virginia.gov/media/vdotvirginiagov/about/programs/biking-and-pedestrian/SPPP_FINAL_OnLine_LowRes.pdf
[58] VDOT. 2024. *Bicycle and Pedestrian Accommodations.* https://www.vdot.virginia.gov/doing-business/technical-guidance-and-support/transportation-and-mobility-planning/bicycle-and-pedestrian-accommodations/

The Virginia Department of Rail and Public Transit offers several grant programs to reduce VMT across the Commonwealth,[59] such as the Commuter Assistance Program, a statewide grant program for programs and projects that are both efficient and effective at increasing ridership on transit, vanpools, and carpooling.[60]

In addition to continuing the activities described above, the following example actions are considered for Measure 4 implementation. These actions are illustrative and not intended to be exhaustive of all actions that could be used to implement this measure.

- **Plan and/or map optimal locations for bike/pedestrian facilities and connecting infrastructure.** This map could be based on commercial corridors, schools, employment centers, transit routes, etc. and will show both public and private property areas of interest.
- **Support construction of bike/pedestrian facilities and regional trails.** Connecting existing trails to support a regional network could further facilitate VMT reductions.
- **Develop programs to support micromobility options.** Support could be financial or could ease permitting and local planning for options such as e-bikes or other micromobility options.

Geographic Coverage

As this measure will be carried out by cities and counties across the MSA, all areas within the MSA and in neighboring regions will benefit from steps to expand micromobility across the MSA.

The actions within this measure are focused on the entire MSA area. The overall measure is specific to the MSA and not meant to encompass a broader or smaller geographic area.

Quantified GHG Reductions ($MTCO_2e$)

PCAP Measure	GHG reductions (MTCO2e), 2025-2030	GHG reductions (MTCO2e), 2025-2050
Reduce vehicle miles traveled and support alternative modes of transportation through bike/pedestrian infrastructure investments.	41,418	371,149

Details about the GHG reduction calculations approach are provided in Appendix B.

Benefits

Co-benefits associated with improving infrastructure may include improved safety outcomes for cyclists and pedestrians, reduced transportation costs and increased wellbeing and physical health from the use of trails and other forms of active transportation.

[59] Virginia DRPT. 2024. *Our Grant Programs.* https://drpt.virginia.gov/our-grant-programs/.
[60] Virginia DRPT. 2024. *CAP (Commuter Assistance Program).* https://drpt.virginia.gov/our-grant-programs/cap-commuter-assistance-program/.

LIDAC Benefits

As this measure will be carried out by Cities and Counties across the MSA, all LIDACs within the MSA and in neighboring regions will benefit from steps to reduce VMTs and invest in bike and pedestrian infrastructure across the MSA. Appendix C includes a list of the LIDAC Census tract IDs.

Similar to Measure 3, benefits for LIDACs within the MSA may include improved air quality and health benefits that could result from potential reductions in vehicular emissions. Health benefits could also include potential reductions in new asthma cases, hospital admissions, and emergency department visits. Additional benefits may include reduced noise pollution from decreased vehicle traffic, improved access to services and amenities, increased access to more reliable and resilient transportation alternatives, and increased wellbeing and physical health from the use of active transportation. Safety could also increase in high-traffic corridors due to the increased dedicated bike/pedestrian infrastructure, and LIDAC residents could experience reduced costs of travel due to greater access of non-vehicular options.

Implementation Considerations

Key Implementing Agency(ies)

- **State and local government agencies.** Agencies such as the Virginia Department of Transportation, North Carolina Department of Transportation, and local governments can implement programs.
- **HRTPO.** As a regional planning organization, HRTPO will work to align multimodal transportation infrastructure with overarching transportation goals in the region.
- **Community groups and nonprofit organizations.** Community-based organizations can provide insight into the transportation patterns and needs of the community when developing multimodal infrastructure.
- **Private sector partners:** Private sector partners, such as land use owners, developers, and businesses play a key role in development decisions and design that affect the viability of using alternatives to driving.

Authority to Implement

City and county governments in the MSA have the authority to implement public transportation projects, policies, and/or pilot programs. To enact specific decarbonization projects, policies, and/or pilot programs, local governments may need to gain approval from a City or County Council or other administrative authority that oversees budgets and/or regulations.

Intersection with Other Funding

Potential funding sources to support implementation of this measure are shown in the table below.

Program/Grant Name	Funding Source
Surface Transportation Block Grant	Federal – Formula
Bicycle and Pedestrian Safety Program	Virginia Department of Transportation

Potential Metrics

Potential metrics to measure progress under this measure are listed below.

Output metrics:

- Completed project count and length of:
  - Shared use paths
  - Sidewalks
  - Bike lanes
  - Paved shoulder
  - Paved unpaved road
  - Other bike/pedestrian facilities
  - Bike/pedestrian design features

Outcome metrics:

- VMT per capita
- Additional miles of bicycle or pedestrian lanes added

Measure 5.

Reduce emissions from port operations through the adoption of low-carbon fuels, electric equipment, and operational changes.

This measure focuses on reducing offroad transportation GHG emissions primarily through actions to decarbonize operations and electrifying ports. On the shoreline of ports, the measure could involve deploying shore power (electric power supplied to docked ships to reduce idling), installing renewable energy, and switching to electric forklifts and other cargo handling equipment, among other activities.

As a state entity, the VPA will be implementing this measure for its facilities across the state, in alignment with the Virginia PCAP, not just for its facilities and operations within the boundary of the Hampton Roads MSA.

Progress to Date and Future Activities and Milestones

In 2013, EPA awarded $750,000 to the VPA to replace diesel cargo handling equipment with hybrid diesel-electric equipment.[61] The port replaced three Tier 1 shuttle carriers with Tier IV diesel-electric carriers three to five years ahead of schedule. The updated shuttles are more fuel-efficient, cleaner, quieter, and save on costs. VPA announced their commitment to become net zero by 2040, and in 2022 released a sustainability report detailing their progress and future decarbonization targets.[62] This includes a goal to source all their energy from clean sources by 2024. VPA has replaced diesel carrier shuttles with hybrid shuttles and plans to electrify yard tractors, develop an offshore wind energy hub, and implement a living shoreline project.

In addition to continuing the activities described above, additional example actions for Measure 5 implementation are listed below. These actions are illustrative and not intended to be exhaustive of all actions that could be used to implement this measure.

- **Source clean energy for port operations.** As discussed above, VPA has met their 2024 goal of utilizing 100% clean energy sources.
- **Continue to fund the port's green operator dray truck replacement program.**
- **Design, deploy and use programs and incentives to decarbonize ports/port electrification.**
- **Explore expanding I64 barge operations to reduce VMT of port-supporting vehicles.** The barge provides an alternative to truck transport and saves on emissions compared to diesel dray trucks.
- **Evaluate potential for the provision of shore power or alternative fuels to reduce emissions from oceangoing vessels.**
- **Fund port equipment transitions to lower emissions models**.

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[61] EPA. 2023. *Virginia Port Authority Hybrid Shuttle Carriers Reduce Costs and Air Emissions.* https://www.epa.gov/ports-initiative/virginia-port-authority-hybrid-shuttle-carriers-reduce-costs-and-air-emissions

[62] The Port of Virginia. 2022. *Sustainability Report: Net-Zero by 2040*. https://www.portofvirginia.com/wp-content/uploads/2023/09/Port-of-VA-Sustainability-Report_2023_12pgs.pdf

Geographic Coverage

This measure aligns with statewide port emissions reductions goals, though only the following Port of VA-operated facilities are located in the Hampton Roads MSA, VPA will be holistically reducing emissions and implementing actions throughout all of its facilities.

Quantified GHG Reductions ($MTCO_2e$)

PCAP Measure	GHG reductions (MTCO2e), 2025-2030	GHG reductions (MTCO2e), 2025-2050
Reduce emissions from port operations through the adoption of low-carbon fuels, electric equipment, and operational changes.	34,295	116,164

Details about the GHG reduction calculations approach are provided in Appendix B.

Benefits

Shifting away from diesel will reduce emissions of NOx, PM2.5, CO, and other air toxics. Reduction in ground level ozone will also be realized.[81]

LIDAC Benefits

As this measure will be carried out by Cities and Counties across the MSA, all LIDACs within the MSA and in neighboring regions will benefit from steps to reduce emissions from port operations across the MSA. A list of the LIDAC Census tract IDs is found in Appendix A.

Within the Hampton Roads MSA, overlaps between locations of ports and LIDACs exist. Through implementing this measure, benefits for port adjacent LIDACs will include improved air quality and health benefits resulting from potential reductions in offroad emissions, as well as potential reductions in new asthma cases, hospital admissions, and emergency department visits and reduced light and noise pollution.

Implementation Considerations

Key Implementing Agency(ies)

- **VPA.** VPA owns and operates (through its private operating subsidiary, Virginia International Terminals, LLC) four general cargo facilities Norfolk International Terminals, Portsmouth Marine Terminal, Newport News Marine Terminal, and the Virginia Inland Port in Warren County. The port also leases and operates the Viginia International Gateway and Richmond Marine Terminal (outside the MSA).
- **Dominion Energy.** The utility provider for the MSA, Dominion plays a crucial role in helping to connect and manage loads and renewable energy opportunities for port operations.
- **Trade groups.** Trade groups will implement the infrastructure updates specified in this measure.

- **Private sector partners.** Private companies and landowners with property near port infrastructure may need to be engaged to coordinate land-use planning. VPA has good relationships with other private sector partners including original equipment manufacturers which play a vital role in efforts covered by this measure.
- **Community colleges.** VPA works with Tidewater Community College to provide necessary training for technical operators and maintenance technicians.
- **Regional planning agencies.** The HRPDC has previously provided support to VPA.

Authority to Implement

VPA has the authority to modify its infrastructure and acquire low-emission equipment and systems used within their facilities as described under this measure.

Intersection with Other Funding

Potential funding sources to support implementation of this measure are shown in the table below.

Program/Grant Name	Funding Source
Alternative Fuel Vehicle Refueling Property Tax Credit	Federal – Formula
EPA Diesel Emissions Reduction Act (DERA): The VPA's hybrid shuttle carriers program has received funding from the EPA through DERA. This program provides incentive funding for projects focused on reducing diesel emissions from old heavy-duty diesel engines that do not meet the newest highway and nonroad engine emission standards	Federal – Formula
EPA Clean Ports Program: The IRA provides $3 billion to fund zero-emission port equipment and technology and to help ports develop climate action plans to reduce air pollutants	Federal – Competitive
Rebuilding American Infrastructure with Sustainability and Equity (RAISE): This federal grant program also offers $1.5 billion in funding for projects at the state and local levels. The eligibility requirements of RAISE allow project sponsors to obtain funding for projects that may be harder to support through other U.S. DOT grant programs	Federal – Competitive
Clean Heavy-Duty Vehicle Program	Federal – Formula
Clean Vehicle Tax Credit	Federal – Formula

Potential Workforce Development Activities

The MSA may need to conduct workforce development activities to train equipment operators and maintenance technicians to enable the electrification of port infrastructure.

Potential Metrics

For the Port of Virginia, VPA is already tracking the following metrics:

- CO_2e tons per 10,000 twenty-foot equivalent unit (TEU)
- Fuel gallons per 10,000 TEU
- Percent electric equipment
- Virginia International Gateway turn-time
- Norfolk International Terminals turn-time

Measure 6.

Reduce GHG emissions through improved equipment efficiencies, increased methane capture at waste facilities, and organic waste diversion.

In the Hampton Roads MSA, the waste sector, which includes landfills, waste incineration, and wastewater treatment facilities, accounts for a notable quantity of GHG emissions, including both methane and carbon dioxide. Though not the highest emitting sector in the MSA, waste emissions are still significant and addressing them will provide multiple benefits to communities, including reduced air pollution in LIDACs.

This measure aims to decrease GHG emission by increasing waste diversion rates through programs such as composting, use of alternative technologies to remove recyclable materials and organics from the waste stream, improved handling of organics (possibly including use of pyrolysis to produce biochar), process improvements, and sharing resources and best practices. Proposed actions within this measure focus on increased access to composting and support of other waste diversion practices, sharing of resources and waste management best practices along with waste facility process and efficiency improvements. Expanded methane-capture technology installation and waste technology innovations are also included. These actions and programs will reduce emissions from the waste sector.

Progress to Date and Future Activities and Milestones

In 2022, the SPSA member localities recycled 381,000 short tons of Primary Recyclable Materials (PRM). Also in 2022, the member localities of the Virginia Peninsulas Public Service Authority (VPPSA) recycled 121,000 short tons of PRM. HRPDC published a Regional Solid Waste Management Plan (RSWMP) in 2020 with the RSWMP for Southeastern Virginia 2020-2025 that specifies that municipal governments within the MSA are implementing recycling programs to divert solid waste to varying degrees. Some municipalities, such as Norfolk, Franklin, and Virginia Beach offer curbside recycling collection programs on a biweekly or monthly basis, while municipalities such as the City of Portsmouth and Chesapeake have discontinued curbside recycling programs and only operate recycling drop-off locations. The Isle of Wight County, City of Norfolk, and City of Virginia Beach operate some composting programs for yard waste, while other municipalities do not yet offer composting services or send yard waste to the landfill.

There is a renewable natural gas facility operating at the Suffolk landfill using methane captured at the landfill.[63] In addition, the Big Behel Landfill in Hampton has a methane capture system.

In addition to continuing the activities described above, additional potential example actions for Measure 6 implementation are discussed below. These actions are illustrative and not intended to be exhaustive of all actions that could be used to implement this measure.

[63] WHRO. 2023. *From trash to fuel: Hampton Roads landfill aims to cut carbon footprint while making natural gas*. https://whro.org/news/local-news/42114-spsa-landfill-renewable-natural-gas-facility

- **Support composting and other waste diversion programs**. This measure could entail creating or implementing waste diversion programs and providing resources for localities regarding such programs.
- **Utilization of automated systems to remove recyclable and organic materials from the waste stream.** These measures would likely be coupled with pyrolysis to produce biochar from organic waste.
- **Expand and/or upgrade methane capture systems at landfills and expand the beneficial use of digester methane gas.**
- **Develop a Model Ordinance and support programs to reduce construction and demolition waste through building reuse, deconstruction, and material diversion and reuse.** Model ordinances can help expand waste best practices more easily to other jurisdictions.
- **Pilot projects the HRSD wastewater treatments facilities including PdNA treatment and exploration of pyrolysis at the Atlantic Treatment Plant to convert a portion of biosolids into biochar.**
- **Closing incineration facilities to decrease emissions from waste burning.**

Geographic Coverage

As this measure will be carried out by Cities and Counties across the MSA, all areas within the MSA and in neighboring regions will benefit from steps to increase equipment efficiency and decarbonize the waste sector across the MSA.

The actions within this measure are focused on the entire MSA area. The overall measure is specific to the MSA and not meant to encompass a broader or smaller geographic area.

Quantified GHG Reductions ($MTCO_2e$)

PCAP Measure	GHG reductions (MTCO2e), 2025-2030	GHG reductions (MTCO2e), 2025-2050
Reduce waste-related emissions through improved equipment efficiencies, increased methane capture at waste facilities, and organic waste diversion.	776,894	7,419,118

Details about the GHG reduction calculations approach are provided in Appendix B.

Benefits

Co-benefits of this measure include GHG emissions reductions, improved indoor and outdoor air quality resulting in improved public health, and cost savings to municipal governments where waste processes improve efficiency or where waste volume is decreased.

LIDAC Benefits

As this measure will be carried out by Cities and Counties across the MSA, all LIDACs within the MSA and in neighboring regions will benefit from steps to reduce waste-related emissions across the MSA. A list of the LIDAC Census tract IDs is found in Appendix A.

This measure will result in co-benefits for LIDACs. It will result in improved air quality, which will improve public health outcomes, especially for those marginalized communities that have historically shouldered a disproportionate amount of air pollution from the waste sector.

Implementation Considerations

Key Implementing Agency(ies)

- **HRSD.** Providing wastewater treatment to 18 Cities and Counties in southeastern Virginia, HRSD will be crucial in implementing wastewater process improvements as part of this measure.
- **Local government organizations.** Local government organizations such as Public Works Departments and other relevant agencies such as SPSA and Virginia Peninsulas Public Service Authority (VPSA) that manage landfills, solid waste management, and wastewater management.
- **State government agencies.** Agencies such as the VA Department of Professional Occupational Regulation provide licensing for wastewater facilities.
- **Private sector partners.** Privately owned waste treatment facilities can be voluntarily involved in emissions savings measures, or implementers can incentivize their involvement.

Authority to Implement

HRSD and landfill facility operators have the authority to implement improvements at their facility locations. City and county governments in the MSA have the authority to implement waste projects, policies, and/or pilot programs. To enact specific decarbonization projects, policies, and/or pilot programs, local governments may need to gain approval from a City or County Council or other administrative authority that oversees budgets and/or regulations.

Intersection with Other Funding

Potential funding sources to support implementation of this measure are shown in the table below.

Program/Grant Name	Funding Source
EPA Solid Waste Infrastructure Recycling Grant Program	Federal
EPA Consumer Recycling Education and Outreach Grant Program	Federal
U.S. Department of Agriculture Rural Energy for America Program Renewable Energy Systems & Energy Efficiency Improvement Guaranteed Loans and Grants	Federal

Potential Workforce Development Activities

Workforce development may be needed to train waste facilities staff in new processes and provide licensing for updated measures. Staff capacity may also need to be increased at composting and wastewater treatment facilities.

Potential Metrics

Potential metrics to measure progress under this measure are highlighted below.

- Weight of waste diverted from landfills or incineration facilities
- Weight of materials composted

Measure 7.

Increase opportunities for carbon sequestration through tree planting, protecting, and restoring high-carbon coastal habitats, wetlands, and forest lands.

Maintaining natural lands and habitats throughout the Hampton Roads MSA is essential to support critical ecosystem services such as cleaning air and water resources. In addition, natural lands have the potential to sequester carbon, further reducing atmospheric carbon. This measure focuses on increasing carbon capture and sequestration through policies, practices, and programs by expanding tree plantings and through additional studies of the potential opportunities for increased sequestration through the MSA. Actions included in this measure aim to increase tree canopy in the short term and explore and plan for supplementary long-term strategies to increase carbon sequestration in coastal areas, estuaries, and maritime ecosystems.

Implementing carbon sequestration strategies will significantly reduce total GHG emissions in the MSA and will yield social economic, and environmental benefits for all residents, including LIDACs. Wetlands and coastal habitats are prevalent in the Hampton Roads MSA and are of particular interest for the sequestration studies in this measure.

Progress to Date and Future Activities and Milestones

At the state level, significant progress has been made in increasing opportunities for carbon capture and sequestration in restored and preserved natural lands. The Virginia Natural Landscape Assessment (VaNLA) is a network of natural lands that was developed by the Virginia Natural Heritage Program within the Virginia Department of Conservation and Recreation.[145] The VaNLA provides a landscape-scale geospatial analysis for identifying, prioritizing, and linking natural lands using land cover data from satellite. The VaNLA has many potential applications and can be used in the Hampton Roads MSA to aid carbon sequestration studies and planning efforts, helping implement this measure through the identification and prioritization of large core areas for carbon sequestration potential.

Additionally, as part of the Chesapeake Bay Phase III Watershed Implementation Plan, Virginia DEQ quantified carbon sequestration co-benefits of best management practices (BMPs) using the Department of Agriculture's Carbon Management & Emissions tool (COMET). These BMPs can be used at the MSA level and cover natural (e.g., tree and forest practices) and working land areas (e.g., tilling and grazing) in both rural and urban settings. Using existing BMPs will help amplify the success of carbon sequestration efforts for localities throughout the Hampton Roads MSA. The MSA has also submitted an application for a NOAA grant to determine the carbon sequestration potential for the Back River Estuary.

Additionally, the City of Chesapeake recently developed an industrial waterfront study to combat sea level rise and plans to create recreation and conservation zones in the creeks and naturalized areas of the Southern Branch of the Elizabeth River.[64]

[64] City of Chesapeake. 2024. *Chesapeake Industrial Waterfront Study.* https://www.cityofchesapeake.net/DocumentCenter/View/16752/Chesapeake-Industrial-Waterfront-Study-Draft-PDF?bidId=

In addition to continuing the activities described above, additional potential example actions for Measure 7 implementation are discussed below. These actions are illustrative and not intended to be exhaustive of all actions that could be used to implement this measure.

- **Study and evaluate opportunities for enhancing carbon sequestration throughout the Hampton Roads MSA, including on public lands and port facilities.**
- **Support the expansion of tree canopy and greenspace.** Support could include establishing expansion goals and potential implementation strategies for tree canopies in urban and rural areas. Additional tree canopy expansion programs could also be developed at the locality or regional levels.
- **Support ongoing state efforts to enhance carbon stocks in wetlands, coastal lands, and coastal estuaries.** Coastal ecosystems are particularly prevalent and important in the Hampton Roads MSA, and this measure will help support implementation of DEQ's Chesapeake Bay Phase III Watershed Implementation Plan identified actions in the MSA.
- **Explore opportunities to protect and restore high-carbon coastal habitats and wetlands and protect, restore, use, and develop agricultural and forest lands.**
- **Support source water protection efforts.**

Geographic Coverage

The actions within this measure are focused on the entire MSA area. The overall measure is specific to the MSA and not meant to encompass a broader or smaller geographic area. Sequestration opportunities in urban, suburban, and rural lands will be explored.

Quantified GHG Reductions ($MTCO_2e$)

PCAP Measure	GHG reductions (MTCO2e), 2025-2030	GHG reductions (MTCO2e), 2025-2050
Increase opportunities for carbon sequestration through natural and working lands, including forestry, wetlands, and coastal ecosystems.	8,480	61,489

Details about the GHG reduction calculations approach are provided in Appendix B.

Benefits

Protection and restoration of natural and working lands will reduce CO_2 emissions and improve air and water quality of the surrounding areas. Tree planting will have similar effects and can also support reduced urban heat island effect through natural cooling as well as improve stormwater management and reduce flooding.

LIDAC Benefits

As this measure will be carried out by Cities and Counties across the MSA, all LIDACs within the MSA and in neighboring regions will benefit from steps to reduce VMTs and invest in bike and pedestrian infrastructure across the MSA. A list of the LIDAC Census tract IDs is found in Appendix A.

Implementation of this measure will also result in benefits to LIDACs across the MSA, such as improved air and water quality due to increased filtration by trees, an increase in employment opportunities in tree care and maintenance, and improved resilience to increases in temperature as trees protect against the urban heat island effect. Residents may also see a decrease in the cost burden of energy to cool their homes during high temperature days as an increased tree canopy provides cooler temperatures throughout the neighborhood and specifically to dwellings with yard and street trees. Increased greening and tree planting can also increase wellbeing and improve mental health.

Implementation Considerations

Key Implementing Agency(ies)

- **Local governments and municipalities.** Operate land and conservation programming and policies within their jurisdictions. These entities can also support tree planting programs and goals.
- **Virginia DEQ.** Provides programming, funding opportunities, and technical assistance in conservation and maintenance of natural and working lands.
- **Virginia Department of Forestry.** Provides programming, funding opportunities, and technical assistance for forest conservation.
- **DCNR.** Provides programming, funding opportunities, and technical assistance in conservation and maintenance for Virginia's state parks and natural area preserves.
- **Local universities.** Studies on carbon reductions from natural sequestration and capture can support funding and potential programming.
- **Local non-governmental environmental organizations.** The Nature Conservancy, the Sierra Club, Chesapeake Bay Foundation, Wetlands Watch, James River Association, Elizabeth River Project, Virginia Forestry Association, and other NGOs provide programming, funding opportunities, and technical assistance in conservation and maintenance of natural and working lands.
- **Private sector partners.** Private landowners will be key partners for implementing changes to land use and forestry practices on their land to increase the region's carbon sequestration capacity.
- **Local organizations and nonprofits.** Local and community-based organizations and nonprofits provide valuable insight into strategically positioning trees to support LIDACs.

Authority to Implement

The responsibility for expanding, preserving, or developing tree canopy on public land usually lies with the governing body of the jurisdiction that owns the land, such as a state natural resources or forestry agency. To enact specific natural sequestration projects, policies, and/or pilot programs, local governments may need to gain approval from a city or county council or other administrative authority that oversees budgets and/or regulations.

Intersection with Other Funding

Potential funding sources to support implementation of this measure are shown in the table below.

Program/Grant Name	Funding Source
Urban and Community Forestry Grants	Federal – Competitive

Potential Metrics

Potential metrics to measure progress under this measure are highlighted below.

Output metrics:

- Acreage of planned implemented BMPs
- Number of trees planted

Outcome metrics:

- Tons of CO_2e sequestered from baseline
- Percent of green space in restored and preserved natural lands

6. Moving Forward

Implementation Grants

Hampton Roads will be eligible to participate in the general competition for CRPG implementation grants, competing against states, municipalities (including other MSAs), tribes, tribal consortia, and territories for up to $4.6 billion in funding.[65] Implementation grant applications are due April 1, 2024, with awards anticipated by the end of 2024.

Comprehensive Climate Action Plan

Recipients of a PCAP planning grant must submit a CCAP two years after the date of the PCAP award (July 2025). The CCAP expands upon the PCAP, adding more information and a finer level of details to information in the PCAP. Hampton Roads' CCAP will include additional modeling to map priority measures. Per EPA's guidance, the CCAP should cover all significant GHG sources and sinks in relevant sectors, create both short-term and long-term GHG emission reduction targets, and articulate a comprehensive set of measures to achieve the targets.[66] The CCAP must include the following sections:

- GHG Inventory
- GHG Emissions Projections
- GHG Reduction Targets (short- and long-term)

[65] US EPA. 2023. *CPRG Implementation Grants*. https://www.epa.gov/inflation-reduction-act/cprg-implementation-grants.
[66] US EPA. 2023. *Climate Pollution Reduction Grants Program: Formula Grants for Planning*. EPA CPRG Planning Grants Program Guidance for States-Municipalities-Air Agencies 03-01-2023

- Quantified GHG Reduction Measures (comprehensive)
- Benefits Analysis
- Low-Income/Disadvantaged Communities Benefits Analysis
- Review of Authority to Implement
- Intersection with Other Funding Availability
- Workforce Planning Analysis
- Next Steps/Future Budget and Staffing Needs

Additionally, at the end of the four-year grant period (approximately mid-2027), states must submit a Status Report. This report must include:

- The implementation status of the quantified GHG reduction measures from the CCAP;
- Relevant updated analyses or projections supporting CCAP implementation;
- Next steps and future budget or staffing needs to continue CCAP implementation.

Appendix A: Community Engagement Resources

LIDAC Survey

The following is the survey report for the LIDAC questionnaire that was distributed to the Technical Committee, Steering Committee and CAC.

Respondents

Twenty-two responses were received as of February 6th, 2024.

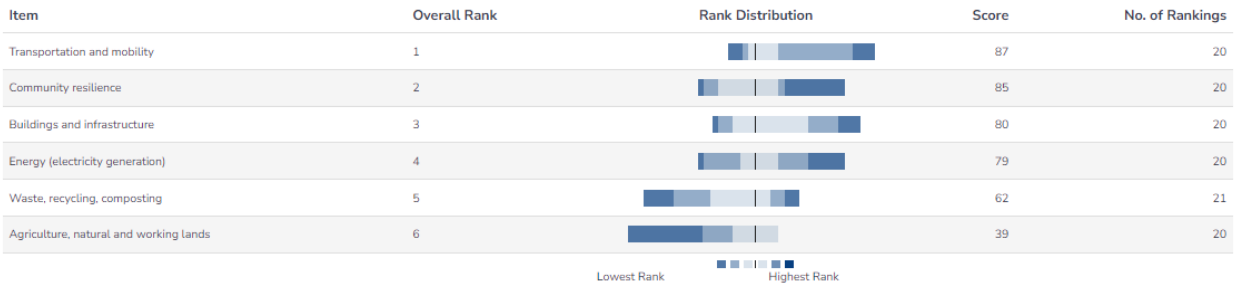
Name	Organization	Region	Committee	Email	Date
Beth Mertz-Guinn (#6, #31)	York County	Virginia	CPRG	elizabeth.mertz-guinn@yorkcounty.gov	01.30 02.06
Gabe Diaz	Diversity, Equity and Inclusion- City of Hampton	Hampton, VA		Gabe.diaz@hampton.gov	01.30
Lamont Curtis	City of Newport News	Virginia	Director of Utilities, Cit. Adv.	curtislw@nnva.gov	01.30
Darryll D Lewis	City of Suffolk	Virginia		dlewis@suffolkva.us	01.30
Mark Podolinsky	City of Virginia Beach	Virginia		mpodolin@vbgov.com	02.01
Vivian Oden	Hampton Roads Community Foundation (1)	Southside		voden@hamptonroadscf.org	02.02
Linda Rice	Hampton Roads Community Foundation (2)	Virginia		lrice@hamptonroadscf.org	02.02
Ruth McElroy Amundsen	Norfolk Solar	Norfolk		rma@cox.net	02.04
25		Virginia Beach	CAC		02.04
Garry Harris	Sustainability Solutions Group and Institute/ Center for Sustainable Communities	Hampton Roads/ Southside/ Portsmouth	CAC	gharris@htsenterprise.com	02.05

	ECO District Hampton Roads				
Edith White	Hampton Roads Community Action Program			edithwhite@hrcapinc.org	02.05
Hunter Noffsinger	Sierra Club Virginia Chapter	Hampton Roads	Steering committee	hunter.noffsinger@sierraclub.org	02.06
Mark Geduldig-Yatrofsky	HRPDC/TPO	Virginia	CAC	magyforthepeople@cox.net	02.06
Ava Lovain	VA DEQ	RVA (central office)	Steering	Anna.lovain@deq.Virginia.gov	02.06
Tom Ballou	Virgia DEQ	Statewide	CPRG Steering Committee	Thomas.ballou@deq.Virginia.gov	02.06
Scott Smith	Hampton	Hampton Roads	CPRG Technical and Steering Committee	Scott.smith@hampton.gov	02.06
Jennifer Privette	City of Newport News	Hampton Roads - Peninsula	Steering/technical	privettejo@nnva.gov	02.06
Megan Hale	City of Norfolk	Hampton Roads		megan.hale@norfolk.gov	02.06
Andrea Case	James City County	Peninsula		andrea.case@jamescitycountyva.gov	02.07
Barbara Gavin	Elizabeth River Project	Elizabeth River Watershed	None- forwarded to me by committee member	bgavin@elizabethriver.org	02.07

Anne Creasy	Sierra Club Virginia Chapter	Norfolk + All of Hampton Roads	Planning	ann.creasy@sierraclub.org	02.08
Dianna Lynn Howard	Virginia Beach Tea Party	VA	CAC	dianna.howard@cox.net	02.08
Tyla Matteson	Sierra Club (3)	Hampton Roads	CPRG Stakeholder	tmatteson1@mindspring.com	02.09

Question Responses

1. Please rank the six proposed focus areas, based on their importance for the community in which your organization works:



2. Do you have specific recommendations for climate action strategies, projects, or actions, based on these focus areas?

Comment Themes:

- Solar
  - Increase funding for rooftop repairs, retrofitting roofs for solar panel installations, and solar installations.
  - Increase funding for educating communities about utilizing funding sources for solar installations.
  - Establish a community solar program.
  - Increase coordination around reducing regulatory hurdles.
- Transportation
  - Expand clean transportation modes and supporting infrastructure.
  - Increase the number of charging stations for EVs.
  - Electrify fleets.
  - Install EV charging stations in LIDACs.
- Buildings
  - Implement energy efficiency programs, retrofits, and standards for affordable housing, government-owned buildings, commercial, residential, and schools.
- Natural Land Usage
  - Create and expand carbon capture on natural lands.

    - Increase reforestation, tree canopy restoration.
- Energy
    - Advance waste-to-energy programs.
    - Further transition from non-clean or non-renewable energy sources to clean and renewable energy sources.
    - Invest in modernizing battery storage for renewable energy sources.
    - Apply efficient electrification in LIDAC residential areas as well as public buildings.
- Programs and funding
    - Identify funding for upgrading or providing weatherization resources in LIDACs.
    - Move to performance-based contracting.
    - Conduct public residential education on energy programs and opportunities.

Lamont City of Newport News	Waste to energy
City of Virginia Beach	I think Hampton Roads needs to work together. Whether it be energy, transportation, waste reduction or community resilience we would be better working as one.
Norfolk Solar	Fight Dominion efforts to stifle solar, both through the SCC James City County's, solar-friendly legislation, and shareholder resolutions and input at shareholder meetings. Educate more people on how to use investor dollars to install solar at no cost to sites. Implement solar consumer protections such as other states have. Remove solar limits in VA such as the cap on PPAs for solar installs less than 50 kW, and the limit on overall net-metered renewable and distributed solar. Encourage all cities go to the SolarAPP+ for solar permitting – eliminate permitting barriers. Eliminate the requirement that Dominion has instituted to submit the insurance declarations page for any solar install before the NMIN is submitted. Legislate to take away Dominion's power to set up barriers to weatherization and bill payment programs – currently there is no oversight on implementation – Dominion is supposed to spend millions per year on weatherizing low-income homes, and yet very few people sign up because Dominion has made the process so convoluted. Set up a better system for splitting the money for weatherization between DHCD and Dominion funds – no one understands the current system, and Dominion takes advantage of that. I highly recommend that folks attend the annual Dominion shareholder meeting (usually first week in May). I think it is really eye-opening to attend their shareholder meeting and see what really matters to them when they are speaking out of the public eye.

	Go to Performance Based Contracting so that utilities have an incentive to use less electricity. Create legislation that all RFPs for certain kinds of work (e.g., solar installs, offshore wind, weatherization, municipal renovation, energy efficiency retrofits) must include clauses that lead to hiring of minorities and/or members of marginalized communities. Can be done by specifying in RFP that percentage of hires must be from Enterprise Zones, Qualified Opportunity Zones, low-income residents (as per HUD definition), marginalized neighborhoods, minorities, HBCU graduates, etc. Write legislation that utilities have to include EV battery storage as a consideration in their 10-year plan. Dominion had as of their last IRP [Integrated Resource Plan] expressly excluded all consideration of EV batteries as a storage option in their IRP (which covers the next 15 years). Legislate some efficiency practices such as that public buildings like municipal offices and banks keep air-conditioning set at or above 78F in the summer, and should not maintain a temperature above 55F in winter when unoccupied (from federal rules). Require that state and federal agencies in Virginia supply a certain number of EV charging stations at the workplace (e.g., 1 per 500 employees to start). Require that state pension plans divest from fossil fuels Norfolk (as an example) currently does not have the personnel time available to do many of the things that our commission has put in our draft Climate Action Plan. Coordinate local environmental and social justice groups, as well as local colleges, to help with the time required to start up many of the obvious and easy ways to reduce carbon. Find funding for roof repair for roofs that need renovation before solar install Find seed funding to start first minority-owned solar installation company in Virginia
#25	More education to equip the community for what they can do and not just wait for government to act.
Sustainability Solutions Group and Institute	-Expand Weatherization, HRRS Rating and Residential Energy Efficiency Improvements -Advance Community Scale Solar and Expanded Roof Top Options -Bolster Utility Scale Energy Efficiency Program -Advance Long Term Duration Energy Storage -Clean Transportation Deployment including EVs, Clean Transit -Reforestation and Tree Planting and Natural Forest Maintenance -Advance Waste to Energy Concepts including Landfills -Advance Carbon Capture and Industrial Emissions Abatement -Standup an Education and Behavioral Energy Use Program

	-Look Beyond Carbon Reductions; Review Health Inequities, Access, Equity Among Carbon Reduction Formulation -Conduct a Comprehensive Carbon Drawdown Approach and Analysis, Solution Building -Develop a Business Compact That Advances Energy Efficiency Solutions Advance Community Resilience Hub Concepts and Deployment -Measure Air Pollution Hot Spots and Pollution Sources -Access for Cumulative Impacts at Community and Neighborhood Level from Pollution Sources
Hampton Roads Community Action Program	Increased education efforts. structural changes to homes to withstand impact of impact at no cost to residents. Access to charging stations.
Sierra Club	- All new schools and other public buildings should be built with solar-ready roofs and should be expected to have solar installed unless an energy analysis demonstrates no savings over time. - Establish a Community Solar Program that benefits low-income renters - Work with other state and local leaders and electric-sector stakeholders to develop a regional high-voltage, long-distance transmission plan to deliver 100% renewable energy to the metropolitan area - Relying on local or state law (where permissible), the metro region should establish its own climate bank to fund zero-emissions technologies in low-income and disadvantaged communities. Establishing such a climate bank can extend the availability of the funding under the IRA in perpetuity - Electrify all city vehicle fleets: The Inflation Reduction Act (IRA), Infrastructure Investment & Jobs Act (IIJA), and other federal and state programs provide significant funding to convert city vehicle fleets to electric vehicles. Local government leaders should consider CPRG funds as an opportunity to electrify municipal vehicle fleets that have not been funded through other programs. - Clean School Bus Program: IIJA provided significant funding to create a new EPA Clean School Bus program to replace existing buses with zero-emission and low-emission models. Local government leaders could consider partnerships with School Districts to use CPRG funds to speed up and expand the transition to clean, zero-emission electric buses. - Investing in clean transit: Utilize IIJA funding to purchase and/or lease zero-emission and low-emission transit buses and to construct or lease supporting facilities and equipment. - Investing in transit infrastructure: Local leaders could fund the construction of cost-effective transit infrastructure that will measurably increase transit ridership by improving speed or reliability, such as dedicated bus-only lanes. - Whole-home electric retrofit program: Establish a municipal whole-home retrofit program using CPRG Implementation Grants for electrification and leveraging other funding sources for holistic health and safety

	improvements and energy efficiency, with a focus on low-income households and environmental justice communities. - Public building retrofits: Adopt a municipal goal – to lead by example – to retrofit all public buildings to be all-electric and energy efficient by 2040. This can also include roof-top solar and EV readiness. - Embodied carbon frameworks: Adopt a framework for reducing embodied carbon in new construction, including an assessment of embodied carbon in buildings and infrastructure projects, targets for reduction, and a timeline and strategies for meeting those targets (e.g., municipal procurement of low-carbon materials, support for local reuse markets, building deconstruction requirements, historic buildings preservation requirements, waste diversion requirements, or embodied carbon requirements in building codes). - Implement a pilot or planning process to target areas for decommissioning all gas infrastructure and replace with neighborhood electrification, with an emphasis on environmental justice and low-income communities. - Programs and policies to accelerate the incorporation of efficient electric technologies and electric vehicle charging at new single-family, multi-unit, or affordable residential buildings and commercial buildings, including building codes related to electric vehicle charging
HRPDC/TPO	Push the envelope on switching away from fossil fuel power for transportation, energy production, and heating/cooling. Impose penalties for wasteful use of fossil fuels (e. g., vehicle engine idling). Discontinue government subsidies for fossil fuel exploration/production.
York County	Building efficiency
VA DEQ (2)	High potency ghg reductions Clean transportation modes and infrastructure Clean power generation Natural lands carbon capture strategies
Hampton	Reduce GHG emissions from vehicles Identify sequestration potential of coastal marshes
City of Newport News	Public building energy efficiency, regional EV infrastructure development, renewable energy, coastal resilience, transportation hubs
City of Norfolk	Expanding renewable energy access (solar, wind) and resiliency through battery storage.

	Improving government building energy efficiencies by upgrading HVAC, lighting, building green certified - focusing in LIDAC areas. Responding the EV infrastructure study by installing chargers for public/fleet use. Electrifying light duty fleet vehicles.
James City County	I would like to see work on electrification and greening our grid - adding more renewables, etc.
Elizabethe River Project	The Watershed Action Plan for the Elizabeth River prioritizes fair and equitable restoration of the Elizabeth River reducing unfair pollution burdens on underserved communities. That includes supporting a regional expansion of carbon reduction and energy efficiency goals as well as facilitating community resilience and adaptation to face rising sea levels. Another goal in the plan is for the VIMS [Virginia Institute of Marine Science] and HRPDC to potentially lead a region-wide strategy meeting with localities to create and adopt a regional plan for adapting to sea level rise. ERP and NSU are currently partnering to create a model of creative practices for engagement and empowerment of under resourced communities to address environmental challenges. An overall reduction in excess nutrients and sediments entering the river to reduce algae blooms and improve water clarity is another goal in the plan, along with assisting localities with meeting their TMDL [Total Maximum Daily Load] goals.
Sierra Club (2)	Investing in clean transit: Utilize IIJA funding to purchase and/or lease zero-emission and low-emission transit buses and to construct or lease supporting facilities and equipment. Investing in transit infrastructure: City leaders could fund the construction of cost-effective transit infrastructure that will measurably increase transit ridership by improving speed or reliability, such as dedicated bus-only lanes. Implement a pilot or planning process to target areas for decommissioning all gas infrastructure and replace with neighborhood electrification, with an emphasis on environmental justice and low-income communities. Incentive programs for implementation of end-use energy efficiency measures in existing government-owned, commercial, and residential buildings Incentive programs for the purchase of certified energy-efficient appliances, heating and cooling equipment, lighting, and building products to replace inefficient products

	Programs and policies to accelerate the incorporation of efficient electric technologies and electric vehicle charging at new single-family, multi-unit, or affordable residential buildings and commercial buildings, including building codes related to electric vehicle charging Implementation of a building energy performance management program for government-owned buildings Implementation of a new benchmarking and building performance standards Programs to promote recovery and destruction of high-global warming potential (GWP) hydrofluorocarbons (HFCs) used in existing appliances, air conditioning systems, and commercial chillers
Virginia Beach Tea Party	There is only 2 choices adapt or retreat.
Sierra Club (3)	The Virginia Chapter Sierra Club has sent you several documents which we recommend. The most important actions will be to significantly lower GHG emissions, as we realize only about 5 years remain in our earth's climate budget, after which some tipping points will be reached and could not be reversed. For Hampton Roads to do their share, a good reference is the Decarbonization Plan for Virginia by the VA Chapter Sierra Club written in January 2024. The link is: https://vasierra.club/DecarbonizationPlan.pdf

3. Is there anything you would like to tell us about these focus areas or how you chose to rank them? (Why you chose highest or lowest priorities, missing focus areas, etc.)

Comment Themes:

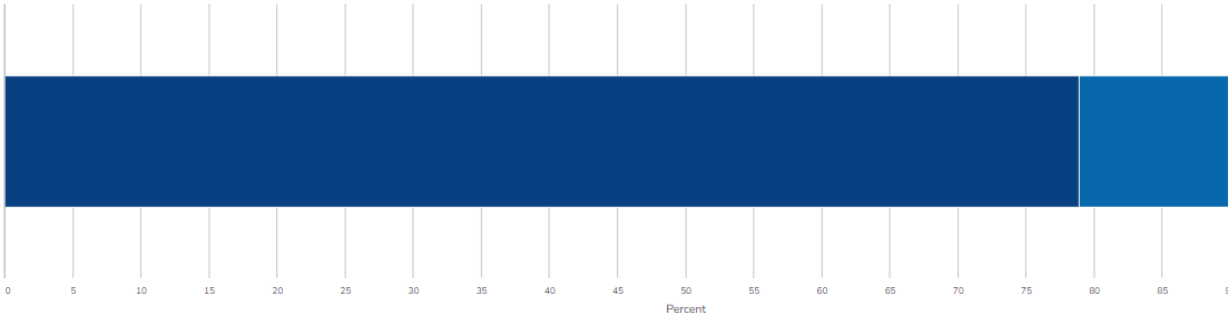
- Climate change resiliency, reducing energy consumption, and climate change impact on LIDAC communities are the top areas of concern.
- Other focus areas:
    - Education
    - Reducing energy consumption
    - Solar
    - Waste Usage (recycling, composting)
    - Weatherization

York County	No
Diversity, Equity and Inclusion-	Limited community feedback

City of Hampton	
Norfolk Solar	I think the two biggest issues are climate change and wealth inequality. Installing solar in low-wealth areas helps with both. See https://solartoday.mydigitalpublication.com/archive/?m=23867&i=803714&p=1&ver=html5 pg 50 of the Fall 2023 issue
Sustainability Solutions Group and Institute	Ranking Beyond Carbon Benefits Leading with Equity and Justice Measure Effectiveness; Per Ton of CO2 removal capability Technical Achievability Potential Achievability Health Benefits Reductions in Energy Burden Advancement in Energy Democracy Preservation of our Natural Resources Community Resilience
Hampton Roads Community Action Program	Climate change disproportionately impacts underserved communities so building resiliency is a natural first step.
Sierra Club	Weatherization and energy efficiency for low-income families will help address high energy costs while also reducing energy consumption, thus reducing greenhouse gas emissions. This should be a very high priority.
HRPDC/TPO	Public education, health, and housing are missing from the list. Education is about our climate crisis is fundamental. Housing is a significant element in fighting climate change, and the adverse health impacts of climate change are numerous. We have connections to a variety of civic organizations across the region and are working to make additional connections.
VA DEQ (2)	Based on largest emissions sectors
Hampton	1 coastal Resilience is most significant impact to our community 2. Little agriculture in our City
City of Newport News	Projects are both local and regional in needs

City of Norfolk	Ranked agriculture, natural and working lands last due to lack of areas in Norfolk. Waste, recycling and composting are extremely important, but less so than the other four categories. Transportation/mobility and Buildings/Infrastructure could be equally ranked. There's a big focus in Norfolk on reducing government building energy consumption; as we committed to 20% reduction by 2032. Resilience is our top focus area, primarily looking at flood prevention during major storm events, but also in social resilience (i.e. building food security)
James City County	Our sustainability team tends to do a lot with recycling so that is why I ranked it first.
Sierra Club (2)	One of the most effective ways to reduce carbon, is to first ensure energy isn't being wasted. Improving building and transportation efficiency is key in reducing carbon, followed quickly by looking at electricity generation and grid needs.
Virginia Beach Tea Party	Everything is about energy it fuels the machines that tills the land for food production, you can't get goods to market without trucks, it fuels the materials that power our homes, industries, business, phones, computers it is the #1 thing that powers the world we know.
Sierra Club (3)	The quickest way to lower carbon emissions is with solar, solar storage and wind energy. This clean energy will replace the energy from fossil fuels. We need a regional climate action plan to install electrification which will power electric vehicles, and heat and cool our homes and buildings. A low priority is nuclear energy, due to its prohibitive costs and lack of adequate protection from leakage. Another lower priority is planting trees and natural sequestration, although good long-term actions, will not allow us to meet carbon reduction goals in time.

4. Is your organization working or connected with any low-income or disadvantaged communities that you recommend we engage with?



Value	Percent	Responses
Yes	78.9%	15
No	21.1%	4

Totals: 19

5. Is your organization willing to partner with us in the future to connect or engage with these communities? (Please select all that apply)

Yes, and the best contact in our organization is:

#25	Edith White edithwhite1@hrcapinc.org
Sierra Club (3)	Ann Creasy, Hunter Noffsinger, Eileen Woll, VA Chapter Sierra Club staff

6. Please tell us what you can about the communities you are connected to and any organizations or representatives you collaborate with to engage them.

Comment Themes:

- Communities in Virginia Beach, Norfolk, Newport News, and Portsmouth came up multiple times
- LIDAC communities within the Hampton Roads area
- Others that came up multiple times:
    - Sierra Club
    - Lamberts Point community

Norfolk Solar	Encourage going directly to civic league meetings in under-resourced communities.
#25	See www.hrcapinc.org
Sustainability Solutions Group and Institute	Multiple Portsmouth Neighborhoods Healthy Portsmouth Bon Secours Old Dominion

	ICAR EVMS Virginia Wesleyan NAACP Sierra Club of Virginia Virginia Organizing United Civic League of Cavalier Manor ECO District Hampton Roads National Environmental Justice Institute Georgia Institute of Technology. Portsmouth Office of Social Services Portsmouth Health Department Virginia Environmental Justice Collaborative Southern Alliance for Clean Energy Interfaith Power and Light People's Solar Power Initiative ACEEE Justice40 Accelerator Justice40 Network Hub University of Maryland Climate and Environmental Justice Initiative NASA Emory University Hercules Research Project US Department of Energy National Renewable Energy Laboratory University of Michigan Energy Equity Project Southern Environmental Law Center Environmental Defense Fund Deep South Center for Environmental Justice
Hampton Roads Community Action Program	Low to mid income levels. Higher rate of unemployment. Communities want positive change to improve conditions and benefit from plans to improve neighborhoods.
Sierra Club	We are heavily engaged in Norfolk with several communities, including the Lambert's Point community. We are also engaged in several communities in Portsmouth.
HRPDC/TPO	We have connections to a variety of civic organizations across the region and are working to make additional connections.
VA DEQ (1)	We have an EJ email list but I do not think it's divided by region of Virginia. Request public input through mixed media
VA DEQ (2)	LIDAC areas throughout the state

Hampton	City has a Neighborhood Services Division in Community Development Department that handles community outreach and engagement.
City of Newport News	Diverse and represent various interests and populations
City of Norfolk	The City of Norfolk works closely with a variety of community partners through our Office of Diversity, Equity and Inclusion, Neighborhood Services and the Department of Housing and Community Development.
James City County	I would have to check with our Neighborhood Development team.
Elizabethe River Project	Elizabeth River Project, Norfolk State University and University of Virginia have partnered to work with communities in the southside of Norfolk as well as Park Place. Community advocates and the civic leagues are critical to that relationship building. Organizations like ForKids, GEAR recovery and Butterfly Village are all amazing partners. More longstanding relationships in Ingleside and Chesterfield heights have been supported by the civic leagues and city officials. Friends of Indian River are critical to engaging property owners in the Eastern Branch and our work in Craddock in Portsmouth has been focused on building trust and a sense of community at Paradise Creek Nature Park.
Sierra Club (2)	We have members across Hampton Roads in many communities esp in Norfolk, Virginia Beach, Hampton, Newport News, and Williamsburg. Lamberts Point in Norfolk, East End in Newport News. St.Pauls area of Norfolk are some key communities we work in.
Virginia Beach Tea Party	City Council, School Board, General Assembly and Congress engaging with those that affect our daily lives running up the cost of living here in VB.
Sierra Club (3)	The York River Group and Chesapeake Bay Group of the VA Chapter Sierra Club has worked with many of the localities in the HRPDC area with an annual Climate Solutions Roundtable, where representatives from the localities present initiatives on reducing greenhouse gas emissions. We also work on air quality and water quality issues involving these localities, to include coal dust from the coal facilities in Newport News and Norfolk. We worked with

	Virginia Organizing on improvements to the public bus system to accommodate residents who depend on reliable bus service.

7. Is there anything else you'd like to tell us as we plan our future public and LIDAC engagement (other groups we should try to reach, suggestions for meaningful engagement, etc.)?

Comment Themes:

- LIDAC, English as a Second Language (ESL), and other diverse community groups should be engaged.
- Ensure that the reason for engaging with diverse community groups is stated clearly at the beginning of the interaction (information sharing v. collecting responses) and result in including the input.
- Use multiple formats to collect responses (surveys, webinars, paid ads, etc.).

Norfolk Solar	See point above in #2 about requiring hiring of LIDAC in RFPs
#25	Hispanic and Filipino organizations should be at the table too and ESL community
Sustainability Solutions Group and Institute	Ensure end goal is around Empowerment, Issue Ownership, Capacity Building and not just information sharing or tokenism
Hampton Roads Community Action Program	Climate pollution is a health issue. An area of future engagement is to tie to social determinants of health.
Sierra Club	Other groups that may provide helpful insights are Virginia Organizing, New Virginia Majority, Chesapeake Climate Action Network
VA DEQ (1)	Request public input through mixed media
VA DEQ (2)	Online education information webinars an surveys have worked best
Hampton	Office of Diversity, equity and inclusion. 757-727-6899
City of Norfolk	Depending on the direction this moves in, I can facilitate connections with other departments and/or community organizations for LIDAC engagement.

James City County	Make sure you are clear on the purpose (i.e. inform vs input) so that residents are not disheartened if their ideas are not incorporated into the project.
Elizabethe River Project	I would be happy to be engaged in this planning process if it would be helpful and if it is open to non-committee members. Thank you.
Sierra Club (2)	comprehensive information on key ideas and programs Sierra Club is encouraging localities to consider, ideas for grant use: https://docs.google.com/document/d/1km81r6MLZguyya2EAQBtA54Pu9XvIKf1KCIJxzh09zA/edit?usp=sharing
Virginia Beach Tea Party	We need to look at ourselves and the communities we live in and be the change we want to see, we can't depend on government to solve our problems.
Sierra Club (3)	We sent this questionnaire to a number of groups that work with LIDAC communities, to include: Lamberts Point Civic League - Norfolk, Park Place Civic League - Norfolk, Norfolk Solar, Virginia Organizing, Chesapeake Climate Action Network, Chesapeake Bay Foundation, Virginia League of Conservation Voters, Elizabeth River Project, NAACP state and Hampton Branch. We are happy to continue to reach out again to these groups and to other groups for meaningful engagement.

PUBLIC ENGAGEMENT: NEWS COVERAGE

The following news article was published on October 4 by WHRO.

Pollution from a paper mill in western Virginia. (Image by Andriy Blokhin via Shutterstock)

State and local officials are making new climate action plans to slash emissions

Written by Katherine Hafner Category: Local News Published: 04 October 2023

Officials at the state and local level are embarking on an ambitious effort to identify the Commonwealth's major sources of climate pollution – and take steps to address them.

It's part of the Biden administration's goal to rapidly reduce the country's contribution to climate change.

State and Hampton Roads agencies have received a total of $4 million in federal pollution reduction grants to draw up plans to reduce greenhouse gas emissions.

This level of climate planning will be a new undertaking for the state, said Tom Ballou, air quality planning manager with the Virginia Department of Environmental Quality.

"We've done it piecemeal," Ballou said. "This is the first time we're going to try to pull everything together in a comprehensive plan."

The Climate Pollution Reduction grants are funded by the Inflation Reduction Act, passed by Congress last year. The law directs hundreds of billions of dollars toward clean energy investments and other measures to combat climate change.

The program is in line with the Biden administration's goal of halving the country's greenhouse gas emissions from their 2005 peak by 2030, said Shaun Eagan, spokesperson for the U.S. Environmental Protection Agency, which is administering the grants.

Greenhouse gases trap heat in the atmosphere, which drives global warming. The United States emits more than 6,000 million metric tons each year, according to the EPA. A majority is carbon dioxide, from burning fossil fuels like coal and natural gas.

Other major greenhouse gases include methane, nitrous oxide and gases used in refrigerants or industrial uses.

Eagan said in an email that the money is meant to encourage the development of comprehensive climate pollution plans “that will reduce pollution, maximize investment benefits and build clean energy economies over the next decade.”

Before local officials can make a plan to cut Hampton Roads’ carbon footprint, they need to know exactly how much carbon pollution is currently emitted — and from where.

That will be a first for the region, said Whitney Katchmark, who’s spearheading the $1 million effort for the Hampton Roads Planning District Commission.

“We haven't really looked, as a region, at reducing greenhouse gases (or) getting a handle on sources,” Katchmark said.

The commission will use the grant money to estimate emissions from key local sources, like vehicle transportation, landfills and the energy used to heat and cool homes and businesses.

Katchmark said she’s not yet sure whether the assessment will also include sources like container ships docked at the Port of Virginia or planes and ships at local military installations, which would impact the region’s overall emissions.

“We've got some unique situations,” she said.

At the state level, the Virginia Department of Environmental Quality has been tracking greenhouse gas emissions for more than 20 years, Ballou said.

Statewide emissions dropped by about 21% between 2005 and 2021. That decrease was mainly driven by the transition from emissions-heavy coal-fired power plants toward cleaner-burning fuels like natural gas, and the increased use of solar power, Ballou said.

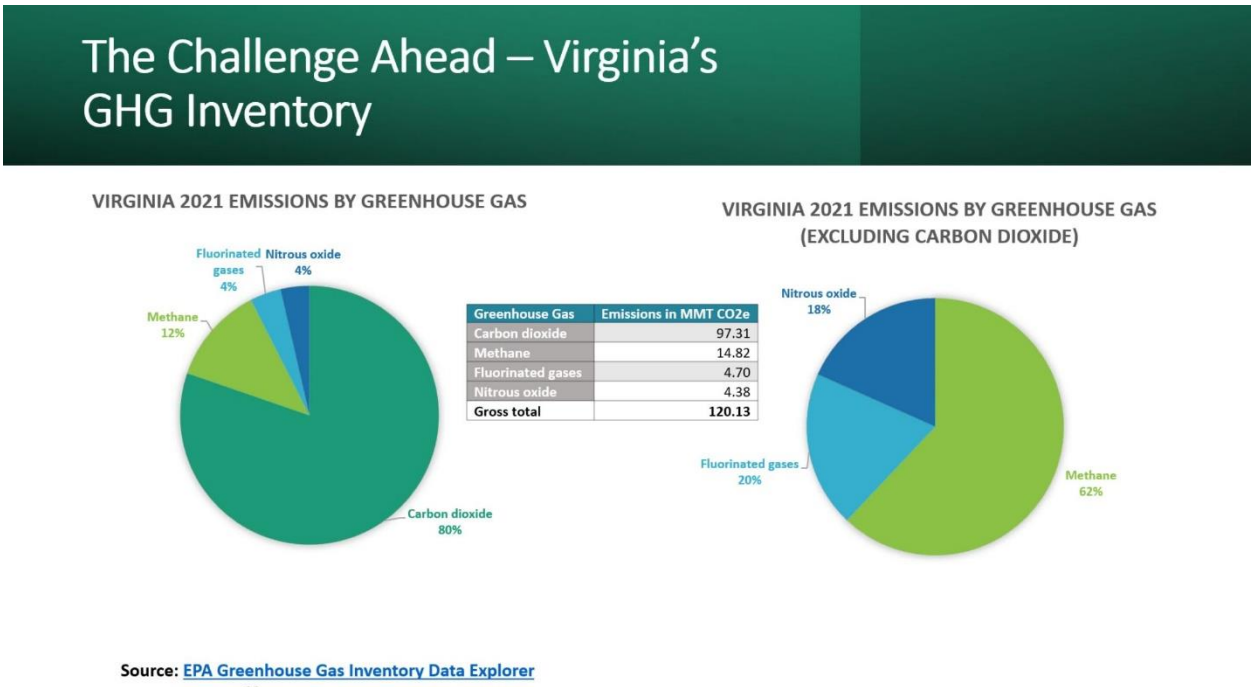


Image via Virginia DEQ

A chart displays Virginia's greenhouse gas emissions by type.

Transportation is Virginia's largest source of climate pollution, accounting for more than 40% of statewide emissions. It's followed by the electric power sector at 21% and other industries with 16%.

The state's new inventory will build on those efforts, Ballou said, using computer modeling tools in line with those used by the EPA. And Virginia will now have to determine steps to actually reduce those emissions.

Both state and local leaders must submit a Priority Climate Action Plan to the EPA in March, outlining specific projects to cut emissions. It's a tight timeline that's forcing officials to scramble a bit, Ballou said.

The EPA will then use those plans to decide which states and localities receive additional funding next year to implement their plans.

Ballou said he doesn't yet know which strategies Virginia will pursue.

In its grant application to the EPA, state officials said they will likely focus on reducing methane, a powerful greenhouse gas generated from sources like landfills; and sulfur hexafluoride, a potent gas that often comes from the electric power sector.

They also proposed targeting sources with high energy demands, like data centers.

In practice, that could mean capturing methane from decomposing waste at landfills, or trying to lower emissions at microchip manufacturers, they wrote.

Katchmark said Hampton Roads officials may propose electrifying local government vehicles or upgrading wastewater treatment plants to use less energy.

"We'll just see what we can build in terms of enthusiasm, and how hard some of the different implementation strategies are," she said.

Mike Dowd, DEQ's air and renewable energy division director, said the EPA is focused on getting "the biggest bang for the buck," as well as ensuring that a significant percentage of the benefits go to lower-income or disadvantaged communities.

A large portion of the state falls into that category, including most of the Eastern Shore and many areas in western Virginia.

Virginia is embarking on the new effort at the same time as it is scheduled to pull out of the multi-state Regional Greenhouse Gas Initiative, which is a cap and trade program designed to reduce carbon emissions.

The initiative requires power plants of a certain size to pay for their carbon emissions in order to incentivize lowering them. Regular auctions of those credits have so far raised more than $650 million for climate adaptation programs in Virginia.

Gov. Glenn Youngkin's administration has sought to pull the state out of the program, citing increased energy bills. The state's air board voted to do so this summer, and Virginia is now set to end its participation at the end of this year. Environmental groups are fighting in court to stop the state from leaving, arguing that state lawmakers must weigh in.

Ballou and Dowd declined to comment on how leaving the initiative could impact the state's new climate plans, citing the ongoing litigation.

Katchmark said it's somewhat daunting to take on a huge, global issue like climate change. But she sees a lot of opportunities for local action. Taken together, they can add up.

"It's probably the collective combination of all these efforts that make a difference," she said. "Certainly we can look at areas where there are a lot of vehicle traffic or stationary air pollution and try to make a dent in reducing that."

Eagan, with the EPA, said the agency has not imposed specific reduction targets for grant recipients.

Ballou said the state is emphasizing public outreach as part of the planning process. Virginians can learn more and access a recent presentation about the state grant on the DEQ's website.

Appendix B: GHG Inventory & Reduction Calculation Methodology

In alignment with HRPDC's EPA-approved work plan, GHG modeling covers the Hampton Roads MSA plus Southampton County and the City of Franklin. The following is a summary of methods used for calculating emissions reductions in the Hampton Roads MSA PCAP. In developing these values, modeling assumptions were made to determine reasonable GHG emissions reductions from the deployment of specific measures. In some cases, there may be areas of overlap for emissions reduction values between measures. For example, some emissions reductions from port vehicles (Measure 5) may be covered by modeling for community-wide ZEV modeling under Measure 3. Modeling for these measures is anticipated to be revised as part of the CCAP process.

GHG Inventory & Business-as-Usual Projection Methodology

The Hampton Roads MSA GHG inventory assesses the GHG emissions for 2019 from the buildings, transportation, waste, and land use, LULUCF sectors. The Business-as-Usual (BAU) scenario projects the 2019 emissions under BAU conditions through 2050.

Buildings. The HRPDC acquired state-level building energy and electricity use sector emissions data from EPA's SIT and then scaled the state-level data down to the counties using the following equation:

$$County\ building\ data_{2019} = \frac{County\ population_{2019}}{State\ population_{2019}} \times State\ building\ data_{2019}$$

The applicable SIT data was used depending on which state a county in the MSA was located in, either Virginia or North Carolina. The BAU projections were compiled by growing the MSA-level building data by a rate of growth calculated from the U.S. Energy Information Administration's (EIA) Short-Term Energy Outlook. EIA's Short-Term Energy Outlook provides energy consumption by sector and source from 2019 to 2050. HRPDC calculated a yearly growth rate and applied it to the 2019 inventory data to project BAU energy sector emissions through 2050.

Transportation. HRPDC used EPA's emission modeling system, Motor Vehicle Emission Simulator (MOVES3), to calculate the emissions from the transportation sector. MOVES3 has on-road vehicle projection data for vehicle population, VMT, energy consumption, and tailpipe GHG emissions by vehicle type and fuel type for internal combustion engine vehicles. It accounts for projected fuel efficiency improvements for internal combustion engine vehicles as a result of existing policies. HRPDC ran MOVES3 with default settings to create the 2019 inventory and BAU projections for population, VMT, energy consumption, and emissions from on-road vehicles.

HRPDC developed ports emissions estimates in alignment with the methodology used in the statewide PCAP for Virginia that was prepared by DEQ. The 2021 U.S. Army Corps of Engineers Entrances and Clearances data was used to develop the number of ship calls in conjunction with Lloyd's Register of Ships produced by IHS Global Limited. For loads and hoteling times, the 2021 Port of Los Angeles was used. Port of Los Angeles is the like port both in ship calls and cargo movements. The 2011 Port of Virginia inventory was used to derive the in bay, RSZ and maneuver times and speeds. For ocean going vessels, the Port of Virginia ratio of calls for the various terminals was used to divide

the Port of Virginia calls (and associated emissions) among the appropriate terminals. For all other sectors, the Port of Los Angeles emissions data was used and ratioed using cargo data from the U.S. Army Corps of Engineers Waterborne Cargo data for the various Virgina ports and for the Port of Los Angeles. For harbor craft, only tug movements were used.

Waste. The Hampton Roads MSA calculated landfill emissions for 2019 using data from EPA's LMOP. LMOP data presents annual and cumulative municipal solid waste (MSW) tonnage, the total capacity of the landfill, and whether the landfill has a gas capture system. The 2019 LMOP data did not include a value for annual tons of MSW generated, and therefore LMOP 2021 data were used as a proxy for 2019 data. The following equation was used to calculate the emissions from each landfill:

$$Emissions = MSW_{annual} \times (Methane_{EF} \times Methane_{GWP}) \times (1 - O_{rate}) \times (1 - G_{capture})$$

Table 7: Variable values for GHG Inventory, Wast Sector

Variable	Value	Description
Emissions	Calculated	Annual emissions for the landfill in $MTCO_2e$.
MSW_{annual}	Retrieved from LMOP data	Annual tons of MSW buried.
$Methane_{EF}$	0.0648	Methane emission factor based on EPA Waste Reduction Model (WARM) assumptions.
$Methane_{GWP}$	28	The AR5 GWP of CH_4.
O_{rate}	0.1 for landfills without gas capture; 0.2 for landfills with gas capture	Oxidation rate based on EPA WARM assumptions.
$G_{capture}$	0 for landfills without gas capture systems; 0.6 for landfills with gas capture systems	Gas capture rate based on EPA WARM assumptions.

Waste combustion facility data was acquired from EPA's Greenhouse Gas Reduction Program Facility-Level Information on Greenhouse gases Tool (FLIGHT). Additional waste combustion data was retrieved from HRSD for biosolid incineration facilities at wastewater treatment plants.

Wastewater emissions data was acquired from EPA's SIT and scaled down from the state to the MSA using the following formula:

$$Hampton\ Roads\ MSA\ wastewater\ data_{2019} = \frac{Hampton\ Roads\ MSA\ population_{2019}}{State\ population_{2019}} \times State\ wastewater\ data_{2019}$$

The applicable SIT data was used depending on which state a county in the MSA was located in, either Virginia or North Carolina. The sum of emissions from all landfills, waste combustion facilities, and wastewater facilities within the Hampton Roads MSA in 2019 was used to represent the total emissions from waste for 2019 for the MSA. The waste data were scaled down from the MSA level to the counties using the following formula:

$$County\ waste\ data_{2019} = \frac{County\ population_{2019}}{Hampton\ Roads\ MSA\ population_{2019}} \times Hampton\ Roads\ MSA\ waste\ data_{2019}$$

The BAU projections were calculated using an average annual population growth rate across the MSA using U.S. Census 2019 population data and 2050 population projection data from either North Carolina's Office of State Budget and Management (OSBM), Hampton Roads' 2050 Socioeconomic Forecast, or the Weldon Cooper Center at the University of Virginia. The county-level waste emissions data from 2019 were grown by the average annual population growth rate.

LULUCF. The HRPDC acquired state-level LULUCF sector emissions data from EPA's SIT and then scaled the state-level data down to the counties. State inventories were downscaled through land area proportions relative to state totals and population proportions relative to state total population.

State total forested land, and forested lands in each MSA county were found and then the fraction was used to downscale per county by using the National Landcover Database's (NLCD) 2021 Land Cover Data. This process was repeated for land converted to forest land and forestland converted to other land. For landfilled yard trimmings and food scraps the U.S. Census data for county and state was used to develop a fraction of the total population in each county. For forest fires, LandFire data was used to find the proportion of burned area in MSA counties relative to state totals and was used to downscale CH4 and N2O emissions. N2O from settlement soils was downscaled through MSA counties developed land area proportions relative to state totals. Agriculture Soil Carbon Flux was downscaled through MSA counties crop land area proportions relative to state totals.

Urban Tree inventory was calculated through determining the amount of sequestration of carbon over time by multiplying the percent urban tree canopy by the urban area found from Census to get the urban tree area, and then multiplied by the average net C emission per area tree cover.

GHG Reductions Methodology

The methodologies, assumption and data sources used for calculating the GHG reductions for each measure are discussed below, by measure.

Measure 1: Create programs to support and incentivize a transition to clean energy, including onsite renewable energy, energy storage system deployment, and fuel switching.

The measure models the resulting GHG emissions reductions from achievement of increased distributed solar adoption, representing the general potential for distributed clean resource additions in the MSA. Total technical potential for rooftop solar in the Hampton Roads MSA was aggregated from Project Sunroof's estimates of the technical potential in each of the counties and cities in the MSA.[67]

Existing rooftop solar capacity assumptions were sourced from PJM's 2023 Load Forecast for the DOM zone and then grown to meet the assumed 2050 level.[68] To determine an adoption rate for future solar adoption, the most aggressive 2050 adoption scenario from National Renewable Energy

[67] Google. 2024. *Project Sunroof*. https://sunroof.withgoogle.com/
[61] PJM. 2023. *2023 Load Forecast*. https://wired.pjm.com/-/media/library/reports-notices/load-forecast/2023-load-report.ashx

Laboratory's (NREL) Storage Futures Study (20%) was applied to the technical potential.[69] To calculate the kWh of solar output, the capacity factor for residential solar from NREL's annual technology baseline corresponding to the geography of Hampton Roads MSA was used. The incremental growth in solar output from current levels, multiplied by grid emissions factors, resulted in the potential avoided emissions from rooftop solar.

Key modeling assumptions included:

- Constant technical potential per building over time
- No incremental rooftop PV installation beyond existing in BAU case
- Linear growth of PV installations between 2023 and 2050 in Policy Case
- BAU emissions factors (2020 eGRID held flat)
- PCAP Policy emission factors (2020 eGRID grown based on 2023 Annual Energy Outlook (AEO) Reference Case)

Data sources utilized include:

- Storage Futures Study: Distributed Solar and Storage Outlook: Methodology and Scenarios (2021), NREL.
- 2023 Load Forecast, PJM (2023).
- Project Sunroof data explorer, (June 2019), Google.
- Annual Technology Baseline, Residential PV (2023), NREL.
- Electric Grid Emission Factor Projections for PCAP Use, AEO 2023.
- EPA eGRID, 2020.

Measure 2: Reduce energy consumption and increase building decarbonization through programs to support, incentivize, and install energy efficiency and electrification measures.

Building energy use and building emission projections are based on energy consumption from electricity, natural gas, fuel oil, and propane in existing residential (single-family, multifamily, and mobile homes) and commercial buildings (office, food service, school, hotel, healthcare, retail, and warehouse). The base year and projections for energy consumption in existing buildings are built from the 2022 AEO, which represented projected energy user prior to the passage of the IRA, from the U.S. EIA. AEO data is scaled to the Hampton Roads Metropolitan Area counties by scaling AEO Census level data with the ResStock and ComStock building models of North American building stock with county-level resolution. The tool first calibrates ComStock and ResStock energy consumption to AEO energy consumption on a Census division level. It then proportionally adjusts county-level energy consumption to the scaled Census division level.

Energy use values have been integrated with emissions factors for primary fuels (electricity, gas, propane and fuel oil) to provide total emissions. Results are provided every five years from 2020 to 2050 and interpolated for years in between. For the Hampton Roads Metro Area, modeling assumed a beneficial electrification scenarios for HVAC measures and Water Heating and Cooking measures,

[69] NREL. 2024. *Storage Futures Study*. https://www.nrel.gov/analysis/storage-futures.html

and a Low scenario for Building Envelope measures implementation in alignment with sources outlined below.

Calculating Energy Changes

CO_2Sight utilizes ICF's Distributed Energy Resources Planner (DER Planner) model for modeling existing buildings. DER Planner is a bottom-up model that is built upon the best practice principles for potential modeling outlined by the National Action Plan for Energy Efficiency in their Guide for Conducting Energy Efficiency Potential Studies.[70] The model can be used to calculate technical, economic, and achievable potential estimates. Together, the CO_2Sight platform and DER Planner estimate energy and emissions changes from a range of decarbonization strategies, including electrification retrofits and energy efficiency, as presented in these results.

Building characteristics and energy use data for modeling buildings are derived from ResStock[71] and ComStock[72] datasets provided by the NREL. These datasets integrate large public and private data sources statistical sampling, detailed sub-hourly building simulations, and high-performance computing. By synthesizing multiple sources into a single resource, these data allow for a granular understanding of the housing and commercial stock and the impacts of building technologies in different communities and businesses. These data are comprehensive and widely used across similar analyses and modeling efforts, and thus allow for the development of comparable results. The ResStock and ComStock energy use data are calibrated to match the EIA's AEO dataset.

DER Planner, informed by stock CO_2Sight measures data, has the capabilities to model various energy efficiency, electrification, and building envelope measures in selected building types. This tool allows the analysis of over 80 residential and commercial measures in selected regions applied to the Hampton Roads Metro Areas Cities and Counties' building characteristics. The model uses key inputs such as equipment stock, participation rate curves, and energy change per measure and estimates potential savings from applying efficient measures available for each building type and end-use. Given the efficient technologies available, this quantifies how much energy could be reduced. To compute total savings potential, the model runs all permutations combining savings per EE measure unit, expected measure penetration, and total number of measure units (or total eligible stock) by all adoption types (ROB and RET).[73]

By integrating DER Planner and comprehensive datasets such as ResStock and ComStock, CO_2Sight aggregates energy and emissions changes to estimate changes in energy use. ICF's program experience and available national data sources inform these measures' impacts on energy use.

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[70] EPA. 2007. *National Action Plan for Energy Efficiency. Guideline for Conducting Energy Efficiency Potential Studies*. https://www.epa.gov/sites/production/files/2015-08/documents/potential_guide_0.pdf
[71] NREL. Nd. *ResStock Analysis Tool*. https://www.nrel.gov/buildings/resstock.html
[72] NREL. Nd. *ComStock*. https://comstock.nrel.gov/
[73] Measures' adoption type definitions:

- **Replace on Burnout (ROB** is Replace On Burnout and implies that the technology will be adopted when the previous technology needs to be replaced.
- **Retrofit (RET)** implies that the technology is adopted before the previous technology needs to be replaced.

Electricity, Natural Gas and Propane Emissions Factors

Values from EPA's Center for Corporate Climate Leadership GHG Emission Factors Hub were used for natural gas, fuel oil, and propane reductions.[74] Electricity Grid emissions factors were derived from SRVC's values from eGRID[75] and held steady for modeling.

Table 8. Fuel Emission Factors (kg CO_2e/MMBTU)

Fuel	Emission Factors
Natural Gas	53.06
Fuel Oil	73.96
Propane	62.39

Measure Intensities and Participation Curves

As an input into DER Planner, each measure has participation (or technology adoption curves) connected to them. A range of factors can impact whether new electric or efficiency technologies are adopted. This approach builds from NREL's Electrification Future Study[76], from which many of the adoption curves are provided. It accounts for costs, supporting infrastructure, ownership and availability, health and sustainability (including policies) and other factors that could influence technology change. Adoption curves are also provided from the implementation energy efficiency programs and informed by ICF expertise.

For ease of use, users can select prepopulated groupings of participation curves to match the types of energy change they want to model. The groupings are outlined below:

HVAC, Water Heating and Cooking Scenarios

- Business-as-Usual
    - Small amount of energy efficiency, no specific electrification strategy or fuel switching
- Gas Efficiency
    - Significant amount of energy efficiency, no electrification, specific emphasis on efficiency for gas equipment. Gas heat pumps in future years.
- Beneficial Electrification
    - Significant amount of energy efficiency, small amount of electrification for those projects that are presently cost-effective
- End of Life Electrification
    - Significant amount of energy efficiency, large amount of electrification when equipment reaches the end of its useful life
- Accelerated Electrification
    - Signification amount of energy efficiency, large amount of electrification prior to equipment reaching the end of its useful life

[74] EPA. Nd. *GHG Emission Factors Hub*. https://www.epa.gov/climateleadership/ghg-emission-factors-hub
[75] EPA. *Emissions & Generation Resource Integrated Database (eGRID)*. https://www.epa.gov/egrid
[76] NREL. Nd. *Electrification Futures Study*. https://www.nrel.gov/analysis/electrification-futures.html

Water Heating and Cooking Scenarios

- Business-as-Usual
    - Small amount of energy efficiency, no specific electrification strategy or fuel switching
- Gas Efficiency
    - Significant amount of energy efficiency, no electrification, specific emphasis on efficiency for gas equipment. Gas heat pumps in future years.
- Beneficial Electrification
    - Significant amount of energy efficiency, small amount of electrification for those projects that are presently cost-effective
- End of Life Electrification
    - Significant amount of energy efficiency, large amount of electrification when equipment reaches the end of its useful life
- Accelerated Electrification
    - Signification amount of energy efficiency, large amount of electrification prior to equipment reaching the end of its useful life

Building Envelope Scenarios

- Business-as-Usual
    - Small amount of energy efficiency on building envelope
- Low
    - Moderate building envelope work, some deep energy retrofits
- High
    - Significant building envelope work, Significant deep energy retrofits

In addition to HVAC; Water Heating and Cooking Pathway selection is being chosen, there are opportunities to influence core Energy Efficiency work occurring in each pathway including:

- Full lighting retrofits and lighting controls
- Smart Thermostats and Building Automation Systems
- New EE appliances
- New EE HVAC equipment

Key data sources for this modeling included:

- ComStock and ResStock data sets
- EPA's ENERGYSTAR Equipment performance thresholds
- ICF's building modeling experience informed by industry standards
- Various state's Technical Reference Manual
- NREL's Electrification Future Study[77]
- DOE's equipment purchasing profiles

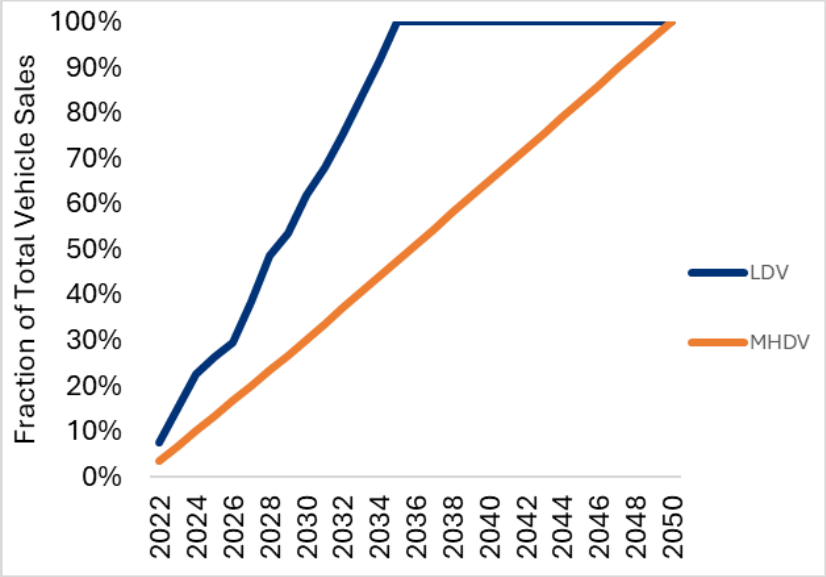
[77] NREL. Nd. *Electrification Futures Study*. Electrification Futures Study Technology Data | NREL Data Catalog

- PNNL's Building Retuning materials
- Montgomery County Maryland's Building Energy Performance Standards Development – Technical Analysis

Measure 3: Develop an electric vehicle (EV) procurement plan and electric vehicle supply equipment (EVSE) deployment strategy to support the adoption of EVs.

This measure models the resulting GHG emissions reduced if the Hampton Roads MSA meets the ZEV sales targets outlined by California's Advanced Clean Cars II (ACCII) rule for LDVs and the Multi-State Zero-Emission Medium- and Heavy-Duty Vehicle (MHDV) Memorandum of Understanding (MOU). Virginia is one of 14 states (including Washington, D.C.) that has adopted California's ACCII rule and is one of 18 states (including Washington, D.C.) that has signed the MOU. The figure below shows the sales targets assumed for LDVs and MHDVs.

Percent sales of vehicles that are zero-emission vehicles



The model uses outputs from the EPA Motor Vehicle Emissions Simulator (MOVES4) to project baseline VMT, vehicle population, energy consumption, and Scope 1 emissions for on-road transportation in the MSA by fuel type (gasoline, diesel, ethanol (E-85), compressed natural gas, and electricity), vehicle source type, and model year. Default input values were used.

Scope 2 emissions from electricity consumption by EVs were found using the following equation:

$$Scope\ 2\ Emissions = Electricity\ Consumption \times Electricity\ Emission\ Factor \quad (1)$$

The electricity emissions factor was held at 2019 eGRID levels for the SRVC subregion, which includes the Hampton Roads MSA, through 2050 for the baseline.

To model GHG emissions reductions in the policy scenario, for each model year, a fraction of VMT was designated as fuel type "electricity" or "hydrogen" based on the ZEV sales curve. The resulting energy consumption was found using the following equation:

$$Energy\ Consumption = VMT \times Energy\ Efficiency, \quad (2)$$

where energy efficiency was in units of kJ/mi for battery electric vehicles (BEVs) and fuel cell electric vehicles (FCEVs). Implied BEV energy efficiencies from the MOVES4 baseline results were used. FCEV

energy efficiencies were sourced from the California Advanced Clean Fleets (ACF) rule making. Scope 1 emissions were found by reducing baseline internal combustion engine vehicle (ICEV) emissions by the ZEV sales fraction. Scope 2 emissions were found using Equation (1). Electricity emissions factor projections were sourced from EIA's AEO for the PJM/Dominion Region.

The following additional key assumptions were made throughout the analysis:

- ZEVs exist in the vehicle fleet for the same length of time as ICEVs.
- ZEV activity/use is identical to an ICEV.
- The annual ZEV sales fraction applies to every fuel type.
- Long-haul MHDVs ZEVs are modeled as FCEV and all other MHDVs ZEVs are modeled as BEV.
- All LDVs ZEVs are modeled as BEVs.
- All BEV populations 2021 and earlier are EPA MOVES4 default.
- The methodology in some cases required re-allocating MOVES4 baseline projected EV back to ICEVs. Where this was necessary, LDVs were designated as gasoline, and MHDVs were designated as diesel.
- The hydrogen supply is assumed to be 50% green hydrogen and 50% blue hydrogen.

This analysis sourced data from EPA MOVES4, eGRID, EIA AEO, the California ACF and ACCII rulemakings, and the Alliance for Automotive Innovation.

Measure 4: Reduce vehicle miles traveled and support alternative modes of transportation through bike/pedestrian infrastructure investments.

This measure models resulting VMT and GHG emissions reduced if the Hampton Roads MSA enhances its active transportation infrastructure by improving pedestrian networks, expanding bike networks, and implementing an electric bikeshare program throughout the MSA. The measure assumes these strategies only result in light-duty passenger vehicle VMT reduction. The potential VMT reduction due to each of these actions was calculated based on the methodology outlined in the *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity,*[78] a document compiled for the California Air Pollution Control Officers Association to provide methods for estimating GHG reductions resulting from various measures.

The resulting passenger VMT reduction across the MSA is shown in the following table. Larger reductions are possible when this measure is paired with other items such as improved transit-oriented development, congestion and/or VMT pricing, encouragement of teleworking, and other disincentives for driving, which are not quantified as part of this PCAP measure and will be further reviewed as part of the CCAP process.

[78] California Air Pollution Control Officers Association. 2021. *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity.* https://www.airquality.org/ClimateChange/Documents/Handbook%20Public%20Draft_2021-Aug.pdf

Table 9: VMT Reduction Assumptions

Strategy Name	Potential VMT Reduction by 2030	Potential VMT Reduction by 2050
Provide Pedestrian Network Improvement	-0.25%	-0.50%
Expand Bikeway Network	-0.0026%	-0.0053%
Implement Electric Bikeshare Program	N/A	-0.0073%

Where calculation input data from specific plans were not available, conservative estimates were made for each active transportation strategy based on the maximum input value listed in the *Handbook*.

The following additional key assumptions were made throughout the analysis:

- VMT reduction only applies to passenger vehicles.
- VMT reductions are taken from the baseline discussed in Measure 3.
- Maximum VMT reductions are assumed to be achieved in 2050. Half of maximum reductions are achieved by 2030, except for electric bikeshare which is assumed to be implemented after 2030.

This analysis sourced data from EPA MOVES4, eGRID, FWHA NHTS 2017 Statistics, and the *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity*

Measure 5: Reduce emissions from port operations through the adoption of low-carbon fuels, electric equipment, and operational changes.

The GHG reduction calculations represented for ports target specific potential projects at select port facilities and locations. These include a set number of equipment and system upgrades and replacements for forklifts, vans, cruisers, shuttles, pickups, buses, and battery systems.

For the battery systems a 12 MW battery storage system and a 5 MW system at different facilities was modeled. To calculate the avoided/reduced emissions that will be garnered by these investments, the following assumptions were made: the 12 MW system would shave demand by a minimum of 8 hours each over 2 daily 2-hour peak demand windows, while the 5 MW system would shave 4 MWh twice a day as well. This amounts to 16 MWh daily per larger system and 8 MWh daily at PPCY that would no longer need to be generated. Assuming the terminals work 360 days a year, this amounts to an annual avoidance of 8,640 MWh of grid generation. Emission factors to support this calculation were taken from EPA's eGRID Power Profiler.

For other equipment, including forklifts, vans, cruisers, shuttles, pickups, and buses, the analysis assumes replacing diesel equipment with zero emission battery electric alternatives. All the equipment replacement emission reduction estimates below have been made utilizing the EPA's Diesel Emissions Quantifier tool.

Data and tools used include:

- U.S. Army Corps of Engineers Entrances and Clearances Data
- U.S. Army Corps of Engineers Waterborne Cargo and Trips Data Files (Manuscript Files)
- Port of Los Angeles Inventory of Air Emissions 2021
- EPA Diesel Emissions Quantifier (DEQ)
- Electricity emission factors from eGRID and emission factors for electricity as a result of Measure 6 were also integrated.

Measure 6: Reduce waste-related emissions through improved equipment efficiencies, increased methane capture at waste and wastewater facilities, and organic waste diversion.

Emissions reductions for this measure were modeled for the closure of three HRSD combustion facilities by 2030, along the timeline estimated by HRSD. Additional reductions were modeled for waste diversion rates increasing from 40% to 60% by 2050, reducing the amount of waste received by landfills and therefore emissions from landfills.

Data sources for this analysis included:

- EPA LMOP: https://www.epa.gov/lmop
- HRSD Combustion Facility Data
- Virginia Annual Recycling Summary Report, Virginia DEQ
- U.S. Census Population Data, https://www.census.gov/data/datasets/time-series/demo/popest/2020s-counties-total.html
- North Carolina Population Growth 2040-2050, Office of State Budget and Management, https://www.osbm.nc.gov/facts-figures/population-demographics/state-demographer/countystate-population-projections/population-growth-2040-2050
- Hampton Roads 2050 Socioeconomic Forecast, HRPDC
- Virginia Population Projection, Weldon Cooper Center at the University of Virginia, https://www.coopercenter.org/virginia-population-projections

Key models and tools that were used in the analysis included:

- EPA Greenhouse Gas Reduction Program (GHGRP) FLIGHT, https://ghgdata.epa.gov/ghgp/main.do
- EPA SIT, https://www.epa.gov/statelocalenergy/state-inventory-and-projection-tool

Measure 7: Increase opportunities for carbon sequestration through natural and working lands, including forestry, wetlands, and other coastal ecosystems.

Reductions for this measure were modeled from increased tree planting, including the planting of 25,000 trees across the region by 2030 with a representative target of planting 5,000 trees per year, a Hampton County local initiative. The number of trees planted by 2030 per locality was scaled by population by using Hampton County's initiative as a model. Each locality was assumed to host tree giveaway programs across the HRPDC. Planting is assumed to start in 2025.

Native tree species were assumed to be planted based on their distribution (within the region) and if the tree habitat included a wide variety of soil types to ensure the species could be planted anywhere within the MSA. Carbon sequestration potential of native trees in Hampton Roads MSA was determined using i-Tree MyTree, which utilizes county coordinates within the MSA and designates the trees as "new planting" and in "partial sun" with a 1-inch diameter.

Data sources and modeling tools used for this measure include:

- Native Tree Species in Hampton Roads MSA: Common Native Trees of Virginia: Identification Guide, https://dof.virginia.gov/wp-content/uploads/Common-Native-Trees-ID-spreads_pub.pdf
- i-Tree MyTree: Accessed through https://www.itreetools.org/. This tool is utilized for assessing the carbon sequestration potential of trees, specifically in Hampton Roads MSA.

Appendix C: LIDAC Census Information

LIDAC Census Tracts- as identified by CEJST

Census tract 2010 ID	County Name	State/Territory
51093280105	Isle Of Wight County	Virginia
51095080102	James City County	Virginia
51175200300	Southampton County	Virginia
51550020100	Chesapeake City	Virginia
51550020300	Chesapeake City	Virginia
51550020500	Chesapeake City	Virginia
51550020700	Chesapeake City	Virginia
51620090200	Franklin City	Virginia
51650010400	Hampton City	Virginia
51650010601	Hampton City	Virginia
51650010602	Hampton City	Virginia
51650010701	Hampton City	Virginia
51650011300	Hampton City	Virginia
51650011800	Hampton City	Virginia
51650011900	Hampton City	Virginia
51650012000	Hampton City	Virginia
51700030100	Newport News City	Virginia
51700030300	Newport News City	Virginia
51700030400	Newport News City	Virginia
51700030500	Newport News City	Virginia
51700030600	Newport News City	Virginia
51700030800	Newport News City	Virginia
51700030900	Newport News City	Virginia
51700031200	Newport News City	Virginia
51700031300	Newport News City	Virginia
51700032006	Newport News City	Virginia
51700032117	Newport News City	Virginia
51700032126	Newport News City	Virginia
51700032128	Newport News City	Virginia
51700032212	Newport News City	Virginia
51700032225	Newport News City	Virginia
51700032226	Newport News City	Virginia
51700032300	Newport News City	Virginia
51710000901	Norfolk City	Virginia
51710000902	Norfolk City	Virginia
51710001100	Norfolk City	Virginia
51710001300	Norfolk City	Virginia
51710001400	Norfolk City	Virginia

Census tract 2010 ID	County Name	State/Territory
51710002700	Norfolk City	Virginia
51710002900	Norfolk City	Virginia
51710003100	Norfolk City	Virginia
51710003300	Norfolk City	Virginia
51710003400	Norfolk City	Virginia
51710003501	Norfolk City	Virginia
51710004100	Norfolk City	Virginia
51710004200	Norfolk City	Virginia
51710004300	Norfolk City	Virginia
51710004400	Norfolk City	Virginia
51710004500	Norfolk City	Virginia
51710004600	Norfolk City	Virginia
51710004700	Norfolk City	Virginia
51710004800	Norfolk City	Virginia
51710005000	Norfolk City	Virginia
51710005100	Norfolk City	Virginia
51710005500	Norfolk City	Virginia
51710005701	Norfolk City	Virginia
51710005800	Norfolk City	Virginia
51710005901	Norfolk City	Virginia
51710005903	Norfolk City	Virginia
51710006000	Norfolk City	Virginia
51710006200	Norfolk City	Virginia
51740210500	Portsmouth City	Virginia
51740211100	Portsmouth City	Virginia
51740211400	Portsmouth City	Virginia
51740211500	Portsmouth City	Virginia
51740211700	Portsmouth City	Virginia
51740211800	Portsmouth City	Virginia
51740211900	Portsmouth City	Virginia
51740212000	Portsmouth City	Virginia
51740212100	Portsmouth City	Virginia
51740212300	Portsmouth City	Virginia
51740212400	Portsmouth City	Virginia
51740212600	Portsmouth City	Virginia
51740213101	Portsmouth City	Virginia
51740980100	Portsmouth City	Virginia
51800065100	Suffolk City	Virginia
51800065300	Suffolk City	Virginia
51800065400	Suffolk City	Virginia
51800065500	Suffolk City	Virginia
51800075501	Suffolk City	Virginia

Census tract 2010 ID	County Name	State/Territory
51800075601	Suffolk City	Virginia
51810041002	Virginia Beach City	Virginia
51810043200	Virginia Beach City	Virginia
51810044806	Virginia Beach City	Virginia
51810045200	Virginia Beach City	Virginia
51810045810	Virginia Beach City	Virginia
51810046221	Virginia Beach City	Virginia
37053110402	Currituck County	North Carolina
51181860100	Surry County	Virginia

LIDAC Census Block Groups- as identified by EJ Screen

County	Block Group ID
Chesapeake City	515500200031
Chesapeake City	515500201001
Chesapeake City	515500201002
Chesapeake City	515500201003
Chesapeake City	515500201004
Chesapeake City	515500202001
Chesapeake City	515500202002
Chesapeake City	515500202003
Chesapeake City	515500202004
Chesapeake City	515500203001
Chesapeake City	515500203002
Chesapeake City	515500204001
Chesapeake City	515500204002
Chesapeake City	515500204003
Chesapeake City	515500205001
Chesapeake City	515500207001
Chesapeake City	515500207002
Chesapeake City	515500207003
Chesapeake City	515500207004
Chesapeake City	515500208053
Chesapeake City	515500208091
Chesapeake City	515500208111
Chesapeake City	515500209031
Chesapeake City	515500209052
Chesapeake City	515500209101
Chesapeake City	515500209112
Chesapeake City	515500214021
Chesapeake City	515500214024
Chesapeake City	515500214031
Chesapeake City	515500214033

County	Block Group ID
Chesapeake City	515500214051
Chesapeake City	515500214072
Chesapeake City	515500215071
Chesapeake City	515500216021
Chesapeake City	515500216024
Currituck County	370531104031
Currituck County	370531104032
Currituck County	370531104040
Currituck County	370531104041
Franklin City	516200901001
Franklin City	516200902001
Franklin City	516200902002
Franklin City	516200902003
Gates County	370739703001
Greensville County	510818801012
Greensville County	510818802002
Hampton City	516500101042
Hampton City	516500101044
Hampton City	516500101045
Hampton City	516500103062
Hampton City	516500103063
Hampton City	516500103091
Hampton City	516500103111
Hampton City	516500103121
Hampton City	516500103141
Hampton City	516500103152
Hampton City	516500103162
Hampton City	516500104001
Hampton City	516500104002
Hampton City	516500104003

County	Block Group ID
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Hampton City	516500104005
Hampton City	516500105021
Hampton City	516500105032
Hampton City	516500105042
Hampton City	516500106011
Hampton City	516500106012
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Hampton City	516500107021
Hampton City	516500108001
Hampton City	516500109001
Hampton City	516500109002
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Hampton City	516500112001
Hampton City	516500112002
Hampton City	516500113001
Hampton City	516500113002
Hampton City	516500114001
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Hampton City	516500118001
Hampton City	516500118002
Hampton City	516500118003
Hampton City	516500118004
Hampton City	516500118005
Hampton City	516500118006
Hampton City	516500119001
Hampton City	516500119002
Hampton City	516500119003
Hampton City	516500120001
Hampton City	516500120002
Hertford County	370919501021
Hertford County	370919502011
Hertford County	370919502012
Hertford County	370919502021
Isle of Wight County	510932801051
Isle of Wight County	510932801052
Isle of Wight County	510932801053

County	Block Group ID
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James City County	510950801022
James City County	510950801023
James City County	510950801032
Newport News City	517000301001
Newport News City	517000301002
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County	Block Group ID
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Pasquotank County	371399605031
Pasquotank County	371399607013
Pasquotank County	371399607014
Portsmouth City	517402102001
Portsmouth City	517402103001
Portsmouth City	517402103002

County	Block Group ID
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Portsmouth City	517402128012
Portsmouth City	517402128013

County	Block Group ID
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Portsmouth City	517402131013
Portsmouth City	517402131033
Portsmouth City	517402131034
Portsmouth City	517402132001
Portsmouth City	517402132002
Portsmouth City	517409801001
Southampton County	511752003001
Suffolk City	518000651001
Suffolk City	518000651002
Suffolk City	518000652001
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Suffolk City	518000653012
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Suffolk City	518000655001
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Suffolk City	518000755032
Suffolk City	518000755041
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Suffolk City	518000756011
Suffolk City	518000756012
Suffolk City	518000757012
Surry County	511818601001
Surry County	511818601002
Surry County	511818601003
Sussex County	511838704002

County	Block Group ID
Tyrrell County	371779601000
Virginia Beach City	518100402001
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Virginia Beach City	518100402003
Virginia Beach City	518100404031
Virginia Beach City	518100404033
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Virginia Beach City	518100406001
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Virginia Beach City	518100448061
Virginia Beach City	518100448062
Virginia Beach City	518100448063
Virginia Beach City	518100448071

County	Block Group ID
Virginia Beach City	518100448072
Virginia Beach City	518100448074
Virginia Beach City	518100448075
Virginia Beach City	518100448081
Virginia Beach City	518100448083
Virginia Beach City	518100452001
Virginia Beach City	518100452002
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Virginia Beach City	518100458082
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Virginia Beach City	518100460023
Virginia Beach City	518100460132
Virginia Beach City	518100460133
Virginia Beach City	518100460192
Virginia Beach City	518100462064
Virginia Beach City	518100462073
Virginia Beach City	518100462132
Virginia Beach City	518100462211
Virginia Beach City	518100462212
Virginia Beach City	518100462213
Virginia Beach City	518100462232
Williamsburg City	518303701001
Williamsburg City	518303702003
Williamsburg City	518303703002
York County	511990502071
York County	511990503061
York County	511990505001

PRIORITY CLIMATE ACTION PLAN

Washington-Arlington-Alexandria
DC-VA-MD-WV Metropolitan Statistical Area

Prepared for the U.S. EPA as a deliverable for the Climate Pollution Reduction Grants (CRPG) Program, section 60114(a) of the Inflation Reduction Act

February 2024

Metropolitan Washington
Council of Governments

DISCLAIMER

This project has been funded wholly or in part by the United States Environmental Protection Agency (EPA) under assistance agreement 5D - 95316301 – 0 to the Washington D.C. Department of Energy and Environment (DOEE). DOEE engaged the Metropolitan Washington Council of Governments (COG) through a subgrant (GAN-FY23-COG-189) to develop this Priority Climate Action Plan (PCAP). The contents of this document do not necessarily reflect the views and policies of the EPA, nor does the EPA endorse trade names or recommend the use of commercial products mentioned in this document.

COG is an independent, non-profit association that brings area leaders together to address major regional issues in the District of Columbia, suburban Maryland, and Northern Virginia. COG's membership is comprised of 300 elected officials from 24 local governments, the Maryland and Virginia state legislatures, and U.S. Congress.

The Washington-Arlington-Alexandria, DC-VA-MD-WV Metropolitan Statistical Area (MSA) PCAP was developed to meet the requirements of the Climate Pollution Reduction Grants (CPRG) program, Inflation Reduction Act Section 60114(a). It does not replace or supersede the COG 2030 Climate and Energy Action Plan, rather it provides a set of priorities for the MSA that will enable governments and other stakeholders in the region to seek competitive implementation funding through the CPRG program, Inflation Reduction Act Section 60114(b).

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COG deeply appreciates the contributions of the CPRG Steering and Technical Committees, COG Committees and multiple stakeholders across the MSA.

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- Air and Climate Public Advisory Committee (ACPAC)
- Built Environment and Energy Advisory Committee (BEEAC)
- Chief Equity Officers Committee (CEOC)
- Climate, Energy and Environment Policy Committee (CEEPC)
- Food and Agriculture Regional Member (FARM) Policy Committee
- Metropolitan Washington Air Quality Committee (MWAQC)
- MWAQC Technical Advisory Committee (MWAQC-TAC)
- Regional Electric Vehicle Deployment (REVD) Working Group
- TPB Community Advisory Committee (TPB-CAC)
- TPB Technical Committee (TPB-Tech)

Additional stakeholders who engaged with COG are listed in Appendix F.

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

ACRONYMS LIST

ACPAC	Air and Climate Public Advisory Committee
ATV	All-terrain vehicles
BAU	Business-as-usual
BEEAC	Built Environment and Energy Advisory Committee
BEPS	Building energy performance standards
BIPOC	Black, Indigenous, and People of Color
BRIC	FEMA Building Resilient Infrastructure for Communities
CBO	Community-based organizations
CCA	Community choice aggregation
CCAP	Comprehensive Climate Action Plan
CECAP	Community-wide Energy and Climate Action Plan
CEEPC	Climate, Energy and Environment Policy Committee
CEOC	Chief Equity Officers Committee
CGA	Common Grain Alliance
CHP	Combined heat and power
CMAQ	Congestion Mitigation and Air Quality
COG	(Metropolitan Washington) Council of Governments
CPRG	Climate Pollution Reduction Grants
CSNA	Climate Solutions Now Act
DERA	Diesel Emissions Reduction Act
DEQ	Virginia Department of Environmental Quality
DOE	U.S. Department of Energy
DOEE	D.C. District Department of Energy and Environment
DPOR	Department of Professional and Occupational Regulation
EEA	Equity Emphasis Areas
EV	Electric vehicles
ESPC	Energy Savings Performance Contract
FACS	Faith Alliance for Climate Solutions
FARM	Food and Agriculture Regional Member
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GCoM	Global Covenant of Mayors
GGRA	Greenhouse Gas Reduction Act
GHG	Greenhouse gas
GWRCCC	Greater Washington Region Clean Cities Coalition
HUD	Housing and Urban Development
ILSR	Institute for Local Self-Reliance
IPCC	Intergovernmental Panel on Climate Change
IRA	Inflation Reduction Act
LIDAC	Low-Income, Disadvantaged Community
MCEC	Maryland Clean Energy Center
MDE	Maryland Department of the Environment

MEA	Maryland Energy Administration
MSA	Metropolitan Statistical Area
MWAA	Metropolitan Washington Airports Authority
MWAQC	Metropolitan Washington Air Quality Committee
NVRC	Northern Virginia Regional Commission
PACE	Property Assessed Clean Energy
PCAP	Priority Climate Action Plan
REC	Renewable energy certificate
REVD	Regional Electric Vehicle Deployment
RHE	Rockville Housing Enterprises
SELC	Southern Environmental Law Center
SEU	Sustainable Energy Utility
STBG	Surface Transportation Block Grant
TPB	Transportation Planning Board
VMT	Vehicle miles traveled
WMATA	Washington Metropolitan Area Transit Authority
WSSC	Washington Suburban Sanitary Commission
WRRF	Water Resource Recovery Facility
WVSWMB	West Virginia Solid Waste Management Board
ZEV	Zero-emission vehicle

EXECUTIVE SUMMARY

Air pollution and climate change pose significant threats to communities and ecosystems worldwide, including the Washington-Arlington-Alexandria, DC-VA-MD-WV Metropolitan Statistical Area (MSA). The diverse communities in metropolitan Washington face health risks like respiratory and cardiovascular illnesses from exposure to air pollutants while climate change leads to additional risks like extreme heat, increased frequency and severity of extreme weather events, and flooding, which all pose additional risks to the safety and well-being of community members.

In light of these interconnected challenges, urgent and coordinated action by leaders is imperative to reduce air pollution and greenhouse gas (GHG) emissions to combat climate change and safeguard communities, particularly those most vulnerable to the impacts of climate change.

Gross GHG emissions for the MSA in 2020 were 61.4 million metric tons of carbon dioxide equivalent ($MMTCO_2e$). Net GHG emissions amounted to 54.2 $MMTCO_2e$ after accounting for the sequestration of GHG emissions attributed to the MSA's forests and green spaces.

In a business-as-usual (BAU) scenario, modeling results indicate that gross emissions are projected to increase by 38% between 2020-2050. Increased emissions are projected to be primarily from the buildings sector due to continued development and increased population growth.

Actions to improve air quality and reduce GHG emissions are underway, coordinated by the Metropolitan Washington Council of Governments (COG) staff and participating governments. COG, alongside Maryland, Virginia, Washington D.C., and many county and city governments within the MSA, have set ambitious goals to reduce GHG emissions. They have also created climate action plans and engaged with local residents and organizations to shape the future of climate resilience and mitigation in their jurisdictions.

The prospect of receiving funding from the Climate Pollution Reduction Grant (CPRG) to expand and accelerate these efforts would bring additional benefits to the MSA, including low-income, disadvantaged communities (LIDACs).

This Priority Climate Action Plan (PCAP) presents eight vital measures to reduce air pollution and GHG emissions in the MSA, summarized in Table 1. These measures were developed through a collaborative and iterative process with the many government offices and committees within the MSA and the states it crosses, as well as other stakeholders such as community-based organizations, private sector actors, utilities, planning boards and committees, and more. These are practical and achievable strategies spanning buildings and clean energy, transportation, waste, and land use sectors.

Table 1 represents cumulative GHG reductions or sequestration in the short term (2025 – 2030) and the long-term (2025 – 2050). In some instances, already existing modeling efforts from COG were used, and in other situations new modeling was conducted. The values presented in Table 1 are not additive as there may be areas of overlap between measures. This might result in double counting when comparing it to the clean and renewable energy measure, which also accounts for emissions reductions from cleaner electricity.

Table 1. Summary of PCAP Measures

Sector	Measure	Cumulative 2025-2030 GHG reductions ($MMTCO_2e$)	Cumulative 2025-2050 GHG reductions ($MMTCO_2e$)
Buildings and Clean Energy	Accelerate the deployment of energy efficiency solutions and decarbonization of residential, institutional, municipal, and commercial buildings.	5.00	66.67
Buildings and Clean Energy	Accelerate the deployment of clean and renewable energy.	2.66	11.24
Buildings and Clean Energy	Study, plan for, and deploy district energy and microgrid opportunities.	Varied based on system type, for a single generalized system ranges from 0.01 - 0.38	Varied based on system type, for a single generalized system ranges from 0.25 - 0.84
Transportation	Provide and promote new and expanded opportunities to reduce VMT through public transportation, non-motorized travel, micromobility, shared travel options, and development.	0.72	5.22
Transportation	Accelerate the deployment of low- and zero- emission transportation, fuels, and vehicles.	2.80	135.50
Transportation	Accelerate the deployment of off-road/non-road electric equipment.	3.40	17.74
Waste	Reduce GHG emissions from waste and wastewater treatment.	5.47	30.23
Land Use	Accelerate the expansion of the regional tree canopy and reduce tree canopy loss.	0.47	3.94

The GHG reduction measures described in the PCAP may provide more than just GHG emission reductions; they will result in additional co-benefits including improved air quality, quality job opportunities, cost savings, and enhanced community well-being across the MSA. From increasing energy efficiency in the buildings sector and developing clean energy generation to improving public transportation to planting more trees, the co-benefits these measures will provide to MSA communities, particularly to LIDACs, can be accelerated through additional funding and coordination action.

COG will develop a comprehensive CAP (CCAP) by 2025. In the meantime, COG will continue to meaningfully engage with stakeholders, including local governments, state governments, industry, community organizations, tribes, a matrix of stakeholders (e.g., Commissions, Committees, academic and research resources, CBOs, foundations and institutions), and the public to inform the development of the CCAP and in the implementation of climate actions, throughout the MSA.

1 INTRODUCTION

The Metropolitan Washington Council of Governments (COG) developed this Priority Climate Action Plan (PCAP) for the Washington-Arlington-Alexandria, DC-VA-MD-WV Metropolitan Statistical Area (MSA) to meet the requirements of the U.S. Environmental Protection Agency's (EPA) Climate Pollution Reduction Grants (CPRG) program. The CPRG program provides funding to states, local governments, tribes, and territories to develop and implement plans for reducing greenhouse gas (GHG) emissions and other harmful air pollution.

The Washington, D.C. Department of Energy and Environment (DOEE) awarded COG a subgrant to lead the development of this PCAP and the other required CPRG planning deliverables for the MSA, including a Comprehensive Climate Action Plan (CCAP, due mid-2025) and a Status Report (due 2027) for the MSA.

1.1 CPRG Program Overview

The Inflation Reduction Act (IRA), signed into law on August 16, 2022, directs funds to lower healthcare costs, increase America's energy security, improve the tax code, create good-paying jobs here in America, and address the existential threat of climate change by funding climate solutions. The IRA contains provisions that directly or indirectly address climate change, including reduction of U.S. GHG emissions and promotion of adaptation and resilience to climate change impacts.[1]

The CPRG program, authorized under Section 60114 of IRA, provides $5 billion in grants to states, local governments, tribes, and territories to develop and implement plans for reducing GHG emissions and other harmful air pollution. The program consists of two phases: planning and implementation. The planning phase provides $250 million in noncompetitive planning grants for state and local agencies, tribes, and territories to develop a PCAP, CCAP, and Status Report. The second phase provides $4.6 billion in competitive grants for eligible applicants to implement GHG reduction measures identified in their applicable PCAP(s).

Definitions

GHGs: GHGs include the air pollutants carbon dioxide (CO_2), hydrofluorocarbons (HFCs), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

GHG Inventory: A list of emission sources and sinks and the associated emissions quantified using standard methods.

GHG Reduction Measure: Implementable actions that reduce GHG emissions or enhance carbon removal. Measures that enhance "carbon removal" are those that increase the removal of carbon dioxide from the atmosphere through, for example, the uptake of carbon and storage in soils, vegetation, and forests (i.e., sequestration).

Benefits: Direct changes in air pollution (e.g., $PM_{2.5}$) that result from a GHG reduction measure.

Co-Benefits: Positive effects beyond the stated goal of a GHG reduction measure (e.g., improved public health outcomes, economic benefits, increased climate resilience).

Low Income Disadvantaged Community (LIDAC): Communities with residents that have low incomes, limited access to resources, and disproportionate exposure to environmental or climate burdens.

1.2 PCAP Overview and Definitions

This PCAP identifies high priority, ready-to-implement GHG reduction measures that will provide significant GHG reductions and other benefits to the metropolitan Washington region. The PCAP

[1] CRS. "Inflation Reduction Act of 2022 (IRA): Provisions Related to Climate Change," October 3, 2022. https://crsreports.congress.gov/product/pdf/R/R47262.

measures were developed based on significant stakeholder engagement and input about potential concepts for which CPRG implementation funding may be sought. Table 2 outlines the information included in this PCAP.[2]

Table 2. Crosswalk of CPRG PCAP requirements to Metropolitan Washington Region PCAP Section

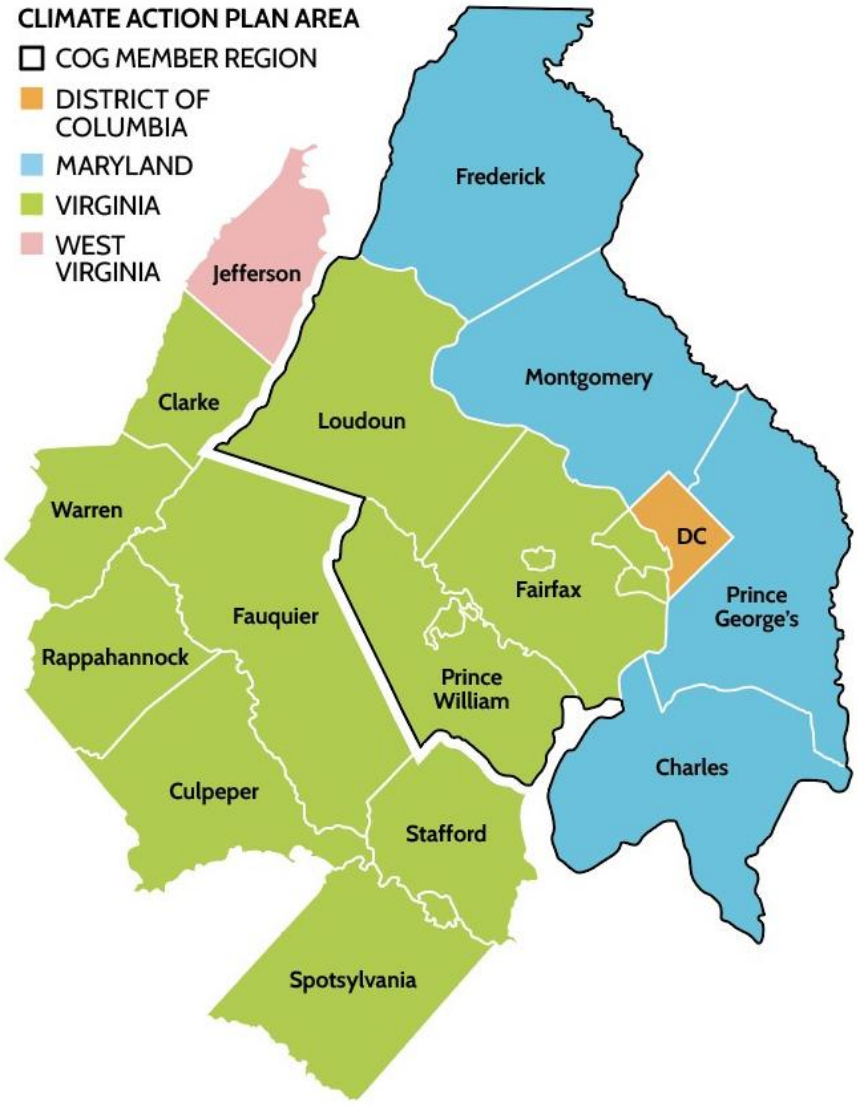
PCAP Required Elements	Metropolitan Washington
GHG Inventory	Section 2.1
Quantified GHG Reduction Measures	Section 4
Low-Income Disadvantaged Community (LIDAC) Benefits Analysis	Sections 1.4 and 3, Section 4 within each measure
Review of Authority to Implement	Section 4 within each measure
PCAP Encouraged/Not Required Elements	
GHG Emissions Projections	Section 2.2
GHG Reduction Targets	Section 2.3
Benefits Analysis for Full Geographic Scope and Population	Will be assessed in the CCAP
Intersection with Other Funding Availability	Section 4 within each measure
Workforce Planning Analysis	Will be assessed in the CCAP

[2] US EPA. "Climate Pollution Reduction Grants Program: Formula Grants for Planning," March 1, 2023. https://www.epa.gov/system/files/documents/2023-02/EPA%20CPRG%20Planning%20Grants%20Program%20Guidance%20for%20States-Municipalities-Air%20Agencies%2003-01-2023.pdf

1.3 Scope of the PCAP

This PCAP covers the Washington-Arlington-Alexandria, DC-VA-MD-WV MSA, the geographic area outlined in Figure 1.[3] The MSA crosses three states (Maryland, Virginia, West Virginia) and the District of Columbia and extends beyond COG's usual geography. Each of these states has developed its own PCAP. COG and the local governments within the MSA are coordinating with state CPRG leads to align GHG reduction priorities.

Figure 1. Jurisdictions included in the Washington-Arlington-Alexandria, DC-VA-MD-WV MSA. Not listed but mapped jurisdictions include Arlington County (VA), City of Alexandria (VA), City of Fairfax (VA), City of Falls Church (VA), City of Fredericksburg (VA), City of Manassas (VA), and City of Manassas Park (VA).



[3] COG is comprised of 24 jurisdictions: The District of Columbia, Town of Bladensburg, City of Bowie, City of College Park, Charles County, City of Frederick, Frederick County, City of Gaithersburg, City of Greenbelt, City of Hyattsville, City of Laurel, Montgomery County, Prince George's County, City of Rockville, City of Takoma Park, City of Alexandria, Arlington County, City of Fairfax, Fairfax County, City of Falls Church, Loudoun County, City of Manassas, City of Manassas Park, and Prince William County. For more information, see https://www.mwcog.org/about-us/cog-and-our-region/local-governments/.

1.4 Approach to Developing the PCAP

1.4.1 GHG INVENTORY AND GHG REDUCTION TARGETS

COG regularly prepares a GHG inventory using the ICLEI (Local Governments for Sustainability) ClearPath tool.[4] COG leveraged and expanded its existing GHG inventory and projections to cover the entire MSA. COG used the existing 2020 GHG inventory for portions of the MSA that fall within COG's geographic scope. For counties and cities outside of this area, COG sought other data sources and approaches to prepare a 2020 GHG inventory for the MSA. Additional information on the GHG inventory may be found in Section 2.1 and Appendix A.

COG and many of the communities within the MSA already have established GHG reduction targets. These are described in Section 2.3 and Appendix B. During the CCAP development process, COG will work with jurisdictions across the MSA to establish an MSA-wide GHG reduction target(s).

1.4.2 PRIORITY GHG REDUCTION MEASURES AND THE PCAP

Many cities and counties within the MSA and the states that the MSA crosses have already engaged in significant climate planning efforts and action. Plans such as the *Metropolitan Washington 2030 Climate and Energy Action Plan,*[5] the *Tree Canopy Management Strategy,*[6] and climate and energy action plans from local governments across the region, and the 2022 TPB GHG Reductions Goals and Strategies Resolution (Resolution R18-2022), provided a solid foundation of planned and ongoing actions to reduce GHG emissions for the PCAP. Appendix B lists existing local, regional, and state plans.

To identify, prioritize, and analyze GHG reduction measures, COG used the process outlined in Figure 2. Stakeholder engagement activities were done continuously across all the steps discussed below.

Figure 2. COG's Process to Develop and Assess Priority GHG Reduction Measures

1. Collect priority project and program ideas. COG used multiple mechanisms to collect ideas for GHG reduction priorities across the MSA. COG reviewed existing plans and climate actions across the region. COG developed and distributed a project survey to CPRG Steering and Technical Committee members to complete or share with other stakeholders (see responses in Appendix D). A public survey was conducted via COG's CPRG website and other virtual channels to collect ideas on community climate priorities (see above and Appendix E).[7] Lastly, COG presented to and held discussions with many stakeholders on existing COG committees and with other external stakeholders.

[4] https://icleiusa.org/clearpath/
[5] https://www.mwcog.org/documents/2020/11/18/metropolitan-washington-2030-climate-and-energy-action-plan/
[6] https://www.mwcog.org/committees/regional-tree-canopy-workgroup/
[7] https://www.mwcog.org/environment/programs/climate-pollution-reduction-grants-cprg-program/

2. Compile ideas and develop GHG reduction measures. COG compiled existing plans and actions, along with responses to both the project and community climate priorities surveys. COG then reviewed these ideas to categorize them by relevant GHG inventory sector, identify themes, and group similar ideas to form broader GHG reduction measures. COG prepared an annotated draft list of measures. To be as inclusive as possible, COG did not explicitly cut any ideas from the initial draft measures list.

3. Prioritize GHG reduction measures. The annotated draft list of measures was shared with the CPRG Steering and Technical Committees and with other stakeholders for review through smaller discussions, webinars, and email. Specifically, COG asked for a review and feedback to identify any potential gaps reviewers saw in line with their priorities for funding, and to identify any potential measures to deprioritize. Using this feedback, COG finalized the list of GHG reduction measures presented in this PCAP.

4. Assess GHG reduction measures. As a next step, COG began to assess GHG reduction measures in line with PCAP requirements, such as quantified GHG reductions, authority to implement, LIDAC benefits, and other information (e.g., available funding, key implementors). COG sought input on many of these analysis elements in the initial project survey. Using the survey results, combined with other relevant information already in existing plans, and based on continued discussions with stakeholders and committees, COG assessed GHG reduction measures. Additional information on quantification of GHG reductions may be found in Appendix A.

5. Draft PCAP. COG drafted the PCAP using information from the previous steps and shared a version with the CPRG Steering and Technical Committees for review. A version of the draft PCAP was also posted publicly online to collect other stakeholder comments and feedback.

6. Finalize PCAP. COG reviewed comments and feedback on the PCAP, addressed many of these, filled in any remaining required information, and completed the PCAP.

1.4.3 IDENTIFYING AND ENGAGING STAKEHOLDERS

Throughout the process outlined above, COG engaged with stakeholders and community representatives throughout the MSA. Engagement consisted of meetings, communications, and coordination between COG, local, and regional climate change and community leaders to ensure that both regional perspectives and local needs are reflected in the plan. Committee members, stakeholders, and community representatives engaged during PCAP development can be found in Appendix F.

CPRG Committees

COG formed CPRG Steering and Technical Committees to advise on GHG emission reduction priority projects, programs, and measures. The committees are comprised of local and state government staff. Priority projects suggested by these groups informed the measures included in this PCAP.

Steering Committee meetings and Technical Committee meetings were held from November 2023 through February 2024, focused on PCAP development, implementation grant evaluation criteria and to discuss prioritizing projects, programs, and measures. The committees emphasized the best ways to collaborate among local governments and communities, and they will continue to advise on the CPRG program through 2027 when the program concludes.

Other COG Committees

In addition to the CPRG Steering and Technical Committees, COG holds regular meetings with local and regional committees representing climate and environmental concerns and with industries that significantly impact GHG emissions. The CPRG was a topic of discussion at recent and ongoing meetings of these committees.

Industry, Utilities, Other Government Partners, and Stakeholders

COG also conducted a succession of meetings, conversations, and emails with stakeholders to gather information, identify priorities, and make connections to inform the PCAP and implementation grant. Groups engaged include utilities, regional stakeholder groups, higher education institutions' sustainability directors, environmentally focused CBOs, and others.

LIDACs

LIDAC benefits and impacts are a primary consideration for selection of priority regional climate pollution reduction projects, programs, and measures. Recognizing that developing authentic and meaningful engagement with LIDACs relies upon dedicated outreach and time to develop relationships, COG targeted its PCAP LIDAC engagement efforts toward gathering and understanding existing priorities and issues identified through local initiatives, established engagement methods, and successful approaches. These efforts have laid the groundwork for deeper and sustained engagement during the development of the CCAP.

PCAP engagement included contributions representing LIDAC interests from both non-governmental organizations and government representatives. Community engagement webinars, individual engagement meetings, and a Community Climate Priorities survey (described below) were offered during the development of the PCAP.

In addition to the Community Climate Priorities survey, COG distributed a questionnaire to local governments, state governments, and COG committees, including the Chief Equity Officers Committee, to gather information about existing outreach activities with LIDAC representatives and organizations. The questionnaire focused on understanding recent and ongoing LIDAC engagement activities at the local level over the past two years and how such engagement informs climate action plans and priority projects, as well as community climate and energy goals. Additionally, the questionnaire sought input on the needs and priorities identified by LIDAC community members related to GHG reduction projects and activities connected to experienced impacts of climate change. This questionnaire is being used to inform future community engagement. COG continues to coordinate with its Chief Equity Officers Committee to provide input on engagement strategies for the CCAP.

Tribes

Tribal engagement is another distinct effort with a relationship building focus within COG's CPRG outreach efforts. COG aims to foster relationships with tribes and tribal communities, ensuring inclusivity throughout the CCAP development and, if awarded, CPRG implementation grant(s). During PCAP development, COG conducted tribal engagement with several tribal communities including the regional Accokeek Foundation and the Patawomeck Indian Tribe in Virginia. As of 2024, there are four state recognized tribes in the MSA including the Maryland Accohannock Indian Tribe, Maryland Piscataway Conoy Tribe, Maryland Piscataway Indian Nation, and the Virginia Patawomeck Indian Tribe. COG acknowledges that there are many indigenous people and communities living throughout the region and will work closely with tribal representatives and organizations to ensure inclusive and equitable contributions to the CCAP.

In meetings with tribal representatives from community and state tribes, several key themes emerged. Partnering on youth education was highlighted as a priority, recognizing the importance of passing down wisdom teachings and embracing the value of conservation for future generations. There was also a strong emphasis on healing the land from the impacts of urbanization and climate change, with a particular need for clean rivers and addressing invasive species. Energy and building retrofits were discussed as essential for environmental sustainability, with a desire to integrate traditional wisdom with modern technology. Concerns were raised about the potential impacts of data centers on the environment, emphasizing the need for careful planning and consideration of ecological restoration efforts. Discussions underscored the importance of a holistic approach, centering indigenous knowledge and values.

Community Members

To incorporate the perspective of community members across the MSA, COG disseminated the CPRG Community Climate Priorities survey to assess community-wide climate priorities. The survey was shared through multiple online channels, extending beyond formal committees to include distribution through social media, the COG CPRG and main COG websites, local representatives, and community-based/non-governmental organizations. The survey gained responses from 86 participants from 13 jurisdictions within the MSA, encompassing a diverse range of individuals, organizations, coalitions, and agencies. Participants were asked to prioritize strategies for mitigating climate change by ranking mitigation strategies. The eight strategies included in the PCAP were ranked by the community in the following order of importance:

1. Land Use
2. Energy Efficient and Clean Energy Buildings
3. Increasing Supply of On-site Clean Energy
4. Transit Options
5. Increasing Off-site Clean Energy
6. Transportation Technology
7. Waste Reduction, Composting, and Recycling
8. Carbon Removal and Sequestration

Participants were requested to reflect on specific equity priorities, barriers to action, and project ideas within the above eight strategies. Summary results are described in Appendix E.

1.4.4 CONTINUED ENGAGEMENT

During the PCAP development, COG strived for inclusivity and relationship building with sister agencies, jurisdictions throughout the MSA, tribes, industry partners, and CBOs representing LIDACs through stakeholder engagement sessions, surveys, and meetings. COG remains committed to broad public engagement during the CCAP development, with a focus on addressing environmental justice and equity concerns and supporting historically underrepresented and overburdened communities.

During development of the CCAP, a thorough Community Engagement Plan (CEP) will focus on diversity, equity, inclusion, and meaningful engagement of tribes and LIDACs in the MSA. Outreach to community stakeholders through ongoing and future engagements will include people and organizations that represent populations that have historically been marginalized, underserved, or left out of climate planning conversations. Through partnering with tribes, CBOs, and COG's

committee of Chief Equity Officers, a conduit for input and engagement across localities and sectors, particularly among underserved community members, is being established.

COG will work to ensure inclusive and equitable contributions to the CCAP and will focus on engagement that meets people where they are. COG aims to engage community members through various channels and will integrate survey responses, feedback from listening sessions, and insights from numerous meetings to further develop the CCAP Community Engagement Plan. Moreover, COG will actively seek input from a diverse audience throughout climate mitigation planning. For example, using insights from separate meetings with members of the Accokeek Foundation and the Patawomeck Indian Tribe, COG is coordinating with state partners experienced in working with state tribes and tribal communities to develop a comprehensive tribal outreach plan. By communicating closely with tribe representatives and organizations, COG will seek to understand initiatives underway and opportunities for future collaboration on projects, programs, and measures.

2 METROPOLITAN WASHINGTON'S CLIMATE CONTEXT

2.1 GHG Inventory

COG developed a GHG inventory of priority sources of GHG emissions within the MSA for the year 2020 (Table 3). A detailed methodology including data resources for the preparation of this inventory are contained in Appendix A. Gross GHG emissions for the MSA were 61.4 million metric tons of carbon dioxide equivalent ($MMTCO_2e$) in 2020. Net GHG emissions amounted to 54.2 $MMTCO_2e$ after accounting for the sequestration of GHG emissions attributed to the MSA's forests and trees.

Table 3. MSA GHG Emissions Inventory

Emissions Type	Emissions Activity or Source	Sub-Activity Source	2020 MSA Total Emissions ($MTCO_2e$)
BUILDINGS			33,079,836
Residential Energy	Emissions from Grid Electricity	Residential Electricity	6,887,936
	Emissions from Stationary Fuel	Residential Natural Gas	4,656,374
		Residential Fuel Oil	248,908
		Residential LPG	104,879
Commercial Energy	Emissions from Grid Electricity	Commercial Electricity	13,491,249
		Commercial Natural Gas	3,968,236
		Commercial Fuel Oil	62,663
		Commercial LPG	30,194
Process and Fugitive Emissions	Fugitive Emissions from Natural Gas Distribution	Natural Gas Fugitive Emissions	251,260
	Other Process and Fugitive	Hydrofluorocarbon (HFCs)	3,378,137
TRANSPORTATION			23,994,733
Transportation and Mobile Emissions	On-Road Transportation (National Emissions Inventory [NEI])	On-Road Mobile Emissions	19,946,011
	Emissions from Off-Road Vehicles (NEI)	Off-Road Mobile Emissions	2,194,931
	Aviation Travel	Passenger Air Travel	1,814,955
	Rail Transportation	Rail Transportation	38,836

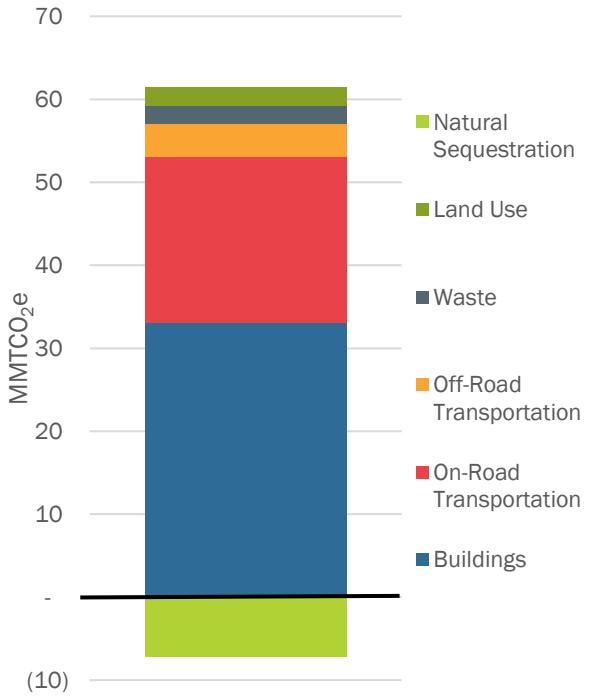
Emissions Type	Emissions Activity or Source	Sub-Activity Source	2020 MSA Total Emissions ($MTCO_2e$)
WASTE			**2,090,407**
Solid Waste	Waste Generation	Landfill Waste Generation	1,390,042
	Combustion of Solid Waste Generated by the Community	Combustion of Solid Waste	618,679
Water and Wastewater	Fugitive Emissions from Septic Systems	Septic System Emissions	60,427
	Nitrification/Denitrification Process N_2O Emissions from Wastewater Treatment	Sewer System Emissions	14,873
	Process N_2O from Effluent Discharge to Rivers and Estuaries	N_2O Effluent Discharge Emissions	6,386
LAND USE			**(4,921,268)**
Agriculture	Emissions from Agriculture Activities	Enteric Fermentation	493,279
		Manure Management	139,287
		Ag Soils	539,978
Forests and Trees Outside of Forests	Average Annual Emissions	Forests Converted to Non-Forests	500,205
		Disturbances in Forests Remaining Forests	253,207
		Loss of Trees Outside Forests	307,305
	Average Annual Sequestration	Forests Remaining Forests	(5,018,124)
		Non-Forests Converted to Forests	(104,368)
		Trees Outside Forests	(2,032,037)
GROSS GHG EMISSIONS (ALL SECTORS)			**61,398,238***
NET GHG EMISSIONS (ALL SECTORS)			**54,243,709***

* Totals may differ due to rounding.

The GHG inventory represents GHG-emitting activities undertaken by residents, businesses, industry, visitors, and government located in the MSA. Approximately 54% of the MSA's gross GHG emissions come from residential and commercial building energy consumption and 39% from transportation (32% is on-road). The remainder of GHG emissions comes from other activities including solid waste, wastewater treatment, agriculture, and fugitive emissions (Figure 3).

Note that 2020 represents an atypical year of GHG emission levels due to the impacts of the COVID-19 pandemic. In many places, as in the metropolitan Washington region, this led to reduced GHG emissions from on-road transportation and changes in patterns in building energy use, along with other anomalies that may not be prevalent in future year inventories.

Figure 3. 2020 MSA GHG Emissions by Activity



2.1.1 GHG INVENTORY METHODOLOGY

The MSA inventory and previous COG inventories have been developed to be compliant with the U.S. Communities Protocol for Accounting and Reporting Greenhouse Gas Emissions (USCP), Global Protocol for Community Scale Greenhouse Gas Inventories (GPC), and Global Covenant of Mayors (GCoM) reporting framework. COG mainly follows the calculation guidance from USCP as the USCP identifies sources of data widely available to communities in the US. COG uses ICLEI's ClearPath tool Community Scale Inventory Module for preparing GHG inventories, which is consistent with both US and global accounting protocols.

COG made every effort to capture a complete and accurate picture of GHG trends across the MSA, while also providing for a consistent methodology that is replicable across communities and inventory years. The GHG inventories follow an activities-based approach, meaning emissions are calculated based on the result of activities happening in the local communities. Local results are totaled to create a picture for the region. See Appendix A for the full methodology.

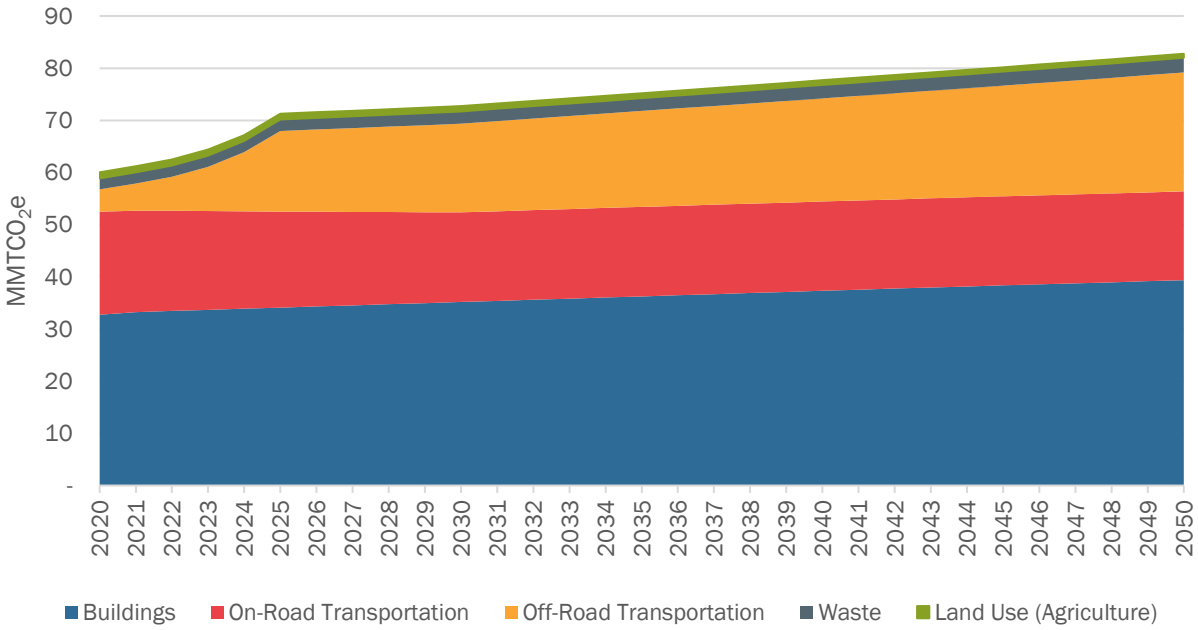
2.2 Business-As-Usual Projections

Business-as-usual (BAU) projections provide a baseline scenario for future GHG emissions. BAU projections account for driving factors such as growth in population, housing and commercial development, and transportation patterns, and estimate the impact they will have on future GHG emissions. BAU projections reflect policies and practices that are currently in place and implemented to-date to reduce GHG emissions, but do not incorporate any additional GHG emission reductions from anticipated future action.

The MSA BAU scenario for this PCAP projected gross GHG emissions out to 2050. Based on the assumptions used, gross emissions increased by 38% between 2020-2050 (not including Land Use - Forests and Trees Outside of Forests).

Figure 4 shows the region's projected BAU emissions to 2050.

Figure 4. MSA Business-As-Usual Projections



See Appendix A for a summary of BAU assumptions. Significant increases were seen in the buildings sector (31% and 10% for residential and commercial energy, respectively) because of continued development and increased population growth. Similarly, population growth is driving waste sector emissions. A decline in GHG emissions from on-road transportation (14%) is seen as a result of continued trends in alternative and electric vehicles, increased efficiency, and other related policies and programs.

2.3 GHG Reduction Targets

The COG Board previously established specific GHG emission reduction goals of 10% below BAU projections by 2012 (bringing regional emission back down to 2005 levels), 20% by 2020 and 80% by 2050 (below the 2005 baseline). In 2019, COG became a Signatory to GCoM. Based on review of the GCoM framework of global best practices for climate planning, updated Intergovernmental Panel on Climate Change (IPCC) recommendations, and a recommendation from the COG CEEPC, the Board approved new 2030 climate goals including:

- The climate mitigation goal of 50% GHG emission reductions below 2005 levels by 2030.
- The climate resilience goal of becoming a Climate Ready Region and making significant progress toward becoming a Climate Resilient Region by 2030.

To be climate ready by 2030, all local governments must assess current and future climate risks, and be actively integrating climate planning across government plans, operations, and communications. To fully be a Climate Resilient Region, the region must have the ability to adapt to

disturbances caused by current and future, acute and chronic climate impacts and successfully maintain essential functions.

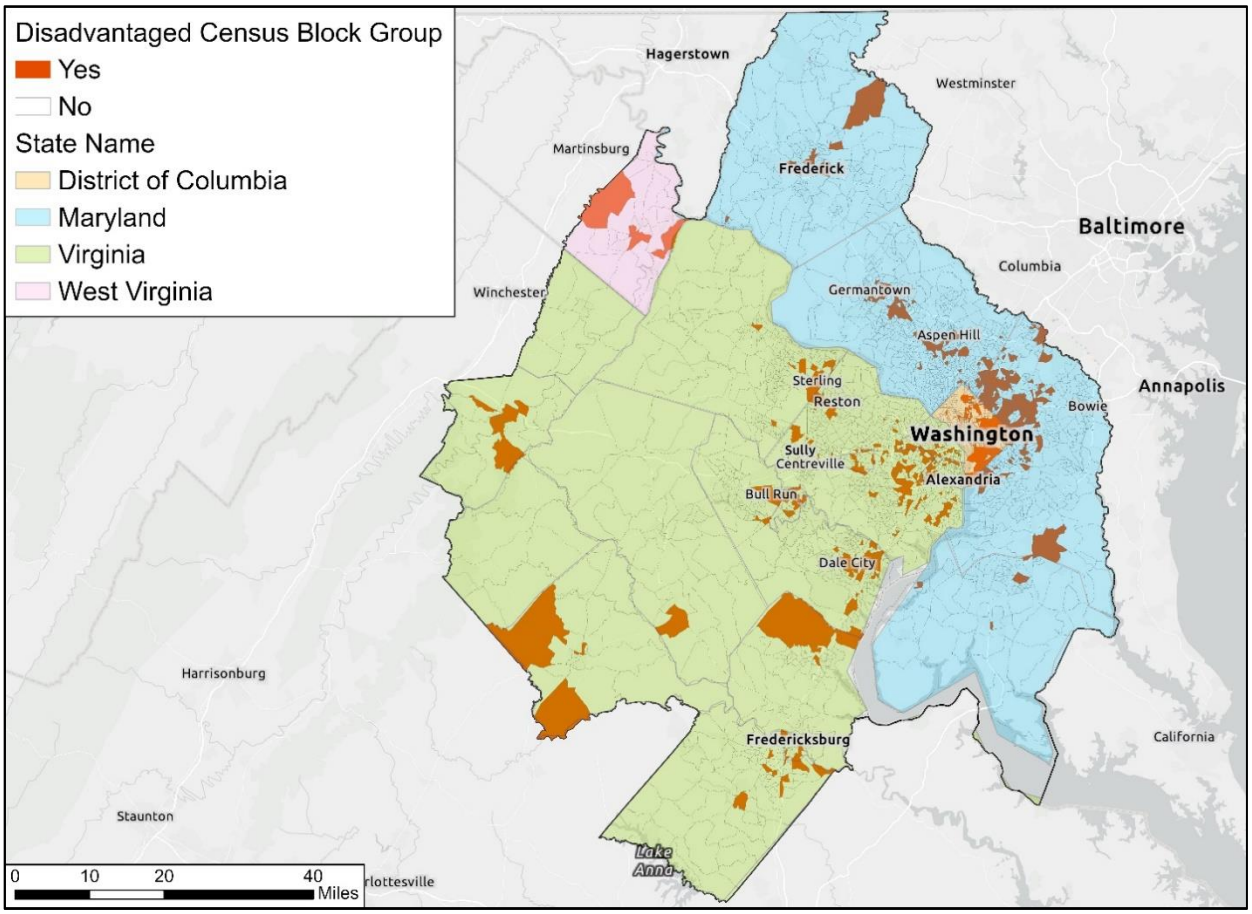
Along with the COG goals, local governments across the MSA and the states the MSA crosses have established goals. Appendix B lists existing local, regional, and state climate and energy goals and plans. During the CCAP development, COG will work with MSA jurisdictions and regional partners to establish an MSA-wide GHG reduction goal(s).

3 METROPOLITAN WASHINGTON LIDACS

3.1 Metropolitan Washington's LIDACs

To identify communities meeting the CPRG LIDAC definition, COG used EPA's Environmental Justice Screening and Mapping Tool (EJScreen) and supplementary data. EJScreen is a tool that uses demographic, social, and environmental datasets to assess the risks and burdens that different communities face. Communities identified as disadvantaged under the EJScreen tool for the MSA include any Census block group at or above the 90th percentile for any of EJScreen's Supplemental Indexes when compared to the nation. COG used EJScreen to visualize and identify Census block groups that EPA designates as disadvantaged in the state (see Figure 5).

Figure 5. LIDACs in the Metropolitan Washington Region as Identified Using EJScreen



In the metropolitan Washington region, 25% of the population is disadvantaged. The percentage of disadvantaged population varies across different states: 47% of the population in D.C., 28% in West Virginia, 23% in Maryland, and 21% in Virginia. A full list of the Census Block IDs that are identified as LIDACs in the MSA is included in Appendix C.

The metropolitan Washington region comprises diverse cities and counties with varying demographics such as education levels, income, and unemployment.

- Education levels vary across the MSA, with 4% of the overall population lacking a high school diploma. However, in LIDACs, this percentage is double the average at 8%.[8]
- Economic diversity is evident in the region's median household incomes. The average median household income across the MSA counties is approximately $125,000. However, within LIDACs, the median household income for the MSA is about 30% less on average at approximately $85,000. Warren County (VA), the City of Fredericksburg (VA), and Jefferson County (WV) reported the lowest household median incomes at $85,096, $89,612, and $94,897, respectively.[9]
- Overall, the unemployment rate in the MSA is 5%, although unemployment rates vary across the region. The District of Columbia experiences the highest overall unemployment rate in the region at 5%; this rises to 10% in LIDAC communities within the District. Maryland experiences the lowest unemployment rate, at about 5% (7% in Prince George's County, 5% in Montgomery County, and 4% in Frederick County). In Virginia, unemployment is 4% (3% in Loudoun County, 5% in Prince William County, 4% in Fairfax County, and 3% in Arlington County). The unemployment rate in Jefferson County, WV is 5%.[10]

The area that is comprised of the largest cluster of connected LIDACs is in Prince George's County (MD). According to the U.S. Census data, Prince George's County is 64.1% Black, 27.0% White, and 4.4% Asian, and 20.9% Hispanic. The racial makeup of the County shows the intersectionality of socio-economic disparities and race, emphasizing the need for targeted and equitable interventions to address systemic inequalities. Prince George's County also reported the highest number of persons who have not attained a high school diploma with 13,997 persons, followed by Montgomery County (MD) with 12,957 persons, and Fairfax County (VA) with 11,256 persons. A similar pattern exists for English proficiency—Prince George's County (16,842 persons), followed by Montgomery County (9,886 persons) and Fairfax County (8,835 persons) reported the highest number of persons experiencing limited English proficiency.[11]

Additionally, as a part of its regular planning and programming, COG's Transportation Planning Board (TPB) developed Equity Emphasis Areas (EEAs)[12] throughout the COG region to elevate equity and inform future growth and investment decisions (see Figure 6 for EEAs). Analysis of the EEAs show significant overlap with LIDACs.[13]

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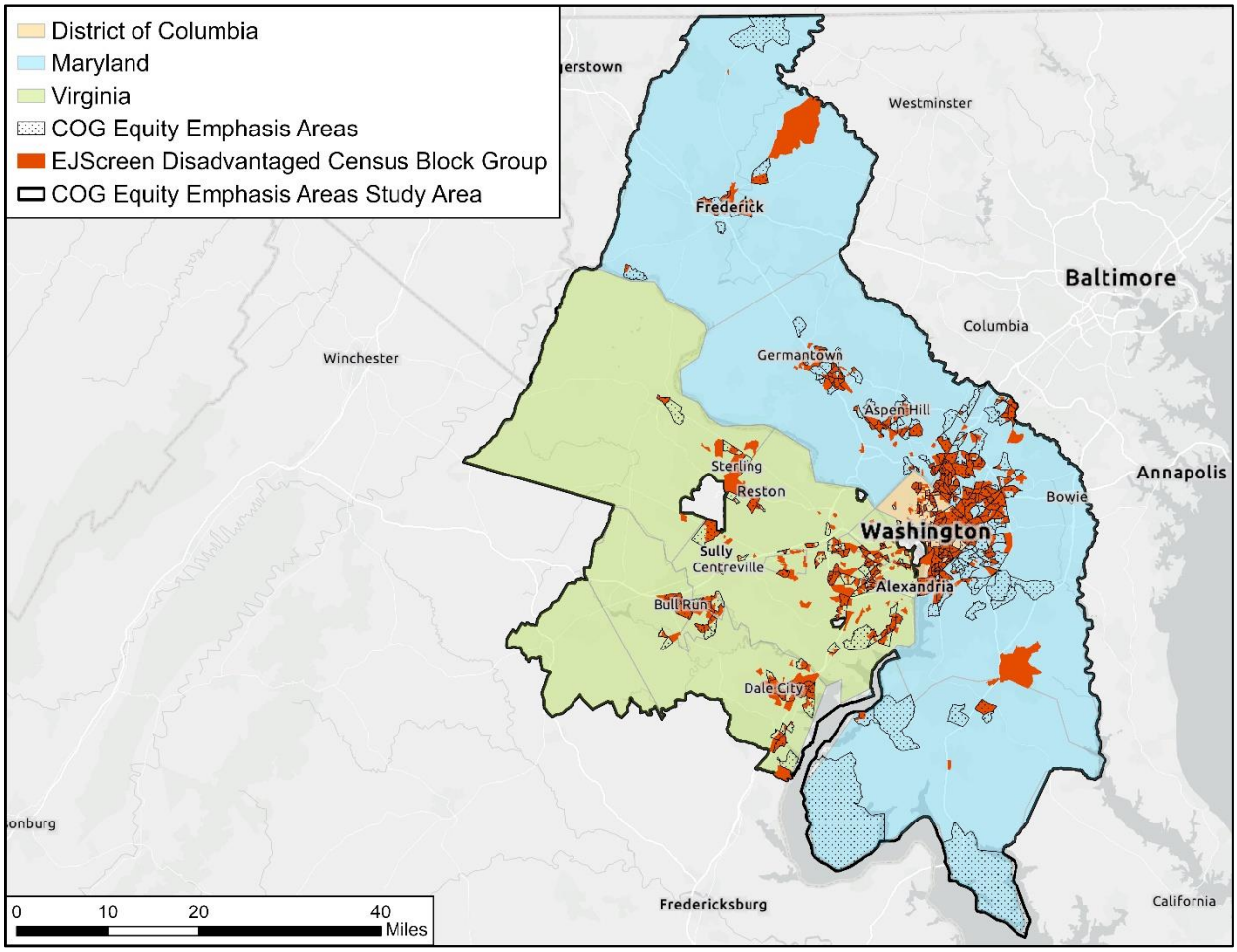
[8] Census Bureau. American Community Survey. 2022. https://www.census.gov/data/developers/data-sets/acs-5year.html
[9] Census Bureau. American Community Survey. 2022. https://www.census.gov/data/developers/data-sets/acs-5year.html
[10] Census Bureau. American Community Survey. 2022. https://www.census.gov/data/developers/data-sets/acs-5year.html
[11] https://www.census.gov/quickfacts/fact/table/princegeorgescountymaryland/PST045223
[12] For more information, see https://www.mwcog.org/newsroom/2021/09/24/equity-emphasis-areas-a-tool-to-prioritize-and-invest-in-communities--equity/.
[13] EEAs have high concentrations of low-income individuals and/or traditionally disadvantaged racial and ethnic population groups. For more information, see here: https://www.mwcog.org/transportation/planning-areas/fairness-and-accessibility/environmental-justice/equity-emphasis-areas.

Figure 6. Overlay of COG EEAs and MSA LIDACs Identified with EJScreen



Recognizing the disparities highlighted in the demographic information across the MSA, particularly within LIDACs and EEAs, COG emphasizes the importance of targeting climate investments in LIDAC (and EEA) community priorities. While the range of low-income, unemployed, low educational attainment, and limited English proficiency varies throughout the region, there are opportunities to positively impact many LIDACs through concentrated and focused efforts in the areas of workforce development, training, and an overall focus of green job creation and sustainable yet affordable housing. COG's LIDAC analysis provides valuable insight to support the implementation of outreach programs to meaningfully engage LIDACs using languages spoken at home, diverse imagery, plain language, and other tools that meet the needs of historically underserved populations.

Consideration of LIDACs is a priority focus for COG when selecting climate pollution reduction projects, programs, and measures. Organizations representing LIDACs and local representatives who frequently work with LIDACs were engaged in the creation of this PCAP. A summary of the engagement efforts conducted with LIDACs is presented in Section 1.4. Furthermore, COG plans to conduct direct and comprehensive engagement with LIDACs throughout the development of the CCAP.

3.2 Climate Impacts and Risks to Metropolitan Washington's LIDACs

Social systems amplify negative impacts from climate risks on Black, Indigenous, and People of Color (BIPOC) individuals and communities, income-eligible households, unhoused individuals, rural communities, and outdoor and agricultural workers.[14] Not only do these communities experience the most severe impacts of climate change, but they are also the least able to prepare for and respond to these impacts due to a lack of resources and socio-political power. According to a 2021 EPA analysis, racial and ethnic minorities are particularly vulnerable to climate change impacts, especially Black and African American individuals.[15]

Minority and low-income communities are more likely to suffer the consequences of climate change due to heightened exposure to climate risks and inaccessibility to resources, such as adequate infrastructure and insurance coverage. Many factors contribute to this inequality, including historical discriminatory practices in housing, education, and employment. Pre-existing health status and living conditions are two key components of climate vulnerability, which are often determined by economic power, social policies, political influence, and structural racism.[16]

Within the Washington MSA, the most prevalent climate risks are extreme heat, extreme precipitation events, sea level rise, and storm surge. These climate risks were evaluated as part of *Climate Ready DC: the District of Columbia's 2016 Plan to Adapt to a Changing Climate* (which applies specifically to D.C.), the Metropolitan Washington *2030 Climate and Energy Action Plan* published in 2020, and other local climate plans. Further, COG and TPB's evaluation of climate risks to the EEAs determined that communities within EEAs are particularly vulnerable to climate risks, including extreme heat, extreme weather and flooding, and sea level rise.

In D.C, average annual temperatures have risen 2°F over the last 50 years and are projected to continue rising in the future. Historically, the average summer high was 87°F. By 2080, this number is projected to increase to 93°F (in a low emissions scenario) or 97°F (in a high emissions scenario). In addition to rising average temperatures, climate change is leading to more intense and frequent heat waves. In 2012, a record-breaking heatwave hit the region and temperatures exceeded 95°F for 11 days. Currently, D.C. experiences 30 "dangerously hot days" (days exceeding 95°F) a year; by 2080, projections indicate that there will be 40-75 of these days. The number of extreme heat days and heat waves is projected to increase across the whole MSA as well; the number of days per year with temperatures above 95°F could reach around 40 days by 2080 under a low emissions scenario, and around 60 days by 2080 under a high emissions scenario.[17]

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[14] Marino, E.K., K. Maxwell, E. Eisenhauer, A. Zycherman, C. Callison, E. Fussell, M.D. Hendricks, F.H. Jacobs, A. Jerolleman, A.K. Jorgenson, E.M. Markowitz, S.T. Marquart-Pyatt, M. Schutten, R.L. Shwom, and K. Whyte, 2023: Ch. 20. Social systems and justice. In: Fifth National Climate Assessment. Crimmins, A.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, B.C. Stewart, and T.K. Maycock, Eds. U.S. Global Change Research Program, Washington, DC, USA. https://doi.org/10.7930/NCA5.2023.CH20

[15] EPA. 2021. Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts. U.S. Environmental Protection Agency, EPA 430-R-21-003. www.epa.gov/cira/social-vulnerability-report

[16] Patnaik, A., Son, J., Feng, A., Ade, C., 2020. Racial Disparities and Climate Change. Princeton Climate Action. https://psci.princeton.edu/tips/2020/8/15/racial-disparities-and-climate-change

[17] A high emissions scenario refers to a Shared Socio-economic Pathway (SSP) that represents the upper boundary of radiative forcing (for example, SSP5-8.5 represents a pathway with an additional radiative forcing of 8.5 W/m^2 by 2100). Under a high emissions scenario, there is intensified exploitation of fossil fuel resources and a more energy-intensive global lifestyle (Böttinger, M. and Kasang, D. The SSP Scenarios. Deutsches Klimarechenzentrum. https://www.dkrz.de/en/communication/climate-simulations/cmip6-en/the-ssp-

The median number of extreme heat days a year in the MSA is 8.61 days; the median in LIDACs is 8.75 days, demonstrating disparities between communities. Urban heat island effects will put populations residing in urban areas at even greater risk of the health effects of extreme heat. Montgomery County mapped urban heat islands across the county to determine the communities that will be most affected.[18] More frequent and severe droughts will also impact the Potomac River and put vulnerable populations in danger due to agricultural and water system disruptions. Rising temperatures may also increase the occurrence of harmful algal blooms in freshwater and marine ecosystems in the MSA, including in the Potomac River.

Although annual amounts of precipitation have not changed significantly, seasonal precipitation rates have changed; fall and winter rates have increased while summer rates have decreased. Additionally, the frequency and intensity of extreme precipitation events is increasing. Today's 1-in-100-year precipitation event could become a 1-in15-year event by late-century for the MSA.

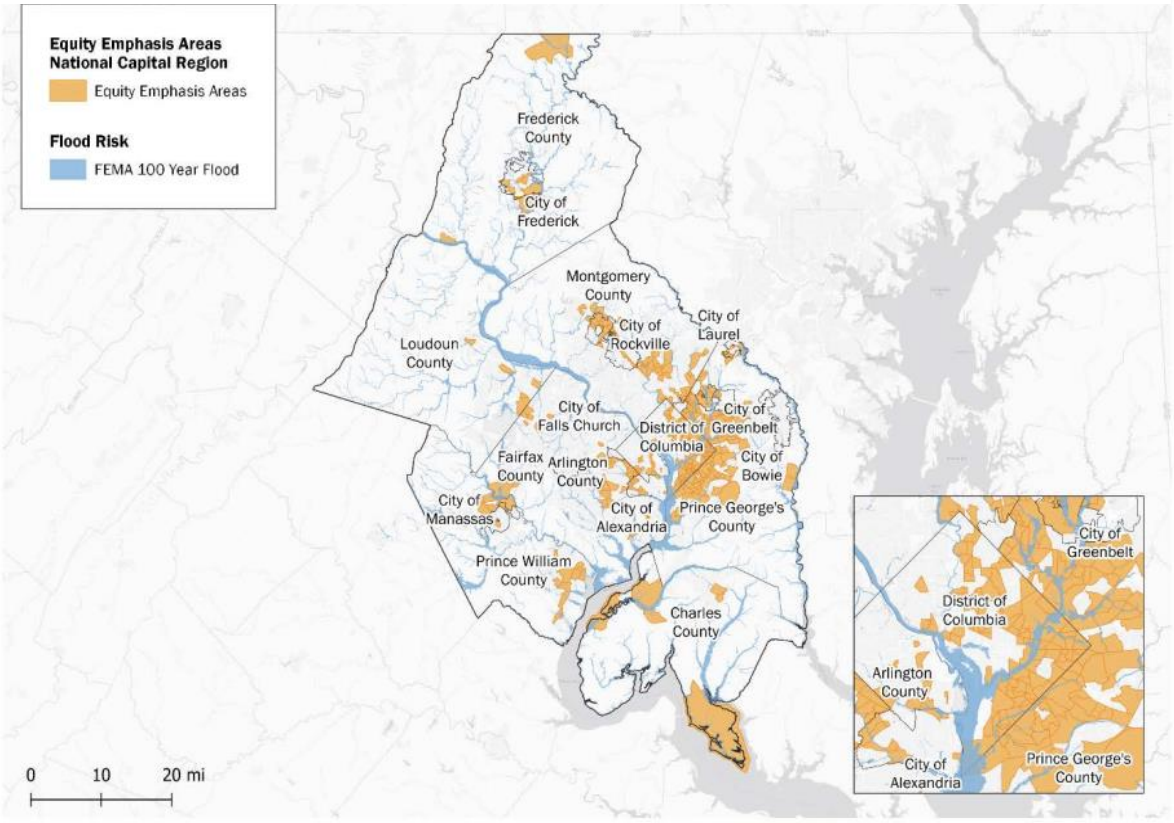
Sea level rise is a problem for low-lying areas in the MSA, particularly in LIDACs. Water levels for the Potomac and Anacostia Rivers (which are both tidal and border LIDACs) have risen 11 inches in the past 90 years. This has resulted in a 300% increase in nuisance flooding along the riverfront. By 2080, there could be up to 3 feet and 5 inches of additional sea level rise. Coastal storms such as hurricanes also create flooding events, and climate model projections indicate that hurricanes will become more intense in the future. The threat of stronger hurricanes combined with rising sea levels puts the region at very high risk of flooding.

EEAs will be more impacted by inland and coastal flooding as well. About 60% of EEAs lie in FEMA 100-year floodplains (about 1 million people total) (see Figure 7), and more than 10% of EEAs will be impacted by a 6-foot sea level rise.

scenarios#:~:text=SSP585%3A%20With%20an%20additional%20radiative%20forcing%20of%208.5,CMIP5%20scenario%20RCP8.5%2C%20now%20combined%20with%20socioeconomic%20reasons.)

[18] https://storymaps.arcgis.com/stories/389babe7ce654fdd87701488ae72e8b6

Figure 7. Equity Emphasis Areas and Inland Flooding Zones for the COG region (orange areas indicate EEAs and blue areas indicate FEMA 100-year floodplains).



Source: FEMA and COG Equity Emphasis Areas

3.3 Benefits and Co-Benefits of GHG Reduction Measures to Metropolitan Washington's LIDACs

Reducing GHG emissions presents a large opportunity to advance equity, environmental justice, health, and economic outcomes in LIDACs. Through strategic interventions in sectors such as buildings, clean energy, transportation, land use, and waste management, communities can experience tangible benefits, including improved air quality, enhanced energy efficiency, increased resilience, and increased access to affordable housing and transportation. Notably, within the eight priority GHG reduction measures, there are significant opportunities to reduce household costs, improve quality of life through better air quality, enhanced green spaces, transit accessibility, and reduced health risks.

Substantial opportunity also exists to enhance the clean energy workforce through tailored trainings, internships, and job placements by both leveraging existing programs and developing new ones. By prioritizing outreach, education, and workforce development initiatives tailored to the needs of LIDACs, climate action programs can effectively mitigate emissions while promoting social equity and building more sustainable and resilient communities.

Additional information on the benefits of each GHG reduction measure for LIDACs in the MSA are presented as a part of each measure below in Section 4.

3.4 Equity, Environmental Justice, and LIDAC Priorities

Through the engagement efforts described in Section 1.4, notable emphasis was placed on equity and environmental justice, particularly concerning the needs of LIDACs. Concerns included air and water quality, greenspace availability, the overall quality of life, and the importance of ensuring that climate initiatives benefit people who have historically faced disproportionate environmental burdens.

Community engagement and empowerment emerged as significant aspects of equity impacts. Responses highlighted the community's call for public support, ensuring investment returns to communities, and involving communities in decision-making during project planning. Priorities also include a focus on addressing food security, creating employment opportunities, and supporting local environmental initiatives in historically underserved neighborhoods.

When asked what emissions reduction projects would have the most positive impact on LIDACs and historically underrepresented communities, responses outlined initiatives and supported priority GHG reduction measures that align with and can be tailored to the unique needs of LIDAC communities. Specifically, communities that include people who use English as a second language, people impacted by environmental impacts on food security, communities overburdened by climate change, air quality, and transportation GHG emissions and pollution, and communities impacted by waste infrastructure such as landfills, incineration sites and trash/recycling collection facilities.

Representatives encouraged the creation or enhancement of programs for climate-related workforce development, increasing access to electric vehicles (EVs), charging infrastructure, and public transit, decreasing vehicle miles traveled (VMT), and clean, efficient, and renewable energy such as solar and weatherization programs. Identified key strategies include:

- Promoting non-car travel, featuring expanded bike lanes, improved bus availability, and pedestrianized streets aimed at enhancing safety and accessibility;
- Locating affordable housing near transit, with an emphasis on the importance of funding for such initiatives;
- Implementing energy efficiency and electrification projects in multifamily and commercial buildings as a crucial step toward reducing energy consumption and emissions;
- Supporting local agricultural and food security initiatives such as community composting and neighborhood farming; and
- Accelerating reuse and repair initiatives, emphasizing waste reduction and promoting local employment.

4 PRIORITY GHG REDUCTION MEASURES

Eight high priority GHG reduction measures were identified for this PCAP, as presented in Table 4. These measures were developed through a collaborative and iterative process with the many government offices and committees within the MSA and the states it crosses, as well as other stakeholders like community-based organizations, private sector actors, utilities, planning boards and committees, and more. These are practical and achievable strategies spanning buildings and clean energy, transportation, waste, and land use sectors.

Table 4. Summary of PCAP Measures

Sector	Measure	2025-2030 GHG reductions ($MMTCO_2e$)	2025-2050 GHG reductions ($MMTCO_2e$)
Buildings and Clean Energy	Accelerate the deployment of energy efficiency solutions and decarbonization of residential, institutional, municipal, and commercial buildings.	5.00	66.67
Buildings and Clean Energy	Accelerate the deployment of clean and renewable energy.	2.66	11.24
Buildings and Clean Energy	Study, plan for, and deploy district energy and microgrid opportunities.	Varied based on system type, for a single generalized system ranges from 0.01 - 0.38	Varied based on system type, for a single generalized system ranges from 0.25 - 0.84
Transportation	Provide and promote new and expanded opportunities to reduce VMT through public transportation, non-motorized travel, micromobility, shared travel options, and development.	0.72	5.22
Transportation	Accelerate the deployment of low- and zero-emission transportation, fuels, and vehicles.	2.80	135.50
Transportation	Accelerate the deployment of off-road/non-road electric equipment.	3.40	17.74
Waste	Reduce GHG emissions from waste and wastewater treatment.	5.47	30.23
Land Use	Accelerate the expansion of the regional tree canopy and reduce tree canopy loss.	0.47	3.94

The GHG reduction measures described in the PCAP may provide more than just GHG emission reductions; they will result in additional co-benefits including improved air quality, quality job opportunities, cost savings, and enhanced community well-being across the MSA. From increasing energy efficiency in the buildings sector and developing clean energy generation to improving public transportation to planting more trees, the co-benefits these measures will provide to MSA communities, particularly to LIDACs, can be accelerated through additional funding and coordination action.

Implementing these measures will depend on available funding, other resources (e.g., staff time), evolving and diverse policy and regulatory landscapes across multiple states, supply chain availability, among other factors. However, COG has outlined a general timeline for PCAP implementation, milestones, and next steps below in Table 5.

Table 5. PCAP Proposed Timeline and Next Planning and Implementation Steps

Milestone	Timeframe
2024	
Deliver final PCAP to EPA	March 1, 2024
Submit CPRG implementation grant	April 1, 2024
Continued engagement, planning, and analysis for the CCAP	May 2024 – December 2024
Expand, accelerate, and develop pilots and programs with CPRG funding, pending award decisions	Late 2024
Continued regional climate action, funding applications, and building on ongoing activities, and aligning/emphasizing PCAP measures	Throughout 2024
2025 – 2026	
Continued engagement, planning, and analysis for the CCAP	Early 2025
Deliver final CCAP to EPA	Mid-2025
Establish approaches for ongoing metrics tracking and track metrics	Late 2025 and on
Continued regional climate action, funding applications, and building on ongoing activities, and aligning/emphasizing PCAP and CCAP measures	Throughout 2025 and 2026
Expand, accelerate, and develop pilots and programs with CPRG funding, pending award decisions	Throughout 2025 and 2026
2027	
Deliver Status Report to EPA	Mid-2027
Continue to implement measures and reduce GHGs at the county and municipal level; Track progress across the MSA	2027 onward

4.1 Buildings and Clean Energy

ACCELERATE THE DEPLOYMENT OF ENERGY EFFICIENCY SOLUTIONS AND DECARBONIZATION OF RESIDENTIAL, INSTITUTIONAL, MUNICIPAL, AND COMMERCIAL BUILDINGS.

Decarbonizing buildings through energy efficiency, fuel switching, adaptive reuse, and other actions are a high priority for the MSA. Building energy consumption accounted for approximately 50% of GHG emissions in the metropolitan Washington region in 2020. This measure focuses on increasing opportunities for owners and users of all building types to access and install technologies to decrease overall energy consumption, increase energy efficiency, and reduce GHG emissions from the built environment. It covers both market rate and low/moderate income customers and private and public buildings.

QUANTIFIED GHG REDUCTIONS AND RELEVANT GHG INVENTORY SECTOR(S)

This measure will reduce GHG emissions in the buildings inventory sector. Cumulative estimated GHG emissions reduction potential for this measure are:

GHG reductions ($MMTCO_2e$), 2025-2030	GHG reductions ($MMTCO_2e$), 2025-2050
5.00	66.67

Key assumptions, methods and data sources used to develop these quantified reduction estimates are provided in Appendix A.

KEY IMPLEMENTING AGENCIES AND PARTNERS

- **State governments.** Government organizations such as the D.C. DOEE, Maryland Green Building Council, Maryland Department of the Environment, Maryland Energy Administration, Maryland Clean Energy Center, Virginia Department of Housing and Community Development, and others offer programs to provide funding and technical assistance for energy efficiency and electrification projects. This may include departments of energy, environment, housing, school districts, and others. Government facilities also are opportunities for building efficiency and decarbonization.
- **Local governments, including public schools.** Local departments of energy, environment, housing, school districts, and others may have additional programs and policies to provide funding and technical assistance for energy efficiency and electrification projects. Government and public facilities and sites also provide opportunities to improve regional building efficiency and reduce GHG emissions from the built environment.
- **Energy utilities.** Most utilities in the MSA serve as providers of existing energy efficiency and building decarbonization programs for rate-payers.
- **Businesses, hospitals, private schools, universities, water utilities, airports, data centers, places of worship**. These entities will implement building improvements and design/build decarbonized buildings.
- **Property owners, developers, renters**. As end users, homeowners, property owners, developers, and renters can make behavior changes and decisions that affect building efficiency. While property owners and developers generally have more control over changes to and within buildings, especially at the time of new construction or major renovations, renters can also make behavior and other changes that will result in GHG reductions.

- **Contractors and equipment/energy service providers.** These partners provide the services and equipment to decarbonize buildings, and may include architects, engineers, energy auditors, consultants, and more. Workforce development organizations also play a key role in building the pipeline of skilled workers to serve the building sector's decarbonization needs.

IMPLEMENTATION ACTIVITIES AND MILESTONES

Actions to implement this measure could include, but are not limited to:

- Create voluntary and/or mandatory benchmarking and labeling programs for buildings.
- Strengthen green building policies and energy codes. Implementing strengthened codes, including "stretch codes," can encourage the mitigation of air pollutants from buildings.
- Conduct energy audits and site assessments. By conducting these assessments, implementers can collect information on which areas of the building inventory, if any, need additional support in achieving improved energy efficiency and decarbonization, and have the highest potential to result in energy savings.
- Facilitate net zero building development. Prioritizing low emissions practices across the lifecycle (in construction, maintenance, and end of life) of new buildings and retrofits to existing buildings can yield more integrated emissions savings.
- Expand or create new programs and incentives for retrofits and upgrades to residential, multifamily, and commercial properties (e.g., building efficiency retrofits including window replacements, insulation, more efficient and/or electric appliances, hybrid or all-electric heat pumps or more efficient gas heat pumps).
- Implement energy efficiency and fuel switching in all buildings, particularly data centers and other large energy users (e.g., hospitals, life sciences, wastewater utilities, CHP/District Energy operators), including implementing solutions to make buildings more efficient and decarbonize buildings, including reducing the use of building-code-required back up diesel generators and transition to cleaner alternatives.
- Expand and/or create new programs for retrofits, incentives, and upgrades to municipal and government buildings, including public schools, government buildings, and operations (e.g., building efficiency and electrification retrofits, street lighting and stadium lighting retrofits, microgrids).
- Fund the deployment of microgrids.
- Plan for and address electric panel and electrical transformer upgrades in residential and commercial properties to support electrification.
- Address refrigerant use in buildings (HVAC, chillers, refrigeration) through replacement with lower global warming potential refrigerants/natural refrigerants.

Some of these activities are already underway to varying degrees across the metropolitan Washington region. For example, the Maryland Climate Solutions Now Act of 2022 requires the Maryland Department of the Environment (MDE) to develop building energy performance standards (BEPS).[19] MDE must develop standards for buildings that, among other requirements, achieve a 20% reduction in net direct GHG emissions by January 1, 2030 compared with 2025 levels for average buildings of similar construction and net-zero direct GHG emissions by January 1, 2040.

[19] https://mde.maryland.gov/programs/air/ClimateChange/Pages/BEPS.aspx

Buildings subject to BEPS in Maryland are 35,000 square feet or larger (excluding the parking garage area). Owners of buildings subject to BEPS will need to report data to MDE each year beginning in 2025. Historic properties, public and nonpublic elementary and secondary schools, manufacturing buildings, and agricultural buildings are exempt.

Furthermore, in January 2024, Montgomery County, Maryland issued a transmittal packet of proposed BEPS regulations to the County Council. Buildings subject to BEPS in Montgomery County are 25,000 square feet or greater and will need to meet a long-term energy performance standard based on-site energy use intensity. The regulations will be considered by the County Council in 2024.[20] The D.C. Government also operates a BEPS program that addresses building as small as 10,000 square feet.

Arlington has a voluntary Green Building Bonus Density Incentive Program and a Sustainable Facilities Policy for municipal buildings. Similar programs exist in other counties and cities in Northern Virginia.

Many utilities in the region (e.g., Dominion), through existing statewide programs (e.g., EmPOWER Maryland) offer rate-payer funded energy efficiency and decarbonization buildings programs for residential, commercial, sector-specific, and income- and age-eligible customers.

Other activities may be further behind in implementation due to limited funds, potential authority limitations, and other barriers such as lack of education/awareness and workforce and supply chain limitations. Most of the activities can be implemented or expanded in the near term.

AUTHORITY TO IMPLEMENT

Maryland, Washington D.C., and Montgomery County, Maryland have enacted legislation mandating BEPS, but Virginia law does not currently allow local governments to establish BEPS or related policies such as energy benchmarking. Energy code implementation across the region is governed by state law, which with some variations limits local governments' ability to implement codes different from that adopted at the state level. Notwithstanding the lack of home rule in Virginia to adopt local building codes, cities and counties in the Commonwealth of Virginia have—for as long as 22 years—fashioned and implemented green building incentive programs based on tiers of BEPs and performance certifications. Additionally, state renewable portfolio standards (RPS) requirements drive the cost for RECs in each state. Thus, all activities mentioned above can be implemented or are being implemented through existing voluntary or regulatory programs.

GEOGRAPHIC COVERAGE

This measure will reduce GHG emissions across the entire MSA.

FUNDING SOURCES

Example potential funding sources include:

- U.S. Department of Energy (DOE) Energy Efficiency and Conservation Block Grants
- DOE Home Efficiency Rebates and Home Electrification and Appliance Rebates
- DOE State Energy Program
- U.S. Department of Housing and Urban Development (HUD) Green and Resilient Retrofit Program

[20] https://www.montgomerycountymd.gov/green/energy/beps.html

- DOE and State Weatherization Assistance Programs
- FEMA Building Resilient Infrastructure and Communities (BRIC)
- Washington DC Sustainable Energy Utility (SEU)
- Maryland Clean Energy Center
- DC Green Bank
- Montgomery County Green Bank
- Inflation Reduction Act Tax Credits (Energy Efficient Commercial Buildings Deduction (179D), and New Energy Efficient Home Credit (45L))
- Utility Programs

LIDAC BENEFITS

These actions could contribute to reducing energy expenses for private and public entities. Indirect benefits include the creation and expansion of green energy jobs and training for auditors, construction workers, contractors, and other building trades such as HVAC suppliers and carpenters. Additionally, these measures may encourage infill development, removing blight from LIDACs and improving visual quality, safety, and quality of life. Retrofit programs typically benefit LIDACs in the urban core and in distressed areas. These measures may result in direct benefits including reduced energy costs from the implementation of energy efficiency measures and educational programs that influence user behavior and result in lower utility bills. The incorporation of microgrids may benefit LIDACs by providing alternative network sources for energy during high demand and increasing reliability. This measure will also improve local air quality, leading to a reduction in related health impacts such as asthma. Potential temporary impacts or dis-benefits for business and residential lease holders during construction include construction noise, fugitive dust, utility interruptions, and in some cases early lease termination to complete construction activities. Following construction, increased rents may be a concern.

SAMPLE METRICS FOR TRACKING PROGRESS

Potential metrics to track the progress of this measure include:

- Number of units retrofitted, disaggregated by residential, institutional, municipal, and commercial buildings
- Number of energy conservation measures installed, disaggregated by residential, institutional, municipal, and commercial buildings
- Participation rates in incentives programs, such as EmPOWER Maryland utility offerings or tax credit programs
- Square footage retrofitted, disaggregated by residential, institutional, municipal, and commercial buildings
- Number of units constructed as net zero, high efficiency or electric, disaggregated by residential, institutional, municipal, and commercial buildings
- Square footage of buildings constructed as net zero, high efficiency or electric, disaggregated by residential, institutional, municipal, and commercial buildings
- Energy use intensity (EUI) and GHG improvements (e.g., for local government buildings)
- Local electricity and natural gas consumption by jurisdiction
- Electricity and natural gas consumption by building (if in EPA Portfolio Manager)

ACCELERATE THE DEPLOYMENT OF CLEAN AND RENEWABLE ENERGY.

This measure aims to accelerate the development of on-site solar energy, complemented by battery storage and microgrids (where feasible), by expanding upon successful existing community-based programs (e.g., Solarize NoVA, SUN-Switch, and Capital Area Solar Switch) and introducing new initiatives and technologies, such as agrivoltaics (the co-location of agricultural production and ground-mounted solar photovoltaic systems).[21] It will provide financial and other support to install solar PV systems at single-family residential properties, including LIDAC properties, and install solar systems at public housing and affordable housing properties, and other residential and commercial buildings. Where on-site solar installation and use is not feasible, off-site solar and other renewable power resources through aggregation options such as community solar, retail choice, and community choice aggregation (CCA) could be used. This measure also includes the use of solar energy for local government operations.

COG's Commitment to Renewable Energy
Based on recommendations from the COG CEEPC, in November 2023, the COG Board endorsed a goal of 250,000 solar rooftops in the region by 2030, with additional goals that call on local jurisdictions to pursue solar installations on government facilities, explore renewable energy for 100% of government operations, and support community-wide efforts to deploy solar, including programs for low-income residents, efficient zoning and permitting processes, and incentives. Currently, there are approximately 73,000 solar energy installations in the region.
Note: This does not cover the entire CPRG MSA.
Source: www.mwcog.org/newsroom/2023/11/08/cog-board-adopts-regional-solar-energy-goals-for-2030-/

QUANTIFIED GHG REDUCTIONS AND RELEVANT GHG INVENTORY SECTORS

This measure will reduce GHG emissions in the buildings sector. It may also reduce emissions in the transportation sector if electric vehicles are charged using distributed renewable energy sources. Cumulative estimated GHG emissions reduction potential for this measure are:

GHG reductions ($MMTCO_2e$), 2025-2030	GHG reductions ($MMTCO_2e$), 2025-2050
2.66	11.24

Key assumptions, methods and data sources used to develop these quantified reduction estimates are provided in Appendix A.

KEY IMPLEMENTING AGENCIES AND PARTNERS

- **State and local governments.** Governments can install and procure renewable energy on or for public facilities (including schools, municipal buildings, and other public buildings), create solar ordinances and updated zoning ordinances, and develop policies and incentive programs to support renewable energy.
- **Utilities and Regional Transmission Organizations.** As providers of large-scale renewable energy and as actors in renewable energy credit markets, utilities can work with entities to negotiate for and procure renewable energy. Utilities may also work with partners to plan for integration of distributed generation and grid modernization to serve community needs.

[21] https://www.energy.gov/eere/solar/agrivoltaics-solar-and-agriculture-co-location

- **CBOs.** Engaging with local CBOs can help ensure that on-site solar initiatives address the specific needs and concerns of local communities. These organizations can also play a role in raising awareness and promoting community participation, (e.g., in community solar programs) or build the pipeline of trained workforce to install more distributed energy generation.
- **Private sector partners.** Collaboration with private sector entities — including solar developers, financiers, building owners, installers, and technology providers — is crucial for implementing on-site solar installations. Public-private partnerships can lead to greater funding and heightened expertise for these projects.
- **Non-profit organizations.** Non-profits can conduct community engagement, education and outreach, capacity building, research on environmental and social impacts of clean energy projects, and/or developing and installing community renewable energy projects.

IMPLEMENTATION ACTIVITIES AND MILESTONES

Actions to implement this measure could include, but are not limited to:

- Expand the reach of existing programs, such as Solarize NoVA, SUN-Switch, and Capital Area Solar Switch programs.
- Map solar opportunities across the MSA to determine potential priorities and investments.
- Provide clean energy and microgrid feasibility assessments at key facilities (e.g., university campuses, hospitals).
- Incorporate community energy infrastructure needs, goals, and strategies in master plans, comprehensive plans, and small area plans.
- Adopt new solar-ready construction ordinances, building codes, and/or incentive programs.
- Provide or promote incentives to encourage installation of solar in the community and for battery storage.
- Install renewable energy systems on schools and municipal infrastructure.
- Implement battery storage pilot initiatives at public facilities.
- Provide technical assistance and support for negotiating and navigating power purchase agreements, CCA, and community solar.
- Examine the possibility of regional demand aggregation.
- Initiate cooperative purchasing initiatives or energy purchasing consortia.
- Develop new state or local policies to help overcome barriers to CCA adoption.
- Leverage existing cooperative purchasing programs, such as the Mid-Atlantic Purchasing Team and COG Cooperative Procurement Program, to fast-track local implementation.
- Establish PPA(s) to provide clean electricity to local government facilities, potentially aggregating demand with other local jurisdictions or large local businesses to reduce cost.
- Implement and share best practices from CCA and retail choice aggregation pilot programs, where applicable.
- Advocate for increased percentages of clean energy in state Renewable Portfolio Standards (RPS) programs.
- Coordinate with utilities to speed up interconnection agreement processing time and ensure equitable costs for transmission upgrades for residents installing solar.
- Provide financial and other support to install solar PV systems at single-family residential properties, including LIDAC properties, public housing and affordable housing properties, and other residential and commercial buildings.

- Implement large off-site solar procurement projects supplying the wholesale PJM electricity market.

Many of these activities are ongoing and will continue to be implemented throughout the region but need to be scaled. Other activities, such as developing new policies to overcome CCA adoption barriers, still need to be implemented and depend on existing authorities. Some of these planned activities can commence in a shorter timeframe, contingent upon available resources (e.g., regional solar opportunity mapping), whereas others may take more time (e.g. adopting solar-ready ordinances) and may be location-dependent.

AUTHORITY TO IMPLEMENT

The authority to implement on-site renewable energy falls on state and local governments in partnership with utilities and the private sector. Programs like Solarize NoVA, SUN-Switch, and Capital Area Solar Switch operate at the building scale, and the implementation authority for voluntary participation rests with individual building owners. On-site solar development is pursued where feasible, but off-site options, such as community solar, retail choice, and CCA, come into play when on-site solutions are not viable. The authority for off-site renewables, particularly community solar, is governed by state law. Utilities in the metropolitan Washington region can offer voluntary renewable energy certificate (REC) purchases (the cost of which is driven by different state RPS requirements), while community solar, retail choice, and CCA require specific state legal authorizations, each addressed by Maryland, D.C., and Virginia laws in their respective domains. Retail choice, allowing customers to choose alternative energy suppliers, is currently authorized in Maryland and D.C. but not in Virginia, except for large electricity users. CCA, allowing local governments to seek energy supplies independently, is legally authorized in Maryland and Virginia, and is subject to state legal provisions similar to those for community solar.

GEOGRAPHIC COVERAGE

This measure will reduce GHG emissions across the entire MSA.

FUNDING SOURCES

Example funding sources include:

- DOE State Energy Program
- HUD Green and Resilient Retrofit Program
- EPA Greenhouse Gas Reduction Fund (including Solar for All)
- FEMA BRIC
- Washington DC SEU
- Montgomery County Green Bank

LIDAC BENEFITS

Transitioning from fossil fuels to renewable energy would provide benefits such as improved indoor air quality and local air quality as well reduced energy bills. Secondary benefits may include site remediation to create spaces for off-site solar development and a competitive market for users who have expanded choices for energy suppliers. In addition, potential health benefits include reduced cases of asthma and upper respiratory disease, and associated effects from diseases such as obesity, diabetes, and chronic infections related to reduced outdoor activities. Job creation and training in the renewable energy space could benefit LIDAC members.

SAMPLE METRICS FOR TRACKING PROGRESS

- Number of solar rooftops
- Amount of distributed solar capacity installed
- Amount of distributed solar capacity installed in LIDACs
- Size of the current solar workforce

STUDY, PLAN FOR, AND DEPLOY DISTRICT ENERGY AND MICROGRID OPPORTUNITIES.

This measure focuses on targeted and strategic uses of district energy systems, with the opportunity to deploy clean energy sources (e.g., renewable gas generated from a landfill or solid waste operations, solar, waste heat recovery, combined heat and power), and potentially pair with microgrids. District energy systems deliver hot water, steam or chilled water from a central plant(s) to multiple buildings via a network of pipes to meet thermal end uses: space heating, domestic hot water, air conditioning or industrial process heating or cooling.

For large energy users (e.g., data centers, water utilities) and campuses (e.g., hospitals, higher education facilities), district energy offers an opportunity for energy efficiency, GHG reductions, and resiliency. Microgrids can provide a form of energy resilience and independence due to their ability to "island" from the larger grid. This is especially important for critical infrastructure, post-disaster community needs, or near 24/7 large energy users when energy is needed during blackouts or other interruptions in service. These opportunities could be targeted in LIDAC areas and form the basis of community resilience hubs and provide needed community facility investment.

QUANTIFIED GHG REDUCTIONS AND RELEVANT GHG INVENTORY SECTOR

This measure reduces GHG emissions from the buildings sector. The potential GHG reduction benefits of district energy systems and microgrids in the metropolitan Washington region is highly dependent on the specific application of the system(s). In 2011, COG worked with FVB Energy Inc to study potential benefits and costs of generalized example district energy systems in the region. The GHG reductions presented below in Table 6 represent the application of various generalized example district energy system types to a comparison building. Calculations based on the FVB study are presented in Appendix A, along with key study assumptions and data sources.

Table 6. Cumulative GHG Reductions for Example Generalized District Energy System Types ($MMTCO_2e$)

System Type	2025-2030	2025-2050
Boilers And Chillers	0.03	0.25
Engine CHP	0.33	0.72
Turbine CHP	0.18	0.38
Combined Cycle CHP	0.38	0.84
Biomass Boiler	0.13	0.70
GSHP	0.01	0.30
Waste Heat	0.09	0.51

KEY IMPLEMENTING AGENCIES AND PARTNERS

- State and local government agencies. Government public buildings are community-focused buildings that can serve as microgrid or resilience hub host sights. State and local governments play a role in planning, development, permitting, and other phases of implementation. They may also be the beneficiaries of investments such as resilience hubs

and critical sheltering. Local governments may need to plan for capital budgeting and procurement.

- **Public Service Commissions, Utilities, Energy Suppliers**. Participation and/or approval by energy utilities (e.g., Pepco) and their regulators, is critical for microgrid owners and operators. Further, utilities and energy suppliers will need to fuel district systems running on clean or renewable gases.
- **Private sector**. Support from the private sector, including key implementers and partners mentioned above, will be required for feasibility assessments, construction planning and development, and potential operations and maintenance. Key industry stakeholders will be important to supplying new sources of zero-emission fuels, such as renewable gas or hydrogen. Financing partners are also important.

IMPLEMENTATION ACTIVITIES AND MILESTONES

Actions to implement this measure could include, but are not limited to:

- Support the identification and selection of high energy users and critical infrastructure for combined heat power (CHP), district energy and/or microgrid implementation.
- Decarbonize existing CHP systems.
- Explore or transition to renewable natural gas (RNG), hydrogen, or other low-carbon fuel solutions for energy sourcing and generation.
- Engage with private sector partners interested in solar, biofuel, CHP, district energy and microgrid implementation solutions.
- Engage with LIDACs where resilience hubs are most needed, and engage with the community on what resources they need.
- Conduct site feasibility assessment and pre-construction planning.
- Partner on grant applications or provide contract support for project planning, feasibility, and implementation support.
- Support state incentives and opportunities to help facilitate district energy and microgrid development.
- Support the development of microgrids.
- Coordinate with state and local governments to reduce barriers to deployment.
- Work closely with regulators and utilities to deploy solutions.
- Conduct pilot programs to demonstrate the viability and utility of resilience hubs.

The accomplishments of CEEPC and its members have also earned the region recognition as a White House Climate Action Champion. This designation made its members eligible for targeted federal technical assistance and grant funding from 2014–2016. One way COG leveraged this opportunity was to conduct local clean energy infrastructure assessments at six sites across the region to determine the feasibility of microgrids, CHP, geothermal, or net zero energy development. Two examples of progress at these sites include the Falls Church School Campus (geothermal energy) and the Washington Hospital Center (microgrid deployment).

Montgomery County has installed a microgrid project at the County's Public Safety Headquarters as part of a comprehensive effort to ensure the resiliency of critical public services during major electric distribution system outages. The project installed a microgrid featuring 2 MW of solar PV canopies mounted over a parking lot and an 800-kW CHP system and reduces GHG emissions of 5,900 metric

tons annually.[22] Montgomery County has also installed a microgrid at the County's Correctional Facility, which will reduce GHG emissions by more than 950 tons annually.[23] In addition, Montgomery County has created Brookville Smart Energy Bus Depot, an integrated microgrid and electric bus charging infrastructure project. Montgomery County also developed a microgrid-powered resilience hub at the Montgomery County Animal Services and Adoption Center.[24] Montgomery County Green Bank created a privately-owned resilience hub in an EEA by electrifying an affordable high-rise apartment building and installing a 159kW solar PV system.[25]

Arlington County's CEP includes a goal to ensure Arlington's energy resilience and includes policy actions that focus on developing resilient energy infrastructure, enhancing energy assurance, and assessing microgrid opportunities for critical services. Under the CEP, in 2023, Arlington County completed its Energy Assurance Plan, which advanced a microgrid and resiliency hub feasibility study and implementation as priority actions, with a focus on primary needs of LIDACs. Maryland has been extending programs to incorporate resiliency projects, e.g., MEA introduced in 2020 the Resilient Maryland Program to provide funding for projects to increase microgrids and other distributed energy resources to improve energy resiliency.

NVRC commissioned a study on the legal viability of district energy systems in 2011, and many of these conclusions and opportunities still stand.[26] The study concluded that: there are clear existing paths for public and/or private establishment, ownership and operation of district energy systems; district energy systems will likely be subject to complex legal frameworks; depending on the ownership arrangements and system characteristics, the operation may be subject to limitations of powers of localities under the "Dillon Rule", to State Corporation Commission Regulation, and land use and environmental regulations; the Code of Virginia provides paths to development of district energy systems, but could be amended to provide more clarity about how district energy systems can be developed and operated.

AUTHORITY TO IMPLEMENT

Where microgrids or district energy systems interconnect with and/or displace infrastructure owned by energy utilities franchised under state law, utility participation and/or permission is typically required, which will also involve state regulatory commissions. It may be necessary to amend some state laws to implement this measure. Where municipally owned utilities are involved, the authority typically resides within the local government. In certain situations, such as greenfield development, microgrid/district energy projects could be developed without utility involvement, though it is more likely that interconnection agreements would be encouraged if not required.

GEOGRAPHIC COVERAGE

The actions within this measure are focused on the entire MSA area, but particular opportunities are focused in areas of high energy use, such as in high density data center populations (e.g., Loudoun and Prince William counties), schools and universities (e.g., University of Maryland), and hospitals.

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[22] Microgrids Public Safety Headquarters (montgomerycountymd.gov)
[23] Microgrids Montgomery County Correctional Facility (montgomerycountymd.gov)
[24] https://www.mymcmedia.org/elrich-announces-new-resiliency-hub-at-animal-shelter/
[25] Montgomery County Green Bank. https://mcgreenbank.org/first-privately-owned-resilience-hub-and-electrification-project-at-hampshire-towers-apartments/
[26] NVRC. https://www.novaregion.org/DocumentCenter/View/3050/NVRC-McGuire-Woods-District-Energy-White-Paper-Au?bidId=

FUNDING SOURCES

Example potential funding sources include:

- Energy Efficiency and Conservation Block Grants
- EPA Greenhouse Gas Reduction Fund
- MEA Resilient Maryland Program
- FEMA BRIC
- DOE Grid Innovation Program
- DOE Smart Grid Grants
- Private sector energy performance contracts

LIDAC BENEFITS

This measure directly benefits D.C. and ancillary service networks within the system as the improvements are focused on large system users such as public and private hospitals, schools, institutions and other large facilities. Secondary or co-beneficiaries include LIDACs due to the reduction of GHG emissions and other air toxins surrounding the fossil fuel facilities, expanded job opportunities and training in the areas of maintenance and system network upgrades, and overall system reliability through the introduction of microgrid components.

SAMPLE METRICS FOR TRACKING PROGRESS

- Number of approved/installed projects
- Capacity of microgrid capacity installed

4.2 Transportation

The transportation sector contributed 39% of the GHG emissions in the metropolitan Washington region in 2020, of which 83% is from on-road transportation and the remaining 17% is from off-road transportation (including construction vehicles, rail, and passenger air travel). The COG region is expected to add about 1.3 million people (an 18% increase) and 900,000 jobs by 2045. At the same time there is expected to be a 12.3% increase in VMT by residents in the region.[27] Population growth and increased VMT are even greater for the whole of the MSA, and vehicle trips are expected to continue to be the predominate mode of transportation in a BAU scenario. As such, it is key to expand access to transit options beyond single occupancy vehicles to increase the mode share for public and active transportation of all trips.

As the federally mandated MPO for the National Capital Region, the TPB is responsible for producing the region's Metropolitan Transportation Plan and Transportation Improvement Program. In June 2022, the TPB adopted a Resolution on the Adoption of On-Road Transportation Greenhouse Gas Reduction Goals and Strategies (TPB Resolution R18-2022). As part of that resolution, the TPB adopted a set of priority strategies to reduce GHG emissions from on-road transportation including:

- Improve walk/bike access to all high-capacity transit stations.
- Increase walk/bike modes of travel, e.g., complete the National Capital Trail Network by 2030.

[27] TPB. Visualize 2045. 2022. https://visualize2045.org/wp-content/uploads/2022/09/Viz2045Final-Report-6-15-22_hyperlinked_.pdf

- Add additional housing near high-capacity transit stations and in COG's Regional Activity Centers.
- Reduce travel times on all public transportation bus services.
- Implement transportation system management and operations improvement measures at all eligible locations by 2030.
- Convert private and public sector light-, medium-, and heavy-duty vehicles, and public transit buses to clean fuels, by 2030.
- Deploy a robust region-wide EV charging network (or refueling stations for alternative fuels) for light, medium, and heavy-duty vehicles.

The resolution also included a set of strategies to be explored in coordination with local and state levels:

- Take action to shift growth in jobs and housing from locations currently forecast to locations near high-capacity transit stations and in COG's Regional Activity Centers to improve the jobs-housing balance locally.
- Make all public bus transportation in the region fare-free by 2030.
- Make all public rail transportation in the region fare-free by 2030.
- Price workplace parking for employees – only in Activity Centers by 2030 and everywhere by 2050.
- Convert a higher proportion of daily work trips to telework by 2030 and beyond.
- Charge a new fee per VMT by motorized, private, passenger vehicles in addition to the prevailing transportation fees and fuel taxes.
- Charge a "cordon fee" (i.e., commuter tax) per motorized vehicle trip for all vehicles entering Activity Centers by 2030.

The TPB's action to adopt GHG goals and strategies specific to the on-road transportation sector were informed by the TPB's Climate Change Mitigation Study of 2021 (CCMS) and a questionnaire of TPB members that was conducted in February and March 2022. The strategies that were studied in the CCMS and later considered by the TPB for adoption are not an exhaustive list of all possible GHG reduction strategies for the on-road transportation sector. As noted previously, documents such as the Metropolitan Washington 2030 Climate and Energy Action Plan and climate action and energy plans from local governments were consulted to identify planned and ongoing actions to reduce GHG emissions. Additionally, strategies that were designated "for further study" by the TPB were designated as such because they were not supported by a majority of members at that time; however, that would not preclude a jurisdiction with implementation authority from implementing one or more of those strategies. A study on those strategies is expected to be completed in June 2024.

The priority GHG reduction measures included below for the transportation sector reflect these already established goals and strategies.

PROVIDE AND PROMOTE NEW AND EXPANDED OPPORTUNITIES TO REDUCE VMT THROUGH PUBLIC TRANSPORTATION, NON-MOTORIZED TRAVEL, MICROMOBILITY, SHARED TRAVEL OPTIONS, AND DEVELOPMENT.

This measure aims to reduce VMT by offering robust, reliable, and safe travel options. It will provide and promote new and expanded opportunities to reduce VMT through public transportation, non-

motorized travel, micromobility, shared travel options, and transit-oriented development. These options include active transportation methods (e.g., bicycling, walking), public transportation (e.g., trains, buses), shared transportation (e.g., carpools, vanpools), and micromobility (e.g., shared bicycles and scooters). Other opportunities for telework and telehealth will also reduce VMT. Land use and transit-oriented development changes also are a part of this measure to help reduce the length of trips and create more opportunities for alternatives to driving.

Public transportation not only reduces GHG emissions, but also improves air quality and makes communities more livable, sustainable, and economically competitive. By attracting businesses, residents, and visitors, well-developed transit systems spur economic growth and development. Public transportation also increases the connectedness of communities, increasing quality of life and economic opportunity by increasing property values and access to jobs, public facilities, and resources.

QUANTIFIED GHG REDUCTIONS AND RELEVANT GHG INVENTORY SECTOR

This measure will reduce GHG emissions in the transportation sector. Emissions from the land use sector may also be impacted because of changes in development. Cumulative estimated GHG emissions reduction potential for this measure are:

GHG reductions ($MMTCO_2e$), 2025-2030	GHG reductions ($MMTCO_2e$), 2025-2050
0.72	5.22

Key assumptions, methods and data sources used to develop these quantified reduction estimates are provided in Appendix A.

KEY IMPLEMENTING AGENCIES AND PARTNERS

- **Local governments and municipalities.** Responsible for land use planning and comprehensive planning; transportation planning, development, and operations, including local transit; program development and administration (e.g., travel demand management programs), and local policies. Will support infrastructure investment and implementation, including pedestrian and cyclist infrastructure.
- **State Departments of Transportation.** Will be key partners in transportation infrastructure planning, development, and operations, such as rail and changes to roads to prioritize bus transportation along state routes, as well as policies related to toll roads and interstate corridor charging and fueling infrastructure.
- **Regional planning organizations and commissions.** Plan for, evaluate, and in some cases fund transportation infrastructure investments and programs. This includes COG, TPB, Northern Virginia Transportation Authority (NVTA), National Capital Planning Commission (NCPC), and other regional planning agencies across the MSA.
- **Regional and local transit agencies.** Transit agencies like WMATA, Maryland Transit Administration (MTA), and Northern Virginia Transportation Commission (NVTC) will be critical to implementing programs and policies.
- **Transit advocates and NGOs**. NGOs and advocates can play a supporting role in education and outreach related to this measure and can also help connect and engage with grassroots organizations and LIDACs.

- **Private sector partners.** Private sector partners, such as landowners, developers, and businesses play a key role in development decisions and design that affect the viability of using alternatives to driving. Business can also implement telecommute and other policies that help manage travel demand. Public-private partnerships can lead to greater funding and heightened expertise for these projects.

IMPLEMENTATION ACTIVITIES AND MILESTONES

Actions to implement this measure could include, but are not limited to:[28]

- Implement infrastructure improvements to support non-motorized travel (e.g., roadway designs that make walking and biking safer, adding bicycle and pedestrian pathways, adding, and expanding sidewalks, improving crosswalks, completion of the National Capital Trail Network and other paved and unpaved trails for bicycle use).*
- Enhance micromobility options, including expanding shared bike, e-bike, and scooters.*
- Improve first mile and last mile connections to transit (e.g., shuttles, bicycle storage, bicycle and pedestrian connections to transit, on-demand transit).*
- Provide improvements and enhancements in public transit service (e.g., operational and service enhancements, bus and rail maintenance and investments to improve reliability and quality of service, low-income/free fare products, and bus rapid transit).*
- Support land use policies that encourage development near high-capacity transit stations and within activity centers, including design that supports walking, biking, and transit.*
- Provide transit capital investments to enhance and expand public transit service (e.g., expansion of bus, rail, and bus rapid transit infrastructure; bus stop improvements such as benches and bus shelters, mobility hubs that bring together transit, bike sharing, transit station improvements for operational efficiency, and other options).*
- Implement or expand policies that promote car/ride sharing and reducing vehicle travel, such as through reduced parking minimums, parking pricing, and congestion pricing, as well as HOV-3 free and other policies to encourage ride sharing.
- Implement incentives that encourage use of sustainable modes, such as incentives for purchasing e-bikes, or incentives for ridesharing and using transit, reduced or fare-free transit.
- Implement policies and incentives to manage travel demand, such as those that promote or require telework policies, employer-based trip reduction, ride matching, and vanpool formation.

AUTHORITY TO IMPLEMENT

The actions associated with making changes to increase pedestrian and bicycle infrastructure can be administered by local and state jurisdictions. Policies that impact land use can similarly be administered by local jurisdictions though zoning codes and potential changes and developers can act on where to build based on these policies. Actions related to public transportation may need approvals from regional or state transportation agencies to be implemented and will need higher levels of authority depending on the scope and scale of changes to public infrastructure. Additional agencies and approvals will be needed for any actions related to charges such as congestion pricing and VMT pricing. Employers also play a key role in providing company policies to allow for

[28] Note: Strategies with an * generally fall within the priority GHG reduction strategies that were adopted by the TPB in June 2022 and are included in the quantified GHG reductions.

teleworking. Of note, for this region there is a relatively high number of federal workers, so changes in employee telework policies will be tied in part to federal agency employee policies.

GEOGRAPHIC COVERAGE

This measure will reduce GHG emissions across the entire MSA.

FUNDING SOURCES

Example potential funding sources include:

- Federal Transit Administration (FTA) Grants – Urbanized Area Formula Program
- FTA –Bus and Bus Facility Grants
- FTA – Capital Investment Grants
- Federal Highway Administration (FHWA) Carbon Reduction Program
- FHWA Congestion Mitigation and Air Quality Improvement (CMAQ) Program
- FHWA Highway Safety Improvement Program (HSIP)
- FHWA Surface Transportation Block Grant (STBG) Program
- Virginia Department of Rail and Public Transportation

LIDAC BENEFITS

The actions in this measure aim to improve public transit service through enhanced and increased service along with prioritizing designated service types within LIDACs. Improving public transit service in the urban core and along commuter routes could encourage increased transit use because of reduced commute times from home to workplace and last mile service. Priorities include the enhancement of bus and rail service that could better serve LIDACs using VRE and Maryland Area Rail Commuter (MARC) regional rail service, and commuter bus and local WMATA bus and rail service in addition to other regional transit service such as Montgomery County's RideOn bus service. Expanding and improving bus transportation will benefit LIDACs as many transit-dependent and low-income transit riders use bus systems.[29]

LIDAC members located in the urban core or near congested highways across the MSA experience significant traffic, noise, pollution, and safety related effects. Suburban and rural areas face another set of barriers that increase pollution due to increased commute times and congestion, resulting in increased transportation GHG emissions. Increasing the use of public transportation and accessible and safe transportation options such as walking and biking can positively impact LIDACs by reducing transportation costs and improving health through active transportation alternatives.

This measure also includes transit-oriented development (TOD) considerations. However, TOD development historically leads to gentrification when supportive policies are not implemented to protect underserved homeowners and renters. This measure will require partnership among municipalities, transit agencies, and the development community to truly benefit LIDACs.

SAMPLE METRICS FOR TRACKING PROGRESS

- VMT and VMT per capita

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[29] Shuling Wu & Jennifer D. Roberts (2023) Transit justice: community perceptions and anticipations of a new light rail transit line in Prince George's County, Maryland, United States, Cities & Health, 7:6, 1012-1028, DOI: 10.1080/23748834.2022.2133573

- Mode share for public and active transportation (e.g., percent of workers commuting by single occupant vehicle, rideshare, transit, bike, walk, telework)
- Transit ridership for bus and rail transit
- Active transportation and micromobility uptake
- Percent of businesses that adopt hybrid or fully remote work policies
- Mode share for public and active transportation of all trips

ACCELERATE THE DEPLOYMENT OF LOW- AND ZERO- EMISSION TRANSPORTATION, FUELS, AND VEHICLES.

This measure aims to accelerate the deployment of low emission and zero-emission transportation, fuels, and vehicles across all on-road sectors including light-, medium-, and heavy-duty vehicles. This includes both personal vehicles and private and public fleets, including school and municipal bus fleets, and support for the deployment of charging and fueling infrastructure. To support the deployment of EVs, a robust network of EV charging must be widely available, reliable, and easy to use for residents and businesses, especially in public community and multifamily settings. Beyond EVs, this measure also allows for flexibility in the use of green hydrogen, biodiesel, and other renewable or low-carbon fuels where options are not available or feasible, particularly for medium- and heavy-duty vehicles and buses.

QUANTIFIED GHG REDUCTIONS AND RELEVANT GHG INVENTORY SECTORS

This measure reduces GHG emissions from the transportation sector. The increase in EV adoption may also impact GHG emissions in the buildings sector depending on how chargers are tied to the built environment. Cumulative estimated GHG emissions reduction potential for this measure are:

GHG reductions ($MMTCO_2e$), 2025-2030	GHG reductions ($MMTCO_2e$), 2025-2050
2.80	135.50

Key assumptions, methods and data sources used to develop these quantified reduction estimates are provided in Appendix A.

KEY IMPLEMENTING AGENCIES AND PARTNERS

- **COG** can support the aggregation of demand via the COG Cooperative Purchasing Program and local EV buying co-ops. This effort can also be supported by **Clean Cities Coalitions and Washington Area New Dealers Association (WANADA).**
- **TPB** can coordinate efforts in the region and has set priority actions that are reflected in this measure.
- **Local and regional transit agencies** are also key implementors in the transition of public transit fleets and clean fuel and EVs. They also coordinate on implementing charging/fueling infrastructure.
- **State and local governments (including public schools)** can transition municipal fleets to EVs or low-carbon fuel vehicles supported by the adoption of green fleet policies and plans and provide incentives or policies to support EV adoption. State agencies, with federal funding, are building out EV charging networks. Local governments can also implement community-wide buying co-ops for EVs for public and private fleets as well as personal

vehicles and provide education to residents and businesses about EVs and EV charging. Governments can also install charging equipment on municipal properties, including through partnerships with utilities and the private sector.

- **Utilities** can provide incentives for transitioning to clean fuel vehicles and installing EV charging (e.g., both Pepco and Dominion Energy offer support for rideshare and electric bus charging infrastructure in the region). Public Utility Commissions (PUC)/ Public Service Commissions (PSC) will coordinate on the relevant regulations for implementation. Water utilities can transition their fleets to low emission vehicles.
- **Private sector actors**, for-hire vehicle operators such as Uber and Lyft or ridesharing companies such as ZipCar, can procure and offer alternative fuel vehicles and provide EV charging infrastructure. Other private sector actors, such as developers, can include EV charging and EV-ready parking in the construction projects to expand the charging network.
- **Vehicle manufacturers.** Auto manufacturers can add new low emissions vehicles to their product offerings.
- **Grocery stores, shopping plazas, and gas/charging and fueling stations**. These entities can work with state and local governments to bring publicly accessible charging and biofuel or hydrogen fueling stations to the region.

IMPLEMENTATION ACTIVITIES AND MILESTONES

Actions to implement this measure could include, but are not limited to:

- Implement systems to manage and use data on vehicle registrations and charging infrastructure (e.g., uptime) and fueling stations.
- Support cooperative purchasing and community buyer co-ops, as well as ride share and car share that accelerate the use of low- or zero-emissions vehicles.
- Pass and implement ordinances that mandate or incentivize clean fuel infrastructure into development.
- Create and implement clean vehicle and clean fuel procurement policies.
- Plan for, develop, and procure EV charging networks, such as along Alternative Fuel Highway Corridors. Also, develop biofuels infrastructure and markets.
- Develop incentive programs for EV chargers in multifamily, public, commercial, and rental properties.
- Create incentives and programs for EV and low emissions vehicles. Incentives can include direct financial incentives or exemptions to certain restrictions (such as D.C.'s driving restriction exemption, HOV lane exemptions in Maryland and Virginia, or emissions testing exemption in Virginia).
- Develop corridor and local hydrogen fueling stations, including focused on serving medium and heavy-duty vehicles. Work with fleet owners and truck dealers to accelerate the adoption of hydrogen vehicles.
- Provide funding to support the conversion of private and public sector light-, medium-, and heavy-duty vehicles, and public transit buses to clean fuels, and for the necessary supportive infrastructure.
- Provide workforce training (e.g., through the Electric Vehicle Infrastructure Training Program) and upskilling of current trades for installation and maintenance of EV charging and fueling infrastructure.
- Conduct regular analysis of the state of clean fuel infrastructure to address any gaps in charging/refueling needs that may hamper the rate of transition.

- Explore innovations in charging such as vehicle-to-grid regenerative power and solar tie-in to EV infrastructure.
- Provide funding to improve the development of battery-operated equipment.
- Properly dispose batteries through creating end of battery life management systems.
- Provide funding to support the conversion of private and public sector light-, medium-, and heavy-duty vehicles, and public transit buses to clean fuels and for the necessary supportive infrastructure.
- Support grid connection upgrades and infrastructure improvements that support affordable, adequate, reliable, and resilient power supply for private and public sector light medium, and heavy-duty vehicles, and public transit buses using clean fuels.

All these implementation activities and milestones support the TPB's adopted priority strategies (June 2022) to convert private and public sector, light-, medium-, and heavy-duty vehicles, and public transit buses to clean fuels and to deploy a region-wide robust EV charging network (or refueling stations for alternative fuels) for light-, medium-, and heavy-duty vehicles.[30] COG is already taking action to support these priorities. In the summer of 2023, a new Electric Vehicle Deployment Clearinghouse was unveiled.[31] A REVD Working Group was also established and is developing a Regional Electric Vehicle Infrastructure Implementation Strategy.[32]

AUTHORITY TO IMPLEMENT

Local jurisdictions have the authority to purchase vehicles for their fleets; such purchases have already been started across the MSA. In some instances, purchasing or procurement policies may need to be adjusted to prioritize low and no emissions vehicles. Private and personal purchasing of low and no emissions vehicles does not have any statutory limitations. Local zoning or code changes may need to be made for charging and fueling infrastructure, and authority to implement varies across the MSA. States are also using transportation funds to support the planning for and development of EV charging infrastructure. Municipalities and residents may need to coordinate with PUCs and PSCs on regulations regarding the siting of public charging infrastructure, charging resale statues, and other issues as appropriate.

GEOGRAPHIC COVERAGE

This measure will reduce GHG emissions across the entire MSA.

FUNDING SOURCES

Example potential funding sources include:

- IRA – Clean Vehicle Tax Credit
- IRA – Previously Owned Vehicle Tax Credit
- IRA – Clean Commercial Vehicle Tax Credit
- IRA – Alternative Fuel Vehicle Refueling Property Tax Credit
- FHWA National Electric Vehicle Infrastructure Formula Program (NEVI)
- FHWA Charging and Fueling Infrastructure Discretionary Grants

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[30] June 2022 TPB meeting recap: Plan update, new climate goals approved - TPB News - News | Metropolitan Washington Council of Governments (mwcog.org)
[31] COG unveils Electric Vehicle Deployment Clearinghouse - News Highlight - News | Metropolitan Washington Council of Governments (mwcog.org)
[32] Regional Electric Vehicle Deployment Working Group | Metropolitan Washington Council of Governments (mwcog.org)

- EPA Clean School Bus Program
- EPA Diesel Emissions Reduction Program (DERA)
- EPA Clean Heavy-Duty Vehicle Program
- FTA Low or No Emission Grant Program
- Maryland EV Excise Tax Credit Program
- Utility incentive programs, such as EmPOWER Maryland

LIDAC BENEFITS

This measure includes considerations for incentivizing the sale of EV and low emission vehicles and creating EV infrastructure such as charging stations. Possible direct benefits to LIDACs include reduction in $PM_{2.5}$ and ozone and related health impacts such as asthma. The inclusion of incentives for EV infrastructure at multifamily, public, commercial, and rental properties will expand the presence of EV vehicle use beyond suburban or more wealthy urban neighborhoods. These measures would benefit LIDACs throughout the MSA region by reducing overall transportation costs. EV network design and thoughtful consideration of charging station placement are key to ensuring that communities are not left out of the EV network.

Members of LIDACs have historically benefited little from EV programs due to the high capital costs to purchase them. However, programs and incentives that expand the use of EV ride sharing or car sharing can bring benefits to LIDACs. Cooperative purchases for heavy-duty and school bus fleet conversions would also reduce local GHG emissions in LIDACs. Indirect benefits to LIDACs include workforce development and training, but existing jobs for internal combustion engine maintenance may start to dissipate.

SAMPLE METRICS FOR TRACKING PROGRESS

- Number of EVs, and low-carbon fuel vehicles registered (or purchased for local government or public fleets)
- Number of publicly accessible installed charging stations by type (e.g., Level 2 or DC Fast Chargers)
- Uptime hours for public charging stations
- Number of alternative fuel stations
- Quantity of biofuels consumed annually
- Number of maintenance/repair workers trained

ACCELERATE THE DEPLOYMENT OF OFF-ROAD/NON-ROAD ELECTRIC EQUIPMENT.

This measure focuses on accelerating the widespread adoption of electric and/or battery-operated off-road/non-road electric and other low emission equipment through education and awareness campaigns and by implementing a comprehensive framework of incentives and assistance programs to make purchase of new equipment or retrofit of existing equipment more accessible and appealing. This equipment includes lawn and landscaping equipment, construction equipment, recreational vehicles like all-terrain vehicles (ATVs), marine vessels, locomotives, and more. It also includes transitioning government owned and operated equipment to electric.

QUANTIFIED GHG REDUCTIONS AND RELEVANT GHG INVENTORY SECTOR

This measure reduces GHG emissions from the transportation sector. Cumulative estimated GHG emissions reduction potential for this measure are:

GHG reductions ($MMTCO_2e$), 2025-2030	GHG reductions ($MMTCO_2e$), 2025-2050
3.40	17.74

Key assumptions, methods and data sources used to develop these quantified reduction estimates are provided in Appendix A.

KEY IMPLEMENTING AGENCY(IES) AND PARTNERS

- State and local government agencies. Local governments can create financial incentives for residents to purchase electric lawn care equipment and for construction companies to purchase electric or retrofit existing construction equipment. They can also work with the private sector to educate consumers. Government agencies can put in place procurement policies for, or contract for, electric-powered off-road equipment and partner with the private sector on upstream programs.
- Private sector (including retailers, landscaping companies, etc.). Share information on equipment, join roadshows to demonstrate and give consumers access to equipment and information about retrofit programs. Also procure and use electric or battery-operated equipment.
- Businesses and residents. Buy and use electric and other low emission equipment.
- Local and regional transit agencies. Key implementors in transitioning equipment to electric.

IMPLEMENTATION ACTIVITIES AND MILESTONES

Actions to implement this measure could include, but are not limited to:

- Provide education and outreach campaigns to introduce new products or technologies to consumers and users (e.g., conduct a "roadshow").
- Expand or create new incentives and technical assistance programs to promote and spread the use of electric equipment.
- Fund the improvement of battery-operated equipment, e.g., increasing the lifespan of battery powered equipment can enable commercial and public entities to adopt battery powered equipment.

There are already examples of available incentives for this measure that could be expanded upon. For example, the City of Bowie, Maryland has implemented a rebate for electric lawn care equipment for residents. Furthermore, the D.C. SEU has implemented a rebate for electric lawn mowers. Because this technology is readily available and programs already exist, this measure could be implemented in the near term.

AUTHORITY TO IMPLEMENT

Because these actions are typically incentive based rather than regulatory, the authority of state and local agencies to mount voluntary programs is typically within their charters. Actions such as regulating criteria air pollution emissions from off-road equipment for the purposes of complying with

ambient air quality standards under state implementation plans or similar regulatory actions are not anticipated in this measure.

GEOGRAPHIC COVERAGE
The actions within this measure are focused on the entire MSA.

FUNDING SOURCES
Example potential funding sources include:

- U.S. EPA Clean Diesel Grant Program/Diesel Emissions Reduction Act

LIDAC BENEFITS
In the short term, benefits may be isolated to business owners and program participants who can afford the upfront costs of transitioning to electric and/or battery-operated equipment. However, as programs gain traction and awareness spreads, LIDACs may become more engaged in the process. Benefits for LIDACs may include reduced operational expenses in the long term for business owners and localized health benefits resulting from reduced GHG emissions and toxins and reduced noise pollution.

SAMPLE METRICS FOR TRACKING PROGRESS

- Dollars of incentives used
- Number of pieces of electric equipment or electric off-road vehicles procured by local government or the private sector
- Number of engines repowered or replaced
- Annual quantity of diesel fuel reduced

4.3 Waste

REDUCE GHG EMISSIONS FROM WASTE AND WASTEWATER TREATMENT.
The waste sector, which includes waste landfills, waste incineration, and wastewater treatment facilities, generates high potency GHG emissions. To address emissions from the waste sector within the metropolitan Washington region, this measure aims to prevent, reduce, and divert waste and to reduce emissions at landfills, solid waste incinerators, drinking water treatment plants, drinking water distribution facilities, and wastewater treatment plants. It also includes harnessing landfill gas (LFG) to generate electricity and heat. This measure covers both inorganic and organic waste.

QUANTIFIED GHG REDUCTIONS AND RELEVANT GHG INVENTORY SECTOR(S)
This measure reduces GHG emissions from the waste sector. GHG emissions from buildings and transportation may also decrease if LFG can be collected and used to generate electricity and heat. Cumulative estimated GHG emissions reduction potential for this measure are:

GHG reductions ($MMTCO_2e$), 2025-2030	GHG reductions ($MMTCO_2e$), 2025-2050
5.47	30.23

Additional indirect GHG emissions reductions may be realized, including reduced energy consumption to process and transport waste and reduced maintenance and operations activities

and inputs (e.g., chemicals). Key assumptions, methods and data sources used to develop these quantified reduction estimates are provided in Appendix A.

KEY IMPLEMENTING AGENCY(IES) AND PARTNERS

- **Local government departments of public works, resource recovery, and/or water.** Oversees landfills, solid waste management and recycling, wastewater treatment operations and facilities.
- **VA Department of Professional and Occupational Regulation (DPOR)**. Oversees the Board for Waterworks and Wastewater Works Operators and On-site Sewage System Professionals, which licenses wastewater treatment facilities.
- **MD Department of the Environment**. Handles solid waste management and recycling in the state. MDE also oversees the Board of Waterworks and Waste System Operators, which sets standards for wastewater treatment plant operators.
- **Washington Suburban Sanitary District (WSSC Water)**. Provides water and wastewater treatment services for Prince George's and Montgomery County in Maryland.
- **WV Solid Waste Management Board (WVSWMB)**. The state agency is charged with helping local Solid Waste Authorities achieve their recycling goals through technical assistance and grants.
- **WV Department of Environmental Protection**. Oversees the Division of Water and Waste Management, which permits wastewater treatment facilities.
- **Additional state government agencies.** The Virginia Department of Environmental Quality, DC Water, and other agencies, where appropriate, will provide guidance and resources for implementation of this measure.
- **Local governments**. General oversight and policy implementation.
- **Private sector**. Including Solid Waste Authorities and privately-owned sanitation centers and wastewater treatment plants, and waste-related businesses support local and state governments in waste and wastewater treatment collection and management.

IMPLEMENTATION ACTIVITIES AND MILESTONES

Proposed actions within this measure focus on increased access to composting, waste diversion practices, waste-to-energy facilities (such as water pollution treatment plants for biowaste), methane capture technology, and food waste reduction programs. These actions and programs will reduce waste sector emissions and provide multiple benefits to communities, including reduced air pollution and improved waste management in LIDACs. Actions to implement this measure could include, but are not limited to:

- Expand and offer new programs to implement waste prevention, recovery and recycling for food waste and other organics. This will include promoting the source reduction of food scraps, edible food recovery and increased recycling of food scraps, along with other organics, through composting, anaerobic digestion, and animal feed operations.
- Expand existing programs or establish new ones to enable using organic waste for compost, including yard trimmings and food waste, for curbside pickup. Collected organic waste will then be brought to a composting site, such as the Prince George's County's Organic Composting Facility in Maryland or Prince William County Balls Ford Road Composting Facility in Virginia, instead of being sent to landfills or waste-to-energy facilities such as the Covanta Fairfax incinerator. The Prince William Landfill is being developed into an Eco-park to capture methane and conduct anaerobic digestion of organic waste. Compost can then

be used to produce soil additives for growing foods and plants. Compost can be collected curbside in city or County-provided composting bins, as proposed below.

- Provide residential compost bins**.** Provide free compost bins to residents, similar to how many cities and counties provide residents with recycling bins. Residents can pick up a compost bin at a city or County sanitation center. They can use the bins at their home to participate in a city or County-run curbside composting program, as described above, or to start their own home composting operation.
- Encourage commercial composting. Establish an educational program to encourage businesses, including restaurants, universities, multi-resident buildings, and other entities to compost organics and food waste. Training and educational materials could highlight incentives such as GHG emissions reductions and cost savings on waste hauling costs. Cities and Counties could provide training materials for businesses, and potentially subsidize the cost of on-site composting vessels. Pairing this with additional investment in industrial composting facilities and an expanded compost collection program would further incentivize commercial composting.
- Provide commercial composting facilities with necessary. For example, de-packaging equipment to handle expired processed foods and Receiving Buildings with bio-filters to reduce volatile organic compounds.
- Invest in industrial composting facilities. Invest in organics and food composting operations at existing and new solid waste facilities, including composting, mulching, and landfill facilities. Current composting facilities in the metropolitan Washington region include the Prince George's County's Organic Composting Facility in Maryland and the Prince William County Eco-Park in Virginia. Enhancing composting operations across the region would build capacity for a residential curbside composting program, as well as composting from commercial stakeholders with larger quantities of organic waste.
- Support new infrastructure and transportation options for moving compost and organic waste to treatment or processing facilities.
- Support recycling activities including feeding animals and anaerobic digestion (AD) with beneficial use of digestate/biosolids.
- Obtain and use new cold storage systems to reduce food waste.
- Conduct waste education and public service campaigns. Educate the public to promote behavioral changes that encourage waste diversion at the source. Establish a public service campaign and disperse educational materials that encourage households to reuse and buy in bulk. Include education that focuses specifically on limiting single-use materials and food waste. Additionally, educate businesses on how they can reduce waste in their operations or implement composting systems, as described in the above action.
- Improve practices and technologies to increase waste reduction, reuse/recovery, and recycling for all waste streams.
- Support product innovation and policy. Enact policies to ban or tax wasteful single-use packaging (e.g., plastic bags, plastic straws, polystyrene). Additionally, establish a program, potentially a grant, to promote research and develop new product designs to replace wasteful products sold and used in industrial processes in the region.
- Establish landfill waste transfer stations and convenience centers. Establish government owned waste transfer stations that will service homeowners, small haulers, and large haulers. Waste collected at this facility will be transferred to other jurisdictions for processing, recovery, and disposal. The facility will incorporate a public convenience center,

which will assist with reuse and waste diversion initiatives. This action is being explored especially in Charles County, Maryland as their landfill nears capacity.

- Monitor, manage, and capture methane from landfills, food scrap/aerobic compost digester systems, and wastewater treatment plants for beneficial use.
- Use methane capture technology. Introduce methane capture technologies, such as anaerobic digesters or LFG collection systems, via regional pilot or demonstration projects. Ensure project data can be easily tracked and monitored, and that projects can be scaled up if deemed effective.
- Develop LFG-to-energy projects. Expand LFG treatment centers at landfills so that captured LFG can be converted into fuel for vehicles, electricity, and heating systems, rather than burned off.
- Develop wastewater heat exchange projects.
- Promote the electrification of the transportation sector to move food waste. Implement waste-to-energy equipment at regional wastewater treatment plants through available anaerobic digestion technology.
- Produce power for renewable fuel production, enhance power reliability for wastewater treatment plants, reduce biosolids production and prevent sanitary sewer overflows to improve water quality and protect public health.

There are limited barriers to implementing this measure, and with proper funding and support, many actions could be implemented in the near future.

AUTHORITY TO IMPLEMENT

The implementing authorities for this measure are state and county government agencies (e.g., Public Works, Department of the Environment, etc.) in partnership, where applicable, with private utilities, landfills, and composting facilities. Public waste management, demonstration projects, waste-related policies, and public education campaigns can all be carried out under the existing powers of local governments. Support from the private sector, including key implementers and partners mentioned above, will be required for projects that expand to private landfills and wastewater treatment centers.

GEOGRAPHIC COVERAGE

The actions within this measure are focused on the entire MSA.

FUNDING SOURCES

- EPA Solid Waste Infrastructure Recycling Grant Program
- EPA Consumer Recycling Education and Outreach Grant Program
- U.S. Department of Agriculture Rural Energy for America Program Renewable Energy Systems & Energy Efficiency Improvement Guaranteed Loans and Grants

Benefits of Addressing Food Waste

Reducing, rescuing, and repurposing food waste can provide broader benefits to the region beyond GHG reductions. Addressing food challenges can bring health and nutritional benefits to LIDACs and reduce GHG emissions associated with food production and transportation, among many other benefits. Within the metropolitan Washington region, some jurisdictions have implemented the first stage of food waste prevention education campaigns (e.g., Montgomery County's Food Is Too Good To Waste campaign).

LIDAC BENEFITS

Using new and innovative technologies to manage longstanding community facilities such as landfills and treatment plants, which are often sited near low-income and overburdened areas, may result in not just a reduction of GHG emissions but also of odor, eye irritants, fugitive dust, sewer overflows, sewage backups, and other nuisance incidents that directly impact homes and businesses surrounding these locations. Exposure to hazardous materials may also be reduced. Expanding composting and other food waste reduction programs at the neighborhood and commercial level may spur the implementation of urban farming, community gardening, food distribution, farmers markets, and other programs which support farm to table programs, reduced organic waste, and other activities which may benefit LIDACs. Local farming, gardening, and composting programs also reduce the amount of organic waste from food in landfills, therefore reducing methane gas emissions, improving air quality in surrounding neighborhoods, and reducing overall GHG emissions.

SAMPLE METRICS FOR TRACKING PROGRESS

- Weight of waste diverted from landfills or waste-to-energy facilities
- Weight of waste composted
- Number of people reached via waste diversion education programs and public service campaigns (e.g., clicks, views, webinar attendees, flier passed out)
- Weight of biosolids diverted from land application
- GHG reductions and equivalencies

4.4 Land Use

ACCELERATE THE EXPANSION OF THE REGIONAL TREE CANOPY AND REDUCE TREE CANOPY LOSS.

Trees and the canopy they create provide numerous environmental, economic, and social benefits. For example, the tree canopy is important for mitigating the urban heat island effect and protecting communities from the increased temperatures that are a result of climate change and can reduce the cost of energy because of reduced need for air conditioning. Trees and other plants are also carbon sinks, removing CO_2 from the atmosphere and sequestering it in their structures. Trees also provide adaptation benefits by storing stormwater and surface water runoff in the surrounding soil, particularly in upstream areas. Trees reduce the occurrence and severity of flood events and prevent erosion.[33] This measure focuses on increasing tree canopies in urban and rural settings and preventing additional tree canopy losses. It involves planning, implementation, and management efforts on both private and public lands and working with community organizations and property owners to identify and implement strategies to increase tree canopy. Expanding green spaces in addition to tree canopy has the potential to increase sequestration potential of the land use sector.

QUANTIFIED GHG SEQUESTRATION AND RELEVANT GHG INVENTORY SECTOR

This measure reduces GHG emissions from the land use sector. Cumulative estimated GHG sequestration potential for this measure is:

[33] World Resources Institute. 5 Reasons Cities Should Include Trees in Climate Action. 2022. https://www.wri.org/insights/urban-trees-city-climate-action

GHG sequestration ($MMTCO_2e$), 2025-2030	GHG sequestration ($MMTCO_2e$), 2025-2050
0.47	3.94

Key assumptions, methods and data sources used to develop these quantified reduction estimates are provided in Appendix A.

KEY IMPLEMENTING AGENCIES AND PARTNERS

- **State department or divisions of natural resources or forestry.** Maintain and provide technical expertise and services for the maintenance and care of trees and other natural lands.
- **Chesapeake Tree Canopy Network.** Provides a platform for partners to share knowledge and best practices.
- **COG Regional Tree Canopy Subcommittee (RTCS).** A subcommittee dedicated to the management of both the tree and forest canopy. COG and its municipal partners are currently working to determine an implementation path for its integrated urban tree canopy management approach.
- **Local governments.** Local governments operate various programs that enhance tree canopy by planting, maintaining, and monitoring the health of trees on public land and operating programs to incentivize private landowners to plant trees.
- **Community organizations.** Local organizations can help inform the strategic placement of trees to benefit LIDACs.
- **Private landowners.** Can choose to voluntarily increase tree canopy on their land.

IMPLEMENTATION ACTIVITIES AND MILESTONES

Actions to implement this measure could include, but are not limited to:

- Use data and mapping tools to identify priority planting areas and track local and regional tree canopy coverage. Implement programs and tools to assist in care and maintenance of trees.
- Implement and expand partnerships with educational organizations to enable students to plant, monitor, and maintain trees. Teaching students how to manage trees (especially in LIDACs) can increase the public awareness of the benefits of tree canopy and expand capacity to plant and monitor trees.
- Support community gardens and small-scale urban agriculture.
- Review and strengthen local tree canopy-related policies and ordinances. Ensure that local policies are aligned to enable implementers to accelerate the expansion of tree canopy.
- Expand existing programs (e.g., the West Virginia Forestry Stewardship Program) or create new incentivizes for planting trees and forestry management on private land, communities, and developments.
- Fund investments on private land. Provide plans and funds to increase tree canopy in public lands such as in parks and forests, as well as on and around public schools, libraries, and government owned buildings and on publicly owned sidewalks that support safe access to transit and active transportation (e.g. walking, biking and micromobility).
- Adopt and implement policies that stimulate use of green infrastructure such as green roofs, green walls, green common areas.

- Design and install green infrastructure to supplement urban canopy in heat-intensive or vulnerable areas.
- Apply green infrastructure to trails, walkways, streets, and roads, integrating green with built infrastructure.

Many of these activities are ongoing but could be expanded or started in the coming years. COG has taken actions to promote increased tree canopy across the MSA. COG's *Tree Canopy Management Strategy*[34] describes the state of urban forest programs in the COG region as of 2018. COG's RTCS is recommending a tree canopy goal of 50% for the COG region as well as goals by land use type.

Programs such as Arlington County's Land Disturbance Activity Ordinance and Programs have resulted in nearly 170 Green Roofs, and the Green Streets Program has resulted in 14 completed projects.

Beyond the COG region, states across the MSA have also focused on goals and actions to increase and maintain tree cover. For example, the Virginia Department of Forestry's 2019 strategic plan has six strategic goals, that focus on protecting the forest resources and the community members of the Commonwealth from wildfire and reduce impacts to the forest from other threats and increasing the social, environmental, and economic benefits provided by trees and forests, among other priorities.[35]

AUTHORITY TO IMPLEMENT

Implementation authority for tree canopy expansion, preservation, or development on public land typically falls within the powers of the owning jurisdiction (e.g., a state natural resources or forestry agency). Public space tree planting and tree canopy maintenance falls to the owning jurisdiction. For private-owned land, consent of or actions from the landowner would be needed, and applicable covenants and zoning restrictions would need to be honored. Any applicable environmental regulations would also apply (e.g., managing stormwater and runoff). Smart growth and green development incentive programs are deployed by numerous cities and counties within COG territory, as well as local government programs for green infrastructure.

GEOGRAPHIC COVERAGE

The actions within this measure are focused on the entire MSA area.

FUNDING SOURCES

Example potential funding sources include:

- U.S. Department of Agriculture (USDA)
- U.S. Forest Service Urban and Community Forestry Grant
- Local government capital improvement program funds
- Foundation Grants

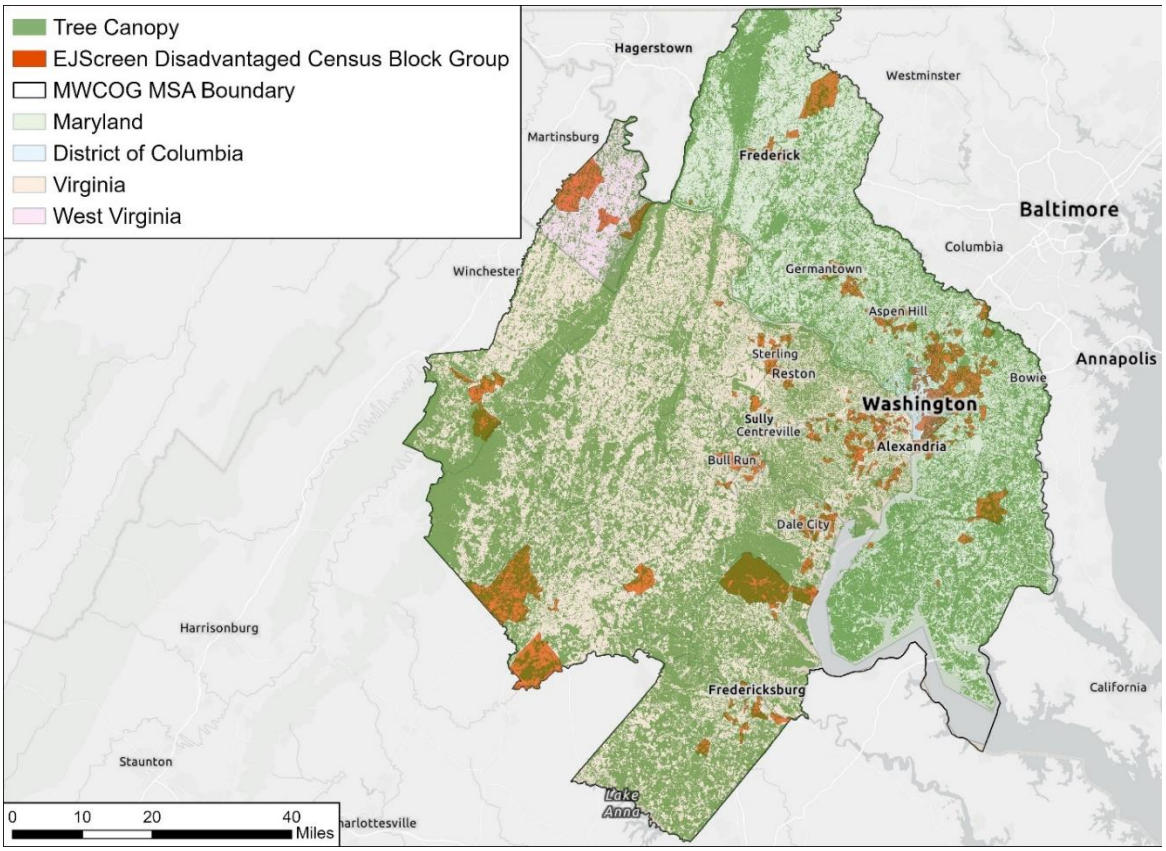
LIDAC BENEFITS

On average, LIDACs have less tree canopy than other areas, particularly urban settings (Figure 8). Increasing the tree canopy can provide cooling and stability benefits in areas within the urban core that are subjected to heat island effects. The regional tree canopy also provides health and aesthetic benefits to LIDAC communities. This measure will have a positive impact for LIDACs in the urban core

[34] https://www.mwcog.org/documents/tree-canopy-management-strategy/
[35] https://dof.virginia.gov/strategic-plan/

where parks and green spaces have been preserved, and in rural and suburban settings where growth boundaries have been implemented to protect green space and the tree canopy. Educational programs and participation opportunities for adults, teens, and children, including environmental stewardship experiences, can lead to greater awareness and further action in the community. Training and employment opportunities for both planting and maintenance of urban forests may benefit LIDAC members in terms of employment, training, and expanded canopy coverage as canopy restoration programs become more prevalent in cities and urban neighborhoods.

Figure 8. Tree Canopy Overlaid with Metropolitan Washington LIDAC Areas



SAMPLE METRICS FOR TRACKING PROGRESS

- Number of priority planting areas identified and addressed
- Tree canopy cover area
- Number of trees planted
- Number of new tree planting programs

4.5 Cross-Cutting Enabling Actions

All the priority GHG reduction measures identified above may be enabled or enhanced through various cross-cutting actions, such as the following.

- **Public education and engagement.** Education, marketing and outreach, and real-time data will accelerate the deployment of GHG reduction technologies, stimulate passive house and/or smart growth standards that incorporate green infrastructure, facilitate behavior

changes, and increase participation in climate and energy programs. Targeting education and engagement efforts on LIDACs by partnering with community leaders and CBOs that represent LIDACs will help bring additional awareness and benefits to these populations. Conducting marketing research to understand barriers and incentives to adoption can help increase program uptake.

- **Build the clean energy workforce.** An expanded and well-trained workforce is critical to implement the breadth and depth of GHG reduction measures in this plan, beginning with education for building owners, architects, designers, and contractors to influence climate-facing development from the design phase. This also includes developing new programs or expanding existing ones to provide training, paid internships, and job opportunities for a clean energy workforce. Some of these opportunities should be focused in LIDACs to bring benefits to these communities.
- **Leverage or establish umbrella organizations to support centralized resources.** Deploying shared resources and funding through a centralized program for implementation-ready projects or pooling resources to accelerate climate action for a set list of climate actions and technologies that benefit multiple jurisdictions can create administrative and other efficiencies. Providing technical assistance can assist stakeholders in completing projects.
- **Clean energy financing.** Clean energy financing and incentives to increase clean energy, energy efficiency, and fuel switching will accelerate the deployment of GHG reduction measures by overcoming capital and funding barriers. Clean energy financing mechanisms may include green banks, green financing, commercial PACE programs, interest rate buy downs, grant or rebate programs, a revolving loan fund (e.g., green bonds, clean energy loans), Energy Savings Performance Contract (ESPC), as well as grants and rebates.

5 NEXT STEPS

COG, state governments (including D.C. DOEE), local governments, and other related entities across the MSA are eligible to participate in the general competition for CPRG implementation grants, competing against other entities nationally for up to $4.6 billion in funding through individual grants ranging from $2 million to $500 million each ($300 million is set aside for tribes and territories). Implementation grant applications are due April 1, 2024, with awards anticipated in 2024.[36]

As the lead organization for CPRG planning deliverables, COG is also responsible for developing a CCAP by mid-2025 and a Status Report on CCAP progress in 2027.

The 2025 CCAP will include:

- An updated GHG inventory for the MSA
- BAU GHG emissions projections and an economy-wide GHG emissions reduction scenario
- GHG reduction targets for the MSA (short- and long-term)
- A comprehensive list of GHG reduction measures that address economy-wide emissions. Building on the PCAP, this will include the following for each measure:
    - Quantified estimates of GHG reduction and costs
    - Key implementing agency or agencies

[36] For more information about the implementation grant applications and competition see: https://www.epa.gov/inflation-reduction-act/about-cprg-implementation-grants.

- Implementation schedule and milestones
- Expected geographic location
- Quantified estimates of co-pollutant reductions (e.g., $PM_{2.5}$, NOx, SO_2, VOCs, air toxics)
- A more robust or quantified analysis of benefits for LIDACs
- A review of the statutory or regulatory authority to implement the measure (and a schedule and milestones for key entities to obtain authority if not existing)
- Identification of funding sources that have been secured for implementation
- Metrics for tracking progress
- A workforce planning analysis

The 2027 CPRG Status Report will include:

- The implementation status of the quantified GHG reduction measures from the CCAP
- Relevant updated analyses or projections supporting CCAP implementation
- Next steps and future budget or staffing needs to continue CCAP implementation

COG will continue to meaningfully engage with stakeholders, including local governments, state governments, industry, community organizations, tribes, a matrix of stakeholders (e.g., Commissions, Committees, academic and research resources, CBOs, foundations, and institutions), and the public throughout the development of the CCAP and in the implementation of climate actions throughout the MSA.

APPENDIX A. GHG INVENTORY, BUSINESS-AS-USUAL PROJECTIONS, AND GHG REDUCTION MEASURE QUANTIFICATION

GHG Inventory

For the CPRG, COG produced a 2020 GHG inventory for the MSA. COG leveraged and expanded its existing GHG inventory and projections for the COG region to cover the entire MSA. COG used the existing 2020 GHG inventory for portions of the MSA that fall within COG's geographic scope. To incorporate counties and cities in the broader MSA COG region, COG sought additional data sources and approaches to prepare a 2020 GHG inventory for the full MSA.

COG completes GHG community-scale inventories for all 24 local government members, Northern Virginia, and metropolitan Washington. COG makes every effort to capture an accurate picture of GHG trends for each of its local government members, while also providing for a consistently applied methodology across all its members' communities. Local inventory results are added together to get the total regional GHG emissions. The emissions attributed to the additional MSA jurisdictions that have been incorporated into COG's 2020 inventory have been calculated as a whole for most sectors included in this inventory.

COG GHG inventories are compliant with both the U.S. Communities Protocol for Accounting and Reporting Greenhouse Gas Emissions (USCP) and Global Protocol for Community-Scale Greenhouse Gas Inventories (GPC). COG inventories use public data readily available on a consistent basis. While both accuracy and consistency are important to GHG inventories, consistency is given a higher priority. COG used global warming potential (GWP) factors from the Intergovernmental Panel on Climate Change Fourth Assessment Report (IPCC AR4).

The inventory follows an activities-based approach, meaning emissions are calculated based on the result of an activity happening in a community. An example of this is that solid waste emissions are calculated based on the tonnage of trash the community sends to a landfill(s). Simply because they do not have a landfill within their jurisdiction's boundaries, does not mean that they are not contributing to landfill emissions.

The broad categories of emission types covered by COG's GHG inventory work include the built environment (including some process and fugitive emissions), transportation and mobile emissions, waste (solid waste and wastewater), and some land use (agriculture, forests, and trees outside of forests). Most of these sectors, except land use, are required elements to be compliant with the USCP and GPC.

The gases calculated within these inventory records include carbon dioxide (CO2), methane (CH4), Nitrous oxide (N2O), Hydrofluorocarbons (HFCs), and Perfluorocarbons (PFCs).

CLEARPATH

ICLEI's ClearPath tool is an online tool for preparing local GHG inventories, forecasts, climate action plans, and monitoring reports. The tool is consistent with both US and global accounting protocols. COG uses the Community Scale Inventory Module to support completing its GHG inventory work for its members and the region. Some of the tool's calculators are used to calculate emissions as

inventory records are created, while in other instances, emissions are calculated outside the tool and recorded in the inventory record.

COVID-19 IMPACTS

The COVID-19 pandemic has had far-reaching impacts on the global economic and social system. Pandemic impacts on GHG emissions are largely due to reduced economic and travel activity. Globally, the pandemic impacted GHG emissions by 4-5% in 2020. The state of Maryland estimates the pandemic had a 4% impact on GHG emission reduction in 2020. COG estimates the pandemic had a 4-6% impact on metropolitan Washington's 2020 GHG emissions.

The pandemic impacted the anticipated reduction in a few key sectors of metropolitan Washington's 2020 GHG emissions inventory. Emissions from the built environment were lower than projected for 2020, in part due to the pandemic; however, the grid getting cleaner and weather impacts also played a role. Emissions from the transportation sector were lower than previously projected for 2020 because less people were on the roads and flying during the height of the pandemic. Finally, solid waste emissions were overall lower than projected for 2020. However, waste that would have been generated and collected from businesses were generated within individual residences during the height of the pandemic and thus it did not make a significant impact on overall GHG emissions in 2020.

BUILT ENVIRONMENT

Residential and Commercial Electricity

Residential Electricity accounts for emissions resulting in electricity use in residential buildings. Commercial Electricity accounts for emissions resulting in electricity use in commercial, government, industrial, and other non-residential buildings and facilities. The Residential and Commercial Electricity emission calculations for the COG member jurisdictions follow the USCP recommended methodology as outlined in Appendix C, BE.2.1 from Version 1.2 of the Protocol. COG annually collects aggregated account and consumption data from the seven electric utilities that serve metropolitan Washington.

Calculations of Residential and Commercial Electricity emissions for the additional MSA jurisdictions also follow the USCP recommended methodology as outlined in Appendix C, BE.2.1 from Version 1.2 of the Protocol. The residential electricity methodology estimates consumption in kilowatt hours (kWh) by multiplying the estimated number of households using electricity with per household electricity consumption data. The Energy Information Administration (EIA) has readily available electricity energy intensity data for the South Atlantic region and the US Census Bureau American Community Survey (ACS) has readily available data on number of households using electricity. The Commercial Electricity methodology estimates consumption by calculating the percent of commercial square footage using electricity. Values for commercial building square footage using electricity are scaled locally by multiplying the local jurisdictional commercial square footage by the percentage of commercial building square footage using electricity in the broader South Atlantic region. These values, in turn, were multiplied by the electricity energy intensity in kilowatt hours per square foot ($kWh/ft.^2$) to get total electricity consumption in kWh per additional MSA jurisdiction.

Electricity consumption data and EPA eGRID emission rates are used to calculate emissions. EPA eGRID Subregions leveraged to complete the MSA inventory include RFC East (RFCE), RFC West (RFCW), and SERV Virginia/Carolina.

Residential and Commercial Natural Gas

Residential and Commercial Natural Gas consumption accounts for combustion emissions from stationary fuel applications, such as boilers and furnaces. The Residential and Commercial Natural Gas emission calculations for the COG member jurisdictions follow the USCP recommended methodology as outlined in Appendix C, BE.1.1 from Version 1.2 of the Protocol. COG annually collects aggregated account and consumption data from the three natural gas utilities that serve metropolitan Washington, which is used to complete emission calculations using this methodology.

Calculations of Residential Natural Gas emissions for the additional MSA jurisdictions follow the USCP recommended methodology as outlined in Appendix C, BE.1.2 from Version 1.2 of the Protocol. This methodology estimates residential utility natural gas consumption in therms by multiplying the estimated number of households using utility natural gas in each jurisdiction with per household natural gas consumption data for the South Atlantic region. The EIA Residential Energy Consumption Survey (RECS) has readily available utility natural gas energy intensity data for the South Atlantic region and the ACS has readily available data on number of households using utility natural gas.

Calculations of Commercial Natural Gas emissions for the additional MSA jurisdictions follow the USCP recommended methodology as outlined in Appendix C, BE.1.3 from Version 1.2 of the Protocol. The Commercial Natural Gas methodology estimates consumption by calculating the percentage of square footage using natural gas. Values for commercial building square footage using utility natural gas are scaled locally by multiplying the local jurisdictional commercial square footage by the percent of commercial building square footage using utility natural gas in the broader South Atlantic region. These values, in turn, were multiplied by the natural gas energy intensity in therms per square foot (therms/ft.^{2}) to get total natural gas consumption in therms per additional MSA jurisdiction.

Residential Fuel Oil and Liquefied Petroleum Gas (LPG)

Fuel oil accounts for both distillate fuel oils and kerosene used in stationary applications. LPG refers to a group of hydrocarbon gases derived from crude oil refining or natural gas processing. Propane is the most common LPG. The Residential Fuel Oil and LPG emissions calculations follow the USCP recommended methodology as outlined in Appendix C, BE.1.2 from Version 1.2 of the Protocol. This methodology estimates residential fuel oil and LPG consumption in gallons by multiplying the estimated number of households using fuel oil or LPG as a home heating fuel in the region and each jurisdiction with the respective residential fuel oil or LPG energy intensity data for the region. Gallons are used to estimate emissions.

Local data on households and consumption related to fuel oil and LPG is not readily available for all MSA members. However, the EIA Residential Energy Consumption Survey (RECS) has readily available fuel oil and LPG energy intensity data for the South Atlantic region and the ACS has readily available data on number of households using fuel oil and LPG as a home heating fuel.

Commercial Fuel Oil and LPG

The Commercial Fuel Oil and LPG emissions calculations follow the USCP recommended methodology as outlined in Appendix C, BE.1.3 from Version 1.2 of the Protocol. These methodologies calculate percentage of square footage using fuel oil or LPG. Values for commercial building square footage using fuel oil or LPG are scaled locally by multiplying the local jurisdictional commercial square footage by the percentage of commercial building square footage using fuel oil or LPG in the broader South Atlantic region. These values, in turn, are multiplied by the fuel energy intensity in gallons per square foot (gallons/ft.^{2}) to get total fuel oil or LPG consumption in gallons per locality and region. Gallons are used to estimate emissions.

The number of commercial buildings and total square footage for each MSA jurisdiction is readily available from the CoStar Commercial Property Records. There is not data readily available on stationary fuel use for these buildings. The EIA does have data available for larger regions on total commercial buildings and square footage; number and square footage of buildings using fuel oil or LPG; and energy intensity. EIA's South Atlantic region in the Commercial Building Energy Consumption Survey (CBECS) includes DC, MD, VA, DE, WV, NC, SC, GA, and FL.
Process and Fugitive Emissions

Natural Gas Fugitive Emissions

Natural Gas Fugitive Emissions accounts for emissions resulting from local natural gas system losses within the community. The Fugitive Emissions from Natural Gas emission calculations use a ClearPath calculator. The fugitive emissions are calculated based on a leakage rate for total annual natural gas consumption. The ClearPath calculator uses a leakage rate of 0.3 percent. Data from the Metropolitan Washington Annual Utility survey needs to first be collected and analyzed for the inventory year prior to completing these steps.

Hydrofluorocarbon Emissions

Hydrofluorocarbons (HFCs) are a type of GHG and are comprised of several organic compounds composed of hydrogen, fluorine, and carbon. HFCs are produced synthetically and are commonly used in air conditioning and refrigerants. HFC emissions in this inventory represent GHG emissions from substitutions for ozone depleting substances. The U.S. EPA annual inventory reports on GHG emissions calculates nationwide emissions for substitutes for ozone depleting substances. Total U.S emissions from substitutes for ozone depleting substances are scaled locally by population to estimate regional values. Local data on substitutes for ozone depleting substances is not available. It would take extensive research and local surveys to develop this data.

TRANSPORTATION AND MOBILE EMISSIONS

On-Road and Off-Road Mobile Emissions

On-Road Mobile Emissions represent exhaust and evaporative emissions of carbon dioxide (CO2), nitrous oxide (N2O), and methane (CH4) from on-road passenger and freight motor vehicles. The mobile off-road equipment data category includes all mobile source emissions that do not operate on roads, excluding commercial marine vehicles, railways, and aircraft. The MSA inventory uses EPA's National Emissions Inventory (NEI) data for on-road mobile emissions and Off-road mobile emissions estimates. COG region inventories typically use EPA MOVES model for these calculations; however, data and modeling are not available for the full MSA.

Passenger Air Travel

Passenger air travel emissions account for commercial aircraft emissions from major commercial airports serving the MSA. The Passenger Air Travel emission calculations generally follow the USCP recommended methodology as outlined in Appendix D, TR.6.D from Version 1.2 of the Protocol. COG's approach uses the best available data to estimate air travel passenger emissions by airport and includes personal travel and business travel by people who live, work, or were visiting an MSA jurisdiction. This includes all air passengers leaving from Ronald Reagan Washington National Airport (DCA) and Washington Dulles International Airport (IAD). COG estimates air travel passenger emissions for air passengers leaving from Baltimore-Washington International Thurgood Marshall Airport (BWI) by allocating emissions by the percent of passengers traveling from COG member jurisdictions to the airport.

To estimate emissions per airport, national aircraft emissions are downscaled based on the local to national ratio of revenue passenger miles for BWI, DCA, and IAD. This approach does not account for aircraft emissions and air passengers that are, for instance, flying into IAD and taking a connecting flight elsewhere. For all originating air passengers departing from the region's three commercial airports – BWI, DCA, IAD – the biennial Washington-Baltimore Regional Air Passenger Survey provides readily available origin-destination data for base and forecast years. There is also readily available data on commercial aircraft emissions and passenger miles traveled for the airports serving the region through EPA and the Bureau of Transportation Statistics, respectively.

Commuter Rail

Commuter Rail Transportation calculates emissions resulting from Maryland Transit Administration (MTA) MARC and Virginia Railway Express (VRE) trains carrying commuters from Maryland and Virginia. The Commuter Rail Transportation emission calculations generally follow the USCP recommended methodology as outlined in Appendix D, TR.4 from Version 1.2 of the Protocol. In this approach, emissions are calculated from annual diesel consumption of commuter rail operators.

Diesel consumption of commuter rail systems (code CR) is readily available via the Federal Transit Administration's (FTA) National Transit Database. MTA reports diesel consumption for their full commuter rail operations, some of which occur outside the MSA. MTA annual diesel consumption is attributed to the MSA by the percent of stations located in the MSA – 63 percent of MTA's MARC stations are in the MSA.

WASTE

Solid Waste

Landfill Waste Generation accounts for the emissions resulting from waste generated by the community in a year and disposed of at a landfill. The Landfill Waste Generation emission calculations follow the USCP recommended methodology as outlined in Appendix E, SW.4 from Version 1.2 of the Protocol. The calculations are based on tons of municipal solid waste (MSW) from local jurisdictions going to a landfill and whether the receiving landfills have methane capture. The EPA FLIGHT Tool was used to identify whether a landfill that regularly receives MSW from the region has methane collection. COG also gathered information on landfill methane collection efficiency from jurisdictions or landfill operators.

The Combustion of Solid Waste accounts for the emissions resulting from the tons of MSW generated by the community in a year and disposed of at a waste-to-energy (WTE) facility. The Combustion of Solid Waste Generated by the Community emission calculations follow the USCP recommended methodology as outlined in Appendix E, SW.2.2 from Version 1.2 of the Protocol.

The best available MSW data from local and regional sources was used to calculate these emissions. Unlike other activities in this inventory, there is no regional, state, or federal source of MSW data that comprehensively reports data in the way needed for GHG inventory calculations.

Wastewater

Septic Systems Emissions account for the fugitive emissions resulting from the physical settling and biologic activity during the treatment process in septic tanks. The Fugitive Emissions from Septic Systems calculations follow the USCP recommended methodology as outlined in Appendix F.WW.11 from Version 1.2 of the Protocol. The methodology estimates GHG emissions based on the population served by septic.

Sewer System Emissions accounts for N2O emissions during the treatment process at wastewater treatment plants (WWTPs). The Nitrification/Denitrification Process N2O Emissions from Wastewater Treatment calculations follow the USCP recommended methodology as outlined in Appendix F.WW.7 from Version 1.2 of the Protocol. The methodology estimates GHG emissions based on the population served by sewer.

N2O Effluent Discharge Emissions account for the emissions resulting from treated wastewater that flows out of a treatment facility and is discharged into waterways. The Process N2O from Effluent Discharge to Rivers and Estuaries calculations follow the USCP recommended methodology as outlined in Appendix F.WW.12 from Version 1.2 of the Protocol. The methodology estimates GHG emissions based on the population served by sewer and daily Nitrogen loads. Data inputs on Nitrogen loads are downloaded from EPA Chesapeake Bay Program's Chesapeake Assessment Scenario Tool (CAST). This data represents a simple average of the annual loads recorded by the Bay Program.

The Regional Wastewater Flow Forecast Model (RWFFM) and COG Cooperative Forecasts are leveraged to estimate populations served by sewer and septic. For jurisdictions not included in COG's Cooperative Forecast, population data are acquired from the ACS.

LAND USE

Agriculture

Emissions from agricultural activities include enteric fermentation, manure management, and ag soils. Enteric fermentation accounts for the methane produced from animal digestion in cows, sheep, goats, swine, and horses. Manure management accounts for emissions from management systems that stabilize or store livestock manure. Ag soils account for nitrous oxide (N2O) emissions from animals, crop production, and fertilizer application.

Agricultural sources and activities relevant to the MSA were calculated using EPA's State GHG Inventory Tool. MSA data inputs into the EPA's State GHG Inventory Tool are pulled at the county-scale from CAST. CAST is a web-based nitrogen, phosphorus, and sediment load estimator tool that streamlines environmental planning in the Chesapeake Bay watershed.

Forests and Trees Outside Forests

Forests and trees outside of forests sequester CO2 during photosynthesis and act as a carbon sink. If removed, they can be a source of emissions. ICLEI's Land Emissions And Removals Navigator (LEARN) tool estimates the local GHG impacts of forests and trees outside of forests. This tool provides information on land cover, including forest cover and change. Forested areas are defined as greater than 1-acre while trees outside forests are individual trees or trees in small patches less than 1-acre. LEARN combines methods outlined in the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions Appendix J with national and regional data sources to derive a first-order approximation of annual GHG impacts over a given time period. The time period analyzed for forests is 2013-2019 and is applied to the 2020 GHG inventory.

Business-as-Usual Projections

BAU projections account for driving factors such as growth in population, housing and commercial development, and transportation patterns, and estimate the impact they will have on future GHG emissions. BAU projections reflect policies and practices that are currently in place and implemented to-date to reduce GHG emissions, but do not incorporate any additional GHG emission reductions

from anticipated future action. The BAU projections for Residential and Commercial Electricity do not reflect the Renewable Portfolio Standard (RPS) policies that have been adopted in the District of Columbia, the state of Maryland, and the Commonwealth of Virginia. Instead, EPA's 2020 eGRID emission factors have been kept constant out to 2050. The impacts of policies that accelerate the deployment of clean energy, such as RPS policies, are reflected in this PCAP's priority GHG reduction measures. Table 7 provides a summary of BAU assumptions used in the development of BAU projections for this PCAP.

Table 7. BAU Assumptions

Emissions Activity	BAU Assumptions
Residential Energy	COG Cooperative Forecasts Round 10.0 household growth by COG member jurisdiction
	Applied to typical housing mix in each community (Single Family Detached, Attached, Apartments 2-4 Units, Apartments 5+ Units)
	Typical energy use intensity by housing type
Commercial Energy	10.0 Cooperative Forecasts employment growth by COG member jurisdiction
	Historic job growth & commercial construction -> SQFT new construction / job
	New building mix by Core, Inner, Outer areas from COG Commercial Construction Report
	Typical energy use intensity by building type (office, retail, flex/other)
On-Road Mobile Emissions	Adopted Transportation Planning Board projections from Vision 2045
	Transportation Demand Model 2.3.75
	Uses Visualize 2045 Transportation Networks & 9.1a Cooperative Forecasts as inputs
	EPA MOVES2014b
	Incorporates incremental improvements in average fuel economy
Air and Rail Travel	Passenger growth based on COG Regional Air Passenger Origin/Destination Forecast
	Percent increase derived from Transportation Planning Board projections of future ridership
Off-Road Mobile Emissions	Held constant
Agriculture	All sources (soils, livestock, manure) decreased at annual rate of recent loss in farmland (2007-2012) from COG What our Region Grows Report,

Emissions Activity	BAU Assumptions
	2017 (Note: the COG region rate was applied to the full MSA in the absence of more specific data for additional MSA jurisdictions)
Waste (Solid Waste and Wastewater), HFCs	Proportional increase with population
Fugitive Natural Gas	Driven by increases in natural gas consumption

GHG Reduction Measure Quantification

The following is a summary of methods used for calculating GHG emission reductions in the COG PCAP. In developing these values, modeling assumptions were made to determine reasonable GHG emissions reductions from the deployment of specific measures. In some instances, already existing modeling efforts were used, these situations are noted below. Additionally, in some cases, there may be areas of overlap between emissions reduction values between measures. For example, electricity emissions factors associated with a progressively cleaner grid were used to determine emissions reduction potential for a range of measures (such as efficiency and electrification). This might result in double counting when comparing it to the clean and renewable energy measure, which also accounts for emissions reductions from cleaner electricity.

ACCELERATE THE DEPLOYMENT OF ENERGY EFFICIENCY SOLUTIONS AND DECARBONIZATION OF RESIDENTIAL, INSTITUTIONAL, MUNICIPAL, AND COMMERCIAL BUILDINGS.

This measure calculated emissions reductions from electrification and energy efficiency in the building sector. Building energy use and building emission projections are based on energy consumption from electricity, natural gas, fuel oil, and propane in existing residential (single-family, multifamily, and mobile homes) and commercial buildings (office, food service, school, hotel, healthcare, retail, and warehouse).

CO_2Sight™ utilizes ICF's Distributed Energy Resources (DER) Planner model for modeling existing buildings. DER Planner is a bottom-up model that is built upon the best practice principles for potential modeling outlined by the National Action Plan for Energy Efficiency in their Guide for Conducting Energy Efficiency Potential Studies. The model can be used to calculate technical, economic, and achievable potential estimates. Together, the CO_2Sight platform and DER Planner estimate energy and emissions changes from a range of decarbonization strategies, including electrification retrofits and energy efficiency.

DER Planner, informed by stock CO_2Sight measures data, has the capabilities to model various energy efficiency, electrification, and building envelope measures in selected building types. This tool allows the analysis of over 80 residential and commercial measures in selected regions applied to the Pennsylvania building characteristics. The model uses key inputs such as equipment stock, participation rate curves, and energy change per measure and estimates potential savings from applying efficient measures available for each building type and end-use. Given the efficient technologies available, this quantifies how much energy could be reduced. To compute total savings potential, the model runs all permutations combining savings per energy efficiency measure unit,

expected measure penetration, and total number of measure units (or total eligible stock) by all adoption types.

By integrating DER Planner and comprehensive datasets such as ResStock and ComStock, CO_2Sight aggregates energy and emissions changes to estimate changes in energy use. The base year and projections for energy consumption in existing buildings are built from the 2022 Annual Energy Outlook (AEO), which represented projected energy user prior to the passage of the IRA, from the U.S. EIA. AEO data are scaled to cover the MSA by scaling AEO Census level data with the ResStock and ComStock building models of North American building stock with county-level resolution. The model calibrates ComStock and ResStock energy consumption to AEO energy consumption on a Census division level. Then the modeling proportionally adjusts county-level energy consumption to the scaled Census division level. Energy use values have been integrated with emissions factors for primary fuels (electricity, gas, propane and fuel oil) to provide total emissions. Results are provided every five years from 2020 to 2050 and interpolated for years in between.

For the MSA, modeling assumed an accelerated electrification scenarios for HVAC as well as Water Heating and Cooking, and a high scenario for building envelope implementation, in alignment with sources outlined below.

As an input into DER Planner, each measure has participation (or technology adoption curves) connected to them. A range of factors can impact whether new electric or efficiency technologies are adopted. This approach builds from NREL's Electrification Future Study,[37] from which many of the adoption curves are provided. It accounts for costs, supporting infrastructure, ownership and availability, health and sustainability (including policies) and other factors that could influence technology change. Adoption curves are also provided from the implementation energy efficiency programs and informed by ICF expertise. For ease of use, users can select prepopulated groupings of participation curves to match the types of energy change they want to model. The groupings are outlined below:

HVAC, Water Heating, and Cooking Pathways

- Business-as-Usual: Small amount of energy efficiency, no specific electrification strategy or fuel switching
- Gas Efficiency: Significant amount of energy efficiency, no electrification, specific emphasis on efficiency for gas equipment. Gas heat pumps in future years.
- Beneficial Electrification: Significant amount of energy efficiency, small amount of electrification for those projects that are presently cost-effective.
- End of Life Electrification: Significant amount of energy efficiency, large amount of electrification when equipment reaches the end of its useful life.
- Accelerated Electrification: Signification amount of energy efficiency, large amount of electrification prior to equipment reaching the end of its useful life.

Water Heating and Cooking Pathways

- Business-as-Usual: Small amount of energy efficiency, no specific electrification strategy or fuel switching

[37] https://www.nrel.gov/analysis/electrification-futures.html

- Gas Efficiency: Significant amount of energy efficiency, no electrification, specific emphasis on efficiency for gas equipment. Gas heat pumps in future years.
- Beneficial Electrification: Significant amount of energy efficiency, small amount of electrification for those projects that are presently cost-effective
- End of Life Electrification: Significant amount of energy efficiency, large amount of electrification when equipment reaches the end of its useful life
- Accelerated Electrification: Signification amount of energy efficiency, large amount of electrification prior to equipment reaching the end of its useful life

Building Envelope Pathways

- Business-as-Usual: Small amount of energy efficiency on building envelope
- Low: Moderate building envelope work, some deep energy retrofits
- High: Significant building envelope work, Significant deep energy retrofits

In addition to HVAC; Water Heating and Cooking Pathway selection being chosen, there are opportunities to influence core energy efficiency work occurring in each pathway including:

- Full lighting retrofits and lighting controls
- Smart Thermostats and Building Automation Systems
- New energy efficient appliances
- New energy efficient HVAC equipment

CO_2Sight uses ICF's Integrated Planning Model (IPM) to generate a trajectory of grid emissions factors associated with the electricity grid. Emissions factors for this measure were derived from the Net Zero Electricity Grid measure. Values from EPA's Center for Corporate Climate Leadership GHG Emission Factors Hub were used for natural gas and propane reductions.[38]

ACCELERATE THE DEPLOYMENT OF CLEAN AND RENEWABLE ENERGY.

The potential GHG emission reductions from increased distributed solar adoption were estimated using a combination of NREL datasets, information on existing distributed solar systems in the region, and regional goals for increased adoption of distributed solar. The data are representative of the COG region, rather than the CPRG MSA territory, but is used as a proxy for rooftop solar potential for this measure.

From NREL's dataset on rooftop solar potential in the U.S., an average kW potential for solar per building was derived using data for zip codes in the region. The average system size metric was applied to the 2030 COG goal of 250,000 solar rooftops in the region to estimate the kW solar potential by 2030. The region's population growth rate was used to continue growing the number of rooftop solar systems in the region through 2050. To calculate the kWh of solar output, the capacity factor for residential solar from NREL's annual technology baseline was used. The incremental growth in solar output from current levels, multiplied by the grid emissions factor from the 2023 AEO Reference Case, resulted in the potential avoided emissions from rooftop solar. The grid emissions factor used was the average of the PJMD and PJME AEO regions for CO_2 emissions factors. The CO_2 emissions factors were combined with the CH_4 and N_2O eGRID emission factor data from the SRVC

[38] https://www.epa.gov/climateleadership/ghg-emission-factors-hub

and RFCE regions to estimate a CO_2e emission factor representing the MSA. The results are summarized in Table 8 and Table 9.

Table 8. Summary Results

Summary Outputs	2022 (Existing)	2030	2050
Buildings with Rooftop Solar	72,701	250,000	287,372
Rooftop Solar Capacity (kW)	807,339	2,797,242	3,215,394
Rooftop Solar Output (MWh)	1,050,235	3,638,820	4,182,777

Table 9. Cumulative GHG Reductions Over Time

Cumulative GHG Reductions (MTCO2e)	2025-2030	2025-2050
Distributed Renewables Measure	2,658,847	11,244,812

Data sources used include:

- Rooftop Solar Photovoltaic Technical Potential in the United States: A Detailed Assessment (2016), NREL Technical Report and dataset
- 2023 Electricity Annual Technology Baseline, NREL
- AEO 2023 Reference Case, electric grid emissions factor data
- EPA eGRID, electric grid emissions factor data, 2020
- COG data collection for existing distributed solar systems in the region
- COG community cooperative forecast, population growth projections

STUDY, PLAN FOR, AND DEPLOY DISTRICT ENERGY AND MICROGRID OPPORTUNITIES.

In 2011 COG worked with FVB Energy Inc to study potential benefits and costs of generalized example district energy systems in the region. This report, "Development of Cost Benefit Information and Business Case for Integrated Community Energy Solutions, Final Report" analyzed the benefits of the application of various generalized example district energy system types to a comparison building. Table 10 presents information from this study in terms of energy consumption differences between applied district systems and the comparison building, emission factors used for the year 2025, and conversion factors used to arrive at annual GHG emissions and GHG reductions for different system types.

To calculate the cumulative GHG reductions over time, varying emission factors for the grid were applied, consistent with other measures analyzed. For the comparison building, grid emission factors were held constant over time.

Table 10. DE System Types

Annual DE System Energy Consumption	Boilers and chillers	Engine CHP	Turbine CHP	Combined cycle CHP	Biomass Boiler	GSHP	Waste Heat	Solar
Gas (mmbtu)	339,845	1,335,623	1,118,251	1,442,068	49,319	94,763	150,313	261,856
Grid power (mmbtu)	256,223	(1,266,944)	(737,520)	(1,493,840)	215,443	489,447	256,223	256,223
Annual Comparison Building Energy Consumption								
Gas (mmbtu)	335,616	335,616	335,616	335,616	335,616	335,616	335,616	335,616
Grid power (mmbtu)	254,853	254,853	254,853	254,853	254,853	254,853	254,853	254,853
% Change in Annual Energy Consumption with DE System	1%	-88%	-36%	-109%	-55%	-1%	-31%	-12%
Conversion and Emission Factors								
kwh/mmbtu	293.071070							
mtCO2e/mmbtu (gas)	0.053115							
mtco2e/kwh (grid power, 2025)	0.00027							
mtco2e/kwh (grid power, BAU, 2025)	0.00029							
Annual DE System GHG Emissions								
Gas ($mtCO_2e$)	18,051	70,941	59,395	76,595	2,620	5,033	7,984	13,908
Grid power ($mtCO_2e$)	20,130	(99,535)	(57,942)	(117,361)	16,926	38,453	20,130	20,130
Annual Comparison BAU Building GHG Emissions								
Gas ($mtCO_2e$)	17,826	17,826	17,826	17,826	17,826	17,826	17,826	17,826
Grid power ($mtCO_2e$)	21,711	21,711	21,711	21,711	21,711	21,711	21,711	21,711
% Reduction in Annual GHG Emissions with DE System	-3%	-172%	-96%	-203%	-51%	10%	-29%	-14%

PROVIDE AND PROMOTE NEW AND EXPANDED OPPORTUNITIES TO REDUCE VMT THROUGH PUBLIC TRANSPORTATION, NON-MOTORIZED TRAVEL, MICROMOBILITY, SHARED TRAVEL OPTIONS, AND DEVELOPMENT.

The measure models the resulting GHG emissions reduced if the MSA achieves the VMT reductions modeled for scenario MS.4 of the *TPB Climate Change Mitigation Study of 2021: Additional Transportation Scenarios Analysis*. This scenario models a variety of strategies to reduce VMT, including land use changes, reduction in transit travel times, telework, and increased walk and bike access, and uptake of micromobility. These strategies result in VMT reduction for passenger vehicles only. The same baseline VMT, vehicle population, energy consumption, and emissions by fuel type and vehicle source type from EPA MOVES4 used for the low- and zero- emissions measures were used for this measure as well. This analysis sourced data from EPA MOVES4, the TPB Climate Change Mitigation Study of 2021 Additional Transportation Scenarios Analysis (June 2022),[39] and eGRID.

ACCELERATE THE DEPLOYMENT OF LOW- AND ZERO-EMISSIONS TRANSPORTATION, FUELS, AND VEHICLES.

The measure models the resulting GHG emissions reduced if the MSA meets the ZEV targets outlined in scenario VT.1 of the TPB Climate Change Mitigation Study of 2021:

- 50% of new light-duty vehicle (LDV) sales are ZEVs in 2030, with 100% by 2040,
- 30% of new medium/heavy-duty (MHD) truck sales ZEVs in 2030, with 100% by 2050, and
- 50% of buses on the road are ZEVs in 2030, with 100% in 2050.

The model uses outputs from the EPA Motor Vehicle Emissions Simulator (MOVES4) to project baseline VMT, vehicle population, energy consumption, and Scope 1 emissions for on-road transportation in the MSA by fuel type (gasoline, diesel, ethanol (E-85), compressed natural gas, and electricity), vehicle source type, and model year. Default input values were used. Scope 2 emissions from electricity consumption by EVs were found using the following equation:

$$Scope\ 2\ Emissions = Electricity\ Consumption\ \times\ Electricity\ Emission\ Factor$$

The electricity emission factor was held at 2020 eGRID levels through 2050 for the baseline.

To model GHG emission reductions in the policy scenario, for each model year, a fraction of VMT was designated as fuel type “electricity” or “hydrogen” based on the ZEV sales curve. The resulting energy consumption was found using the following equation:

$$Energy\ Consumption = VMT\ \times Energy\ Efficiency$$

where energy efficiency was in units of kJ/mi for battery-electric vehicles (BEVs) and fuel cell electric vehicles (FCEVs). Implied BEV energy efficiencies from the MOVES4 baseline results were used. FCEV energy efficiencies were sourced from the California Advanced Clean Fleets (ACF) rule. Scope 1 emissions were found by reducing baseline internal combustion engine vehicle (ICEV) emissions by

[39] ICF, Fehr and Peers, and Gallop Corporation. “TPB Climate Change Mitigation Study of 2021, Additional Transportation Scenarios Analysis: TPB Survey Identified Scenarios.” June 2022. file:///C:/Users/18745/Downloads/CCMS_2021_Additional_Transportation_Scenarios_Analysis__-_TPB_Survey_Identified_Scenarios_v5.pdf

the ZEV sales fraction. Scope 2 emissions were found using Equation (1). Electricity emission factor projections were sourced from EIA's AEO for the MSA region.

The following additional key assumptions were made throughout the analysis:

- ZEVs exist in the vehicle fleet for the same length of time as ICEVs.
- ZEV activity/use is identical to an ICEV.
- The annual ZEV sales fraction applies to every fuel type.
- Long-haul medium and heavy-duty vehicles (MHDVs) ZEVs are modeled as FCEV and all other MHDVs ZEVs are modeled as BEV.
- All LDVs ZEVs are modeled as BEVs.
- All BEV populations 2021 and earlier are EPA MOVES4 default.
- The methodology in some cases required re-allocating MOVES4 baseline projected electric vehicle back to internal combustion engine vehicles. Where this was necessary, LDVs were designated as gasoline, and MHDVs were designated as diesel.
- The hydrogen supply is assumed to be 50% green hydrogen and 50% blue hydrogen.

This analysis sourced data from EPA MOVES4, eGRID, and EIA AEO, and electricity emission factors used were consistent with the factors from IPM used in other measures.

ACCELERATE THE DEPLOYMENT OF OFF-ROAD/NON-ROAD ELECTRIC EQUIPMENT.

To estimate GHG emission reductions from this measure, off-road GHG emissions were assumed to remain constant, as presented in the MSA BAU. To estimate cumulative reductions, in each year, a percent reduction from BAU was then applied. This percent reduction was derived from the modeling from the COG 2030 CEAP, by calculating the 2030 CEAP COG region BAU off-road emissions in a given year to the 2030 CEAP COG region GHG reduction scenario off-road emissions in that same year. The annual percent reduction was held constant from 2030 through 2050.

REDUCE GHG EMISSIONS FROM WASTE AND WASTEWATER TREATMENT.

For the waste sector, the same method was applied as was used for off-road emissions, building off an approach that scales COG 2030 CEAP GHG reductions to the larger MSA region. For the wastewater treatment sector, GHG emission reductions were estimated calculating an average annual percent GHG emission reduction across from wastewater treatment across the MSA states (MD, VA, WV) from EPA's state-level non-CO_2 GHG projections and mitigation assessments[40] and then applying those annual percent reductions to the MSA BAU for wastewater treatment.

ACCELERATE THE EXPANSION OF THE REGIONAL TREE CANOPY AND REDUCE TREE CANOPY LOSS.

For this measure the main tools used were:

- i-Tree MyTree (Accessed through https://www.itreetools.org/. This tool is used for assessing the carbon sequestration potential of trees, specifically in Maryland.

[40] EPA. "Non CO_2 Greenhouse Gas Data Tool." https://cfpub.epa.gov/ghgdata/nonco2/

- ICLEI LEARN: Utilized via https://icleiusa.org/LEARN/. This tool is used for estimating tree canopy cover percentage in the MSA, employing 1-meter resolution data from the University of Vermont and the Chesapeake Conservatory land cover data.

The main assumptions are derived from legislative goals set forth by Washington, D.C. and Maryland.

- In Washington, D.C., the goal is to increase tree canopy coverage from 35% to 40%. The goal was within Sustainable DC—a planning effort to make the District of Columbia the greenest, healthiest, and most livable city in the nation. https://doee.dc.gov/sites/default/files/dc/sites/ddoe/page_content/attachments/Draft_Urban_Tree_Canopy_Plan_Final.pdf
- The 5 Million Trees Initiative was mandated by Maryland legislation through the Tree Solutions Now Act of 2021. Part of this legislation included a historic directive to plant 5 million native trees on public and private land by 2031. https://news.maryland.gov/dnr/2023/06/01/five-million-trees-please-maryland-rolls-out-5-million-trees-initiative/

Tree canopy cover percentage for the MSA is estimated using the ICLEI LEARN tool, using 1-meter resolution data from the University of Vermont and the Chesapeake Conservatory land cover data to assess tree cover in "settlement" areas.

Carbon sequestration potential of native trees in Maryland is determined using i-Tree MyTree, which utilizes county coordinates within each MSA Maryland County and designates the trees as "new planting" and in "partial sun" with a 1-inch diameter.

Data used included:

- Urban and Rural Areas Census data for 2010 and 2020: Obtained from the U.S. Census Bureau's website at https://www.census.gov/programs-surveys/geography/guidance/geo-areas/urban-rural.html
- Native Tree Species in Maryland: https://msa.maryland.gov/msa/mdmanual/01glance/html/trees.html

APPENDIX B. METROPOLITAN WASHINGTON CLIMATE AND ENERGY PLANS AND TARGETS

REGIONAL

- Transportation Planning Board Visualize 2045, 2022 update, goals are specific to the on-road transportation sector:
  - 50% below 2005 levels by 2030
  - 80% by 2050
- Metropolitan Washington 2030 Climate and Energy Action Plan, 2020
  - 50% below 2005 levels by 2030
  - 80% by 2050

DISTRICT OF COLUMBIA

- Carbon Free DC, 2023
  - 60% Reduction in emissions by 2030 compared to 2006 baseline
  - 50% Reduction in per capita energy use by 2032 compared to 2006 baseline
  - 50% Energy from renewables by 2032

MARYLAND

City of Bowie

Updated Climate Action Plan, 2020

- 50% by 2030 below 2015 levels

Charles County

- Community climate plan began development in 2023

Frederick County

- Climate Emergency Resolution, 2020
  - 50% from 2010 levels by 2030
  - 100% by 2050
- Sustainable Frederick County, 2017
  - 25% reduction below 2007 levels by 2025

City of Greenbelt

- Sustainability Plan Framework, 2013
  - Meet State of MD and COG goals (COG goals noted above and MD goal of 25% below 2006 levels by 2020)

City of Laurel

- Phase II of developing a Sustainable Community Implementation Framework kicked off in 2023

Montgomery County

- Montgomery County Climate Action Plan, 2021
  - 80% below 2005 levels by 2027
  - 100% below 2005 levels by 2035

Prince George's County

- Climate Action Plan, 2022
  - 80% below 2008 levels by 2050

City of Rockville

- Climate Action Plan, 2022
  - 50% reduction below 2005 levels by 2030
  - Zero GHG emissions on or before 2050

City of Takoma Park

- Sustainability and Climate Action Plan, 2019
  - Does not establish new GHG goals but instead works toward being consistent with state, County, and COG plans.
- Sustainable Energy Action Plan, 2014
  - Does not establish new GHG goals but instead works toward being consistent with state and County plans.

State of Maryland

- Maryland Climate Pollution Reduction Plan, 2023
- The 2030 Greenhouse Gas Reduction Act (GGRA) Plan, 2021
  - The Act established the goals of 40% reduction below 2006 levels by 2030.
  - The Plan calls for achieving the target of 50% reduction below 2006 levels by 2030.
- The Climate Solutions Now Act (CSNA), 2022
  - The CSNA adjusted statewide GHG emission goals to include net zero carbon emissions by 2045.
  - The CSNA also calls for a reduction of statewide GHG emissions by 60% below 2006 levels by 2031.

VIRGINIA

City of Alexandria

- Energy and Climate Change Action Plan, 2023
  - Does not establish new GHG goals but affirms commitment to Paris Climate Agreement goals.
- Eco-City Alexandria Environmental Action Plan, 2019
  - 50% below 2005 levels by 2030
  - 80 – 100% below 2005 levels by 2050

Arlington County

- Community Energy Plan Roadmap, 2022 (years 1-2), updated for years 3-5 in 2024

    - Supports CEP goal of county-wide carbon neutral by 2050
  - Community Energy Plan Update, 2019
    - County-wide carbon neutral by 2050, compared to 2007 levels
- Energy Assurance Plan, 2023 (resilience)
- Carbon Neutral Transportation Master Plan (2024)

City of Falls Church

- Community Energy Action Plan (CEAP), 2023
  - 50% below 2005 levels by 2030
  - 80% below 2005 levels by 2050
  - Net zero emissions by 2050

Fairfax County

- Resilient Fairfax Climate Adaptation and Resilience Plan, 2022
- CECAP Implementation Plan, 2022
  - Does not establish new GHG goals but instead works toward meeting CECAP goals
- Community-wide Energy and Climate Action Plan (CECAP), 2021
  - By 2030, 50% below 2005 levels
  - By 2040, 75% below 2005 levels
  - By 2050, carbon neutral

Loudoun County

- Loudoun County Energy Strategy, 2023
  - Supports state goal to become net zero by 2045 and achieve a carbon-free grid by 2050
- Loudoun County Energy Strategy, 2009
  - County-wide goal to reduce GHGs from 3.85 million metric ton to 3.0 million metric ton by 2040
  - Government operations goal to reduce emissions 15% between 2007 and 2012

City of Manassas

- Draft Climate Action Plan, 2023
  - 50% GHG reduction from 2005 levels by 2030
  - 80% reduction from 2005 levels by 2050

Prince William County

- Community Energy and Sustainability Master Plan, 2023
  - By 2030, 50% below 2005 levels
  - By 2035, use 100% renewable electricity county-wide
  - By 2050, achieve carbon neutrality in government operations

Commonwealth of Virginia

- Virginia Clean Energy Plan, 2022

    - Ensure access to abundant, reliable, affordable, and clean energy so all Virginians can live, work and raise a family in a growing and thriving Commonwealth.
- Virginia Clean Economy Act, 2020
    - Mandates Dominion Energy Virginia and Appalachian Electric Power, produce 100% renewable electricity by 2045 and 2050, respectively.
    - Sets energy efficiency standards.
- Virginia 2018 Energy Plan
    - Plan mentions state commitment to Under2Coalition goal of reducing pollution and keeping global temperature rise under 2°C.

WEST VIRGINIA

- State of West Virginia 2018-2022 State Energy Plan, 2017

APPENDIX C. IDENTIFICATION OF LIDACS IN THE WASHINGTON-ARLINGTON-ALEXANDRIA, DC-VA-MD-WV MSA

Table 11. Census Block IDs for the MSA

City/County	State	Census Block ID	City/County	State	Census Block ID
District of Columbia	DC	11001000501	Prince George's County	MD	24033804001
District of Columbia	DC	11001001002	Prince George's County	MD	24033804002
District of Columbia	DC	11001001803	Prince George's County	MD	24033804002
District of Columbia	DC	11001001803	Prince George's County	MD	24033804102
District of Columbia	DC	11001001803	Prince George's County	MD	24033804102
District of Columbia	DC	11001001804	Prince George's County	MD	24033804300
District of Columbia	DC	11001001804	Prince George's County	MD	24033804300
District of Columbia	DC	11001001804	Prince George's County	MD	24033804400
District of Columbia	DC	11001001901	Prince George's County	MD	24033804400
District of Columbia	DC	11001001901	Prince George's County	MD	24033804600
District of Columbia	DC	11001001901	Prince George's County	MD	24033804801
District of Columbia	DC	11001001902	Prince George's County	MD	24033804801
District of Columbia	DC	11001002001	Prince George's County	MD	24033804801
District of Columbia	DC	11001002001	Prince George's County	MD	24033804802
District of Columbia	DC	11001002002	Prince George's County	MD	24033804802
District of Columbia	DC	11001002101	Prince George's County	MD	24033804900
District of Columbia	DC	11001002101	Prince George's County	MD	24033804900
District of Columbia	DC	11001002102	Prince George's County	MD	24033805000
District of Columbia	DC	11001002102	Prince George's County	MD	24033805000
District of Columbia	DC	11001002201	Prince George's County	MD	24033805000
District of Columbia	DC	11001002201	Prince George's County	MD	24033805101
District of Columbia	DC	11001002202	Prince George's County	MD	24033805101
District of Columbia	DC	11001002400	Prince George's County	MD	24033805201
District of Columbia	DC	11001002501	Prince George's County	MD	24033805201
District of Columbia	DC	11001002501	Prince George's County	MD	24033805202
District of Columbia	DC	11001002503	Prince George's County	MD	24033805202
District of Columbia	DC	11001002504	Prince George's County	MD	24033805202
District of Columbia	DC	11001002702	Prince George's County	MD	24033805500
District of Columbia	DC	11001002702	Prince George's County	MD	24033805500
District of Columbia	DC	11001002704	Prince George's County	MD	24033805601
District of Columbia	DC	11001002801	Prince George's County	MD	24033805601
District of Columbia	DC	11001002801	Prince George's County	MD	24033805601
District of Columbia	DC	11001002802	Prince George's County	MD	24033805602
District of Columbia	DC	11001002802	Prince George's County	MD	24033805602
District of Columbia	DC	11001002802	Prince George's County	MD	24033805602

District of Columbia	DC	11001002900	Prince George's County	MD	24033805700
District of Columbia	DC	11001002900	Prince George's County	MD	24033805700
District of Columbia	DC	11001003000	Prince George's County	MD	24033805700
District of Columbia	DC	11001003000	Prince George's County	MD	24033805801
District of Columbia	DC	11001003200	Prince George's County	MD	24033805801
District of Columbia	DC	11001003200	Prince George's County	MD	24033805802
District of Columbia	DC	11001003200	Prince George's County	MD	24033805802
District of Columbia	DC	11001003200	Prince George's County	MD	24033805904
District of Columbia	DC	11001003400	Prince George's County	MD	24033805904
District of Columbia	DC	11001003400	Prince George's County	MD	24033805906
District of Columbia	DC	11001003500	Prince George's County	MD	24033805906
District of Columbia	DC	11001003500	Prince George's County	MD	24033805907
District of Columbia	DC	11001003600	Prince George's County	MD	24033805907
District of Columbia	DC	11001003702	Prince George's County	MD	24033805908
District of Columbia	DC	11001003802	Prince George's County	MD	24033805909
District of Columbia	DC	11001004100	Prince George's County	MD	24033806000
District of Columbia	DC	11001004300	Prince George's County	MD	24033806000
District of Columbia	DC	11001004702	Prince George's County	MD	24033806000
District of Columbia	DC	11001004703	Prince George's County	MD	24033806100
District of Columbia	DC	11001004703	Prince George's County	MD	24033806501
District of Columbia	DC	11001004703	Prince George's County	MD	24033806501
District of Columbia	DC	11001004703	Prince George's County	MD	24033806501
District of Columbia	DC	11001004704	Prince George's County	MD	24033806601
District of Columbia	DC	11001004704	Prince George's County	MD	24033806601
District of Columbia	DC	11001004801	Prince George's County	MD	24033806601
District of Columbia	DC	11001004801	Prince George's County	MD	24033806602
District of Columbia	DC	11001004802	Prince George's County	MD	24033806602
District of Columbia	DC	11001004802	Prince George's County	MD	24033806602
District of Columbia	DC	11001004901	Prince George's County	MD	24033806711
District of Columbia	DC	11001004902	Prince George's County	MD	24033806712
District of Columbia	DC	11001005004	Prince George's County	MD	24033806713
District of Columbia	DC	11001005004	Prince George's County	MD	24033806713
District of Columbia	DC	11001005203	Prince George's County	MD	24033806713
District of Columbia	DC	11001005501	Prince George's County	MD	24033806714
District of Columbia	DC	11001005503	Prince George's County	MD	24033806714
District of Columbia	DC	11001005601	Prince George's County	MD	24033806800
District of Columbia	DC	11001005601	Prince George's County	MD	24033806900
District of Columbia	DC	11001005801	Prince George's County	MD	24033806900
District of Columbia	DC	11001005900	Prince George's County	MD	24033807000
District of Columbia	DC	11001006400	Prince George's County	MD	24033807000
District of Columbia	DC	11001006400	Prince George's County	MD	24033807000
District of Columbia	DC	11001006804	Prince George's County	MD	24033807000
District of Columbia	DC	11001007100	Prince George's County	MD	24033807000

District of Columbia	DC	11001007100	Prince George's County	MD	24033807301
District of Columbia	DC	11001007100	Prince George's County	MD	24033807305
District of Columbia	DC	11001007203	Prince George's County	MD	24033807305
District of Columbia	DC	11001007301	Prince George's County	MD	24033807404
District of Columbia	DC	11001007304	Prince George's County	MD	24033807405
District of Columbia	DC	11001007304	Prince George's County	MD	24033807407
District of Columbia	DC	11001007304	Prince George's County	MD	24033807409
District of Columbia	DC	11001007304	Prince George's County	MD	24033807410
District of Columbia	DC	11001007401	Prince George's County	MD	24033807500
District of Columbia	DC	11001007401	Prince George's County	MD	24033980000
District of Columbia	DC	11001007403	Arlington County	VA	51013100300
District of Columbia	DC	11001007403	Arlington County	VA	51013100700
District of Columbia	DC	11001007404	Arlington County	VA	51013101602
District of Columbia	DC	11001007406	Arlington County	VA	51013101603
District of Columbia	DC	11001007406	Arlington County	VA	51013101603
District of Columbia	DC	11001007407	Arlington County	VA	51013101701
District of Columbia	DC	11001007407	Arlington County	VA	51013101703
District of Columbia	DC	11001007407	Arlington County	VA	51013101704
District of Columbia	DC	11001007408	Arlington County	VA	51013101704
District of Columbia	DC	11001007408	Arlington County	VA	51013101705
District of Columbia	DC	11001007409	Arlington County	VA	51013101705
District of Columbia	DC	11001007409	Arlington County	VA	51013101803
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District of Columbia	DC	11001007502	Arlington County	VA	51013102001
District of Columbia	DC	11001007502	Arlington County	VA	51013102002
District of Columbia	DC	11001007503	Arlington County	VA	51013102003
District of Columbia	DC	11001007503	Arlington County	VA	51013102003
District of Columbia	DC	11001007504	Arlington County	VA	51013102003
District of Columbia	DC	11001007504	Arlington County	VA	51013102100
District of Columbia	DC	11001007601	Arlington County	VA	51013102100
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District of Columbia	DC	11001007604	Arlington County	VA	51013102701
District of Columbia	DC	11001007604	Arlington County	VA	51013102702
District of Columbia	DC	11001007604	Arlington County	VA	51013102804

District of Columbia	DC	11001007605	Arlington County	VA	51013102804
District of Columbia	DC	11001007605	Arlington County	VA	51013102904
District of Columbia	DC	11001007605	Arlington County	VA	51013103000
District of Columbia	DC	11001007605	Arlington County	VA	51013103100
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District of Columbia	DC	11001007707	Arlington County	VA	51013103503
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District of Columbia	DC	11001007803	Arlington County	VA	51013103800
District of Columbia	DC	11001007803	Arlington County	VA	51013103800
District of Columbia	DC	11001007803	Culpeper County	VA	51047930202
District of Columbia	DC	11001007804	Culpeper County	VA	51047930202
District of Columbia	DC	11001007804	Culpeper County	VA	51047930202
District of Columbia	DC	11001007804	Culpeper County	VA	51047930203
District of Columbia	DC	11001007806	Culpeper County	VA	51047930300
District of Columbia	DC	11001007806	Culpeper County	VA	51047930300
District of Columbia	DC	11001007807	Culpeper County	VA	51047930501
District of Columbia	DC	11001007807	Fairfax County	VA	51059415300
District of Columbia	DC	11001007808	Fairfax County	VA	51059415401
District of Columbia	DC	11001007808	Fairfax County	VA	51059415401
District of Columbia	DC	11001007808	Fairfax County	VA	51059415401
District of Columbia	DC	11001007809	Fairfax County	VA	51059415500
District of Columbia	DC	11001007809	Fairfax County	VA	51059416000
District of Columbia	DC	11001007901	Fairfax County	VA	51059420100
District of Columbia	DC	11001007901	Fairfax County	VA	51059420300
District of Columbia	DC	11001007901	Fairfax County	VA	51059420503
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Prince George's County	MD	24033803606	Manassas Park City	VA	51685920100
Prince George's County	MD	24033803608	Manassas Park City	VA	51685920100
Prince George's County	MD	24033803608	Manassas Park City	VA	51685920201
Prince George's County	MD	24033803610	Jefferson County	WV	54037972300
Prince George's County	MD	24033803612	Jefferson County	WV	54037972300
Prince George's County	MD	24033803612	Jefferson County	WV	54037972300
Prince George's County	MD	24033803613	Jefferson County	WV	54037972401
Prince George's County	MD	24033803613	Jefferson County	WV	54037972401
Prince George's County	MD	24033803613	Jefferson County	WV	54037972401
Prince George's County	MD	24033803700	Jefferson County	WV	54037972402
Prince George's County	MD	24033803700	Jefferson County	WV	54037972505
Prince George's County	MD	24033803801	Jefferson County	WV	54037972505
Prince George's County	MD	24033803803	Jefferson County	WV	54037972505
Prince George's County	MD	24033803803	Jefferson County	WV	54037972506
Prince George's County	MD	24033803900	Jefferson County	WV	54037972701
Prince George's County	MD	24033803900	Jefferson County	WV	54037972701
Prince George's County	MD	24033803900	Jefferson County	WV	54037972701
Prince George's County	MD	24033804001			

APPENDIX D. PROJECT IDEAS SUBMITTED TO COG

This list of project ideas in Table 12 is from fall of 2023 and may not be exhaustive of projects or programs that COG may be including in a CPRG implementation grant application. The ideas presented here were used as a starting point to develop PCAP measures, and some may be carried into COG's implementation grant application.

Table 12. Submitted Project Ideas

Submitting Organization	Project Concept
Public	Consumer education campaigns for household food waste reduction ("prevention")
Alexandria	Direct installation and ownership of solar energy generation systems on city-owned and managed facilities
Alexandria	Deep energy retrofits for low-income multifamily housing
Alexandria	Healthy Homes improvements, capacity building, and monitoring
Alexandria	VFA facility capital planning software, climate mitigation overlay
Alexandria	Regional collaboration for passive-design and building performance education, training, and certification pathways
Arlington County	Energy performance for LIDAC multifamily & commercial buildings
Arlington County	Energy performance for non-LIDAC multifamily & commercial buildings
Arlington County	MUSH (Municipal, University, Schools & Hospitals) program for energy performance
Arlington County	Regional education and training program on advanced building design and retrofits
Arlington County	Energy efficiency, solar and storage for non-profits and places of worship
Arlington County	Finance mechanisms
Arlington County	Technical assistance and education
Charles County	Mulching facility relocation and composting facility
Charles County	Landfill gas (LFG) to energy
Charles County	Landfill convenience center and waste transfer station
Charles County	County fleet EV transition
Charles County	Urban tree canopy program expansion
City of Frederick	Tree canopy incentive program
D.C. DOEE	Regional composting program
Fairfax County	Technical and financial assistance to property owners implementing energy efficiency updates
Fairfax County	Resilience hubs pilot program
Fairfax County	Clean energy clearinghouse/ "concierge" service
Fairfax County	Boost low-income weatherization and energy efficiency programs
Frederick County	Solar power purchase agreement and community solar
Frederick County	Pilot projects for non-diesel alternatives and data center back up space
Frederick County	Solar and microgrids for county buildings
Frederick County	Reimbursements for energy efficiency upgrades, solar, and EVs
Frederick County	Weatherization and energy efficient retrofits to LIDAC multifamily buildings

Frederick County	Reducing VMT through transit systems
Frederick County	Urban reforestation and green infrastructure
Frederick County	Implementation of biodiesel for fleet that cannot be electrified
Frederick County	EVs for county fleet
Frederick County	BEPS internal
Frederick County	BEPS external
Loudoun County	Electrified and efficient equipment "road show"
Loudoun County	Studies and business plan for district energy for commercial and residential buildings
Montgomery College	Smart grid, ice thermal storage, natural refrigerants, Rockville Campus and Takoma Park Silver Spring Campus
Montgomery County	Urban shade tree planting project
Montgomery County	Installation of enhanced diversion technologies at the Montgomery County Shady Grove Transfer Station to manage approximately 450,000 tons of waste that was not recycled and that otherwise will go to the Regional Residuals Facility or a landfill
Montgomery County	Community health worker climate-based community outreach and engagement, in Spanish
Montgomery County	Reforest open areas and enhance and expand existing forest and forested stream buffers on private properties. The project will work with private property owners to stop mowing and add forest plantings to expand and enhance forest coverage around the county
Montgomery County	133 affordable housing properties and 32 additional multifamily properties in overburdened and underserved neighborhoods to complete modernizing upgrades to save energy and improve quality of life
Montgomery County	Smart meter electrical panel upgrade program for EEAs, water heater loaner program, heat pumps for income-qualified residents with delivered fuel
Montgomery County	Support incentives and turn-key solutions to install EV charging infrastructure at multi-unit dwellings as well as other public and commercial sites needed to support the equitable and rapid adoption of electric vehicles
Montgomery County	Microgrid/resiliency hub and renewable energy "green" power production at four county owned locations
Montgomery County	Increase size of Capital Bikeshare e-bike fleet
Montgomery County	Provide funding to farmers or composting companies for the construction of an on-farm food scrap composting facility.
Montgomery County	Provide funding to farmers for the construction of an accessory solar array that will provide electricity to the agricultural operation.
Montgomery County	Increase the amount of funding in the Office of Agriculture (OAG)'s Soil Amendment Program, which provides county farmers with free deliveries of LeafGro, the compost produced at the County-operated yard trim composting facility in Dickerson
Montgomery County	Leaf blower rebate program
Montgomery County	Yard Trim Composting Program, installation of a dry fermentation anaerobic digester system will produce significant quantities of methane for use as Renewable Natural Gas for fuel or part of the process to produce hydrogen fuel for buses, trucks, and cars
Montgomery County Green Bank (MCGB)	MCGB BEPS Readiness Program - ASHRAE energy audit and guaranteed financing for projects identified in audit as economical

Montgomery County Green Bank	MCGB Energize Multifamily Program - Mezzanine finance loan to owners and developers who are restricted by senior lending.
Montgomery County Green Bank	MCGB Building Decarbonization Bond - Conduit capital markets issuance to support BEPS Readiness (above) and Energize Multifamily (above) by using grant capital for a guarantee.
Montgomery County Green Bank	MCGB Resiliency Hub Accelerator - Financing support from MCGB plus grant support to manage storage economics.
Montgomery County Green Bank	MCGB Resiliency Bond -Conduit capital markets issuance to support Resiliency Hub Accelerator (above) using grant capital for a guarantee.
Montgomery County Public Schools	Retrofit schools in equity areas with energy efficient upgrades and decarbonization measures to improve the indoor learning environment
Montgomery County Public Schools	Install agrivoltaics at Loiderman Reach Hub
Montgomery County Public Schools	Convert 35 additional fleet (non-bus) vehicles to clean energy & add messaging on fleet about Climate Actions
Montgomery County Public Schools	Install additional electric vehicle charging stations for fleet
Montgomery County Public Schools (MCPS)	Completely decarbonize some MCPS schools
Montgomery County Public Schools	Real-time energy/utility (electric, water, gas) monitoring enhancements at all schools so real-time consumption can be viewed and acted upon by students, staff, and other building users. Students have expressed a desire for their real-time data to be available for them to be able to act.
NVRC	Expand Solarize NoVA
Prince George's County	Solar PV grants for Energy Resiliency Communities (ERC)
Prince George's County	Implementation of Solar PV and Solar Thermal Hot Water Systems for public housing properties
Prince George's County	Zero-emission bus and supporting infrastructure (microgrid, battery storage, charging stations)
Prince George's County	Circular tree canopy program
Prince George's County	Accelerate purchase of EVs for gov ops
Prince George's County	Assist affordable housing building owners to comply with BEPS
Prince George's County	BEPS for Government buildings
Prince George's County	Infrastructure and technical monitoring upgrades at Prince George’s County’s municipal landfills
Prince William County	Regional tree canopy grant program
Rockville	Renovation and conversion to efficient electrification of 100 affordable residential units
Rockville	LED streetlight conversion
Rockville	Heavy-Duty fleet electrification - replace three shuttle buses and seven heavy-duty vehicles with electric models (pending market availability)

Rockville	Heavy-Duty fleet EV charging - DC Fast Charging to serve 10 heavy-duty fleet vehicles
Rockville	Rockville Swim and Fitness Center Energy Efficiency and Renewable Energy Upgrades (Lighting, variable frequency pumps, solar hot water, solar panels, electrification, and energy efficiency strategy to meet Montgomery County and Maryland BEPS)
Rockville	Expansion of Montgomery County Residential Electrification Incentives
Rockville	Expansions of solar rooftops and parking lot canopies on City of Rockville facilities
Rockville	Upgraded efficient and electric appliances, solar, and energy efficiency of 100 apartments and town homes owned by Rockville Housing Enterprises (RHE) property at Scarborough Square
Rockville	Upgraded roofs, energy efficiency, insulation, and air sealing, windows, and doors at RHE Scarborough Square town homes and apartments.
Rockville	EV Charging stations at RHE properties (at three multifamily apartment/town home developments and 29 scattered single-family homes)
Rockville	City of Rockville Facility LED Light Retrofits
Rockville	Landscape equipment electrification (public and private)
Rockville	Mobile EV charger for fleet
Rockville	Energy Audits and Electrification Plan for City Facilities to meet County and State BEPS. Only one of about 10 facilities has received a Level 2 energy audit in the last 18 years.
Rockville	Implementing electrification for HVAC and other City appliances, energy efficiency upgrades at 10 facilities.
Rockville	Reforestation at RedGate Park Arboretum to plant 5,000 trees and 2,500 shrubs.
Rockville	Greenspace Master Plan to maximize sequestration of City-owned lands
Rockville	Curbside Food Waste Compost Program. A local transfer and regional commercial compost site would need to be identified.
Rockville	Bikeshare Program Expansion to Twinbrook metro and neighborhood
Rockville	Establish Carshare or E-carshare Program
Rockville	Multiple Bicycle and Pedestrian Safety and facility expansion Projects
Rockville	Transit projects: MD 355 BRT construction serving Rockville (County project currently under design); MD 586 BRT construction serving Rockville (County project currently under design)
Rockville	Outreach, Education, Engagement with diverse communities and messaging materials coordinated by County, State, or COG to advance IRA incentives, energy efficiency, electrification, EVs, bike/ped/transit, waste reduction/compost, and sequestration.
Takoma Park	Solar canopies in city-owned parking lots
Takoma Park	Technical assistance program to help municipalities divest from fossil fuels
Takoma Park	Multifamily Building Improvement Grant (MFBIG) to make electrification/efficiency upgrades
Takoma Park	Commercial Building Improvement Grant to make electrification/ efficiency upgrades
Takoma Park	Clean Building Workforce Development Program
Takoma Park	Capital Area Resiliency Hub creation - retrofit existing buildings like schools or community centers with solar, battery storage, generators, etc.
Takoma Park	Multifamily EV charging station program

Takoma Park	Municipalities Building Performance Support Program - support gov building efficiency upgrades
University of Maryland/Prince George's County	Retrofitted solar microgrid
WMATA	Enhanced bus service i.e., WMATA's Better Bus Network Redesign Visionary Network implementation and other regional transit service improvement projects that will align service with regional development and travel patterns and increase access to frequent service that is easier to use
WMATA	Bus priority infrastructure projects i.e., dedicated bus lanes/clear lanes, transit signal priority and access efforts across the region
WMATA	First/last mile improvements and use that support access to transit and other active transportation modes
WMATA	Zero-emission buses and supporting infrastructure (i.e., battery storage, charging stations)
WSSC Water	The implementation of aeration control improvements across all six Water Resource Recovery Facilities (WRRFs) including integration of blowers and upgrades/replacements of aeration systems.
WSSC Water	Capture and recovery of ammonia product from liquid portion of solids stream at Piscataway Maryland Bio-Energy WRRF to recycle as fertilizer and reducing treatment volume and methanol and electricity use.
WSSC Water	Water and Wastewater Pump Optimization: Develop a process/system to monitor operation of pumps and provide actionable information on performance and operational condition for operating efficiency and reduce minimal energy usage.
WSSC Water	Install sewer thermal exchange equipment and solar array at the Anacostia, Maryland Depot to provide low-carbon heating, cooling, and hot water at this facility.
WSSC Water	Continue fleet electrification plan through acquisition of 60 electric vehicles and 13 electric forklifts as well as charging infrastructure available for both employees and the public at our facilities throughout Prince George's and Montgomery County Maryland.
WSSC Water	Install a microgrid at the Potomac water filtration plant consisting of 9 MW of natural gas engine generation plus 860 kW of solar. Include carbon capture of exhaust gas and removal and sequestration of carbon off-site.

APPENDIX E. COMMUNITY CLIMATE PRIORITIES SURVEY RESULTS

To capture a larger perspective of communities in the MSA, COG disseminated the CPRG Community Climate Priorities survey to assess community-wide climate priorities. The survey was shared through multiple online channels, extending beyond formal committees to include distribution through social media, the COG CPRG and main COG websites, local representatives, and community-based/non-governmental organizations. The survey gained responses from 86 participants from 13 different jurisdictions within the MSA, encompassing a diverse range of individuals, organizations, coalitions, and agencies.

COMMUNITY PRIORITIES

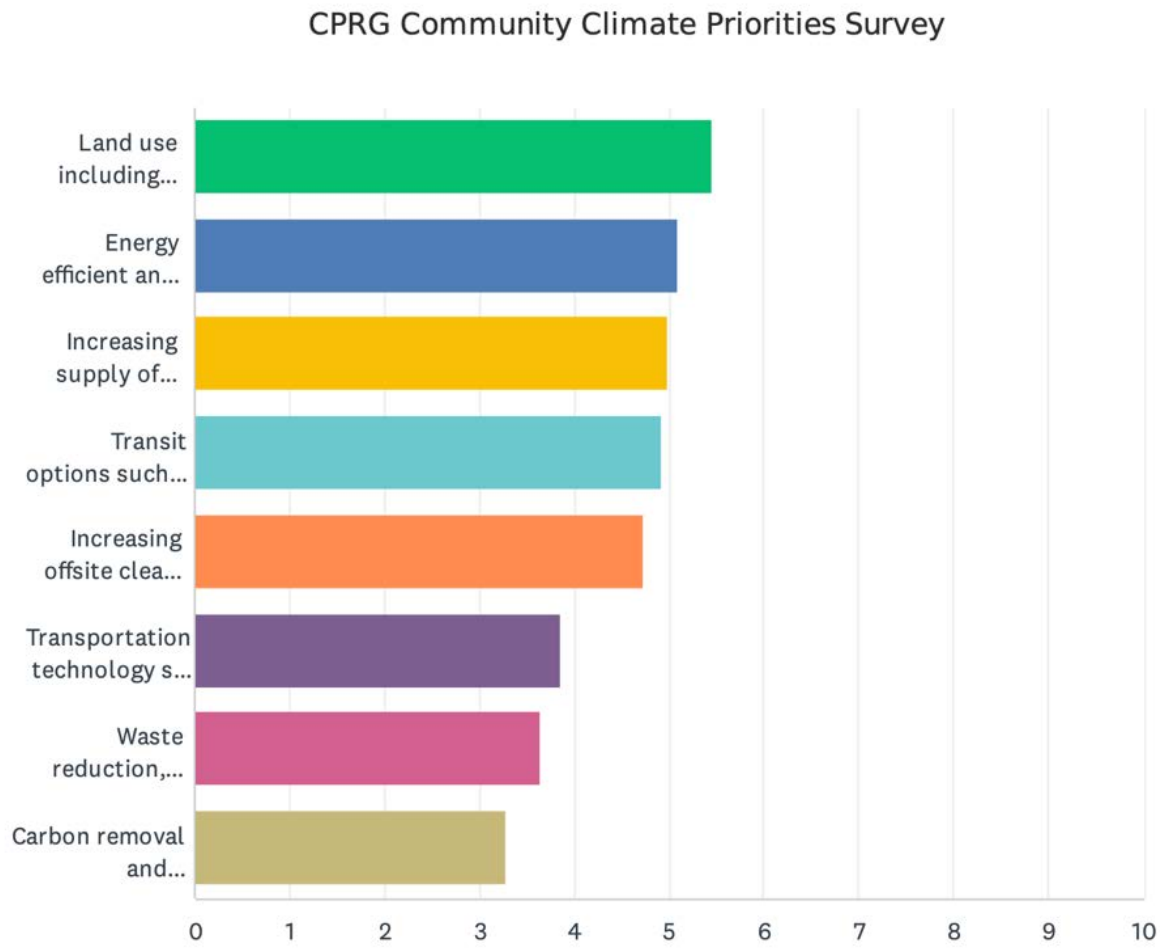
Participants were assigned the task of prioritizing GHG reduction strategies based on their perceived importance in mitigating climate change. The rankings of these strategies were averaged to generate an overall score. The following outlines the ranked strategies based on community input, listed from highest to least priority:

1. **Land Use** (including development planning, land conservation, and environment protection): 23.26% (Score 5.45)
2. **Energy Efficient and Clean Energy Buildings**: 17.44% (Score 5.09)
3. **Increasing Supply of On-site Clean Energy** (e.g., rooftop solar): 10.47% (Score 5.00)
4. **Transit Options** (such as increased use of public transportation, bike and pedestrian travel options, and reduction of travel): 17.44% (Score 4.93)
5. **Increasing Off-site Clean Energy** (e.g., community solar, utility-supplied energy): 9.30% (Score 4.74)
6. **Transportation Technology** (such as clean fuels and Low/Zero-Emission Vehicles): 5.81% (Score 3.86)
7. **Waste Reduction, Composting, and Recycling**: 11.63% (Score 3.64)
8. **Carbon Removal and Sequestration** (including green infrastructure such as trees and wetlands): 4.65% (Score 3.28)

These results are also displayed in Figure 9.

These rankings reflect the community's prioritization of strategies to mitigate climate change. Land use, energy efficient buildings, and on-site clean energy supply ranked as top priorities, with an emphasis on sustainable development and clean energy initiatives.

Figure 9. Results from COG's Community Climate Priorities Survey



EQUITY AND LIDAC PRIORITIES

The community responses outlined two overarching themes in response to questions that polled equity impact priorities. There was a notable emphasis on environmental justice, particularly concerning the needs of LIDACs. Concerns included air and water quality, greenspace availability, and overall quality of life that underscored the importance of ensuring that climate initiatives benefit people who have historically faced disproportionate environmental burdens.

Community engagement and empowerment emerged as significant aspects of equity impacts. The responses highlighted the community's call for public support, ensuring investment returns to communities, and involving communities in project planning and decision-making. This theme also encompassed a focus on creating employment opportunities, supporting local initiatives such as community composting and neighborhood farming, and fostering a sense of ownership and agency within historically underserved populations. Together, these themes conveyed the community's perspective on the most important equity impacts to achieve in the context of climate action. When assessed on what emissions reduction projects would have the most positive impact on communities that are low-income, disadvantaged, and overburdened, or have been historically underrepresented in planning processes, respondents outlined initiatives tailored to the unique needs of these communities. Key strategies identified included the promotion of non-car travel, featuring expanded bike lanes, improved bus availability, and pedestrianized streets aimed at enhancing safety and accessibility. Additionally, there was a strong emphasis on reuse and repair

initiatives, such as community-engaged compost programs and durable materials reuse infrastructure, with the goal of reducing waste and promoting local employment.

Affordable housing near transit emerged as a significant strategy, with respondents emphasizing the importance of funding allocation for such initiatives. Respondents also emphasized the importance of implementing energy efficiency projects in multifamily and commercial buildings as a crucial step toward reducing energy consumption and emissions. In summary, respondents delineated a comprehensive set of emissions reduction projects addressing transportation, waste management, energy efficiency, and community development, reflecting a commitment to sustainability and economic well-being within these communities.

BARRIERS

Respondents identified several barriers hindering their organizations from advancing climate change initiatives and energy efficiency planning. The most prevalent challenges included limited access to program funding, cited by 37.21% of respondents, followed closely by the high cost of alternatives at 36.05%. Time constraints were identified by 34.88% of respondents, while 29.07% specified other barriers not covered in the provided options. Limited knowledge was noted as a challenge by 20.93% of respondents, and 19.77% indicated limited access or inconvenience of programs as a barrier. These findings underscore a range of impediments that individuals and organizations encounter, providing valuable insights into considerations of the multifaceted challenges associated with advancing climate mitigation initiatives and energy efficiency planning.

Some survey respondents highlighted personal challenges such as time constraints and limited knowledge, emphasizing the need for more accessible and user-friendly information and resources. Others mentioned specific barriers related to their expertise or organizational focus, such as the lack of transparency on data center energy use, obstacles in rezoning industrial space, and challenges related to living in an apartment where residents may feel limited control over larger-scale initiatives.

Additionally, respondents underscored financial considerations, including the high capital cost, the need for concierge services to guide individuals through the process, and limited access to utility services and infrastructure. These nuanced insights highlight the diverse array of obstacles faced by organizations, emphasizing the importance of tailored solutions to address their unique circumstances.

PROJECT EMPHASIS

When responding to the question about advancing projects within COG's eight identified areas for climate action strategies, participants provided a diverse range of project ideas aligned with the key focus areas: Planning, Equity, Clean Electricity, Zero Energy Buildings, Zero-Emission Vehicles, Mode Shift and Travel Behavior, Zero Waste, and Sequestration.

Their input reflected emphasizing the need for projects that span urban planning, social equity, renewable energy, sustainable infrastructure, transportation, waste management, and carbon sequestration. The following insights offer valuable perspectives on the types of initiatives respondents believe should be prioritized to address the multifaceted challenges posed by climate change within the COG region.

The community responses reflected several key themes that resonated across the spectrum of climate action strategies within COG's identified areas.

- **Equity and Inclusive Clean Energy Transition:** A recurring priority was the promotion of equitable clean energy transitions, particularly in LIDACs. The responses advocated for green job opportunities, diverse representation, and inclusive decision-making processes to ensure the benefits of clean energy initiatives reached everyone.
- **Renewable Energy:** Another prevalent theme was the commitment to advancing renewable energy. This involved a push for increased use of renewable energy sources, such as solar.
- **Sustainable Transportation:** This recurring theme of sustainable transportation focused on zero-emission vehicle (ZEVs), robust charging infrastructure, and enhanced public transit options.
- **Waste Reduction and Recycling Initiatives:** Respondents expressed a collective commitment to a circular economy, emphasizing waste reduction, recycling initiatives, and legislative support for reuse infrastructure. Additionally, there was a shared focus on climate resilience through community planning, increased green spaces, and stormwater management solutions.

These common themes underscored the community's strong emphasis on inclusivity, environmental sustainability, and climate resilience in shaping climate action strategies.

CONCLUSION

COG values community input and will continue to engage with the public more broadly within the MSA on the development of the CCAP, with a focus on addressing environmental justice concerns and supporting historically underrepresented and overburdened communities. While all input from the Community Climate Priorities survey was carefully considered in developing PCAP measures, not all suggestions could be feasibly included as designated measures. Survey responses were used in conjunction with ongoing and planned project activities from participating jurisdictions, serving as a resource to confirm regional climate priorities. COG will use the responses of this survey to inform the CCAP and its wider Community Engagement Plan for the CCAP and continue to seek engagement from a wider, more diverse audience within its climate mitigation planning processes.

Thank you to all community members who participated in shaping the climate priorities for the metropolitan Washington region.

APPENDIX F. STAKEHOLDER AND COMMUNITY REPRESENTATIVES

Some of the organizations that attended meetings or engaged with COG, or which COG initiated outreach, include those listed in Table 13.

Table 13. COG CPRG Steering and Technical Committees

Committee	Organization	Jurisdiction
Steering Committee Members	Arlington County, Office of Sustainability and Environmental Management and Office of Climate Coordination and Policy	Virginia
	Charles County, Climate Resilience and Sustainability	Maryland
	City of College Park, Department of Planning and Community Development	Maryland
	City of Falls Church, Environmental Sustainability Programs	Virginia
	City of Frederick, Office of Sustainability	Maryland
	City of Gaithersburg	Maryland
	City of Greenbelt, Public Works	Maryland
	City of Manassas, Planning and Development	Virginia
	Clarke County, Environmental and Water Resources	Virginia
	Culpeper County	Virginia
	D.C. Department of Energy & Environment (DOEE)	District of Columbia
	Frederick County, Division of Energy and Environment	Maryland
	Loudoun County, Department of Building & Development	Virginia
	Maryland Department of Environment (MDE)	Maryland
	Maryland Department of Transportation (MDOT)	Maryland
	Montgomery County, Climate Change	Maryland
	Prince George's County, Department of Environment	Maryland
	Prince William County, Environmental and Energy Sustainability	Virginia
	Rappahannock County, Community Development	Virginia
	Town of Bladensburg	Maryland
	Virginia Department of Environmental Quality (DEQ)	Virginia
	Virginia Department of Transportation (VDOT)	Virginia
	Washington Suburban Sanitary Commission (WSSC Water)	Maryland
Technical Committee Members	Arlington County, Energy Program	Virginia
	City of Fairfax, Public Works and Environment	Virginia
	City of Falls Church, Environmental Sustainability Programs	Virginia
	City of Laurel, Environmental Programs	Maryland
	City of Rockville, Environment Commission	Maryland
	City of Takoma Park, Public Works	Maryland

	Connected DMV, Climate and Energy	District of Columbia
	DC Water	District of Columbia
	D.C. DOEE	District of Columbia
	Fairfax County, Environmental and Energy Coordination	Virginia
	Frederick County, Department of Climate and Energy	Maryland
	Loudoun County, Energy Program	Virginia
	MDE	Maryland
	Maryland Department of Transportation (MDOT)	Maryland
	Montgomery County Department of Environmental Protection	Maryland
	Prince George's County, Department of Environment	Maryland
	Virginia Department of Environmental Quality (DEQ)	Virginia
	Virginia Department of Transportation (VDOT)	Virginia
	Northern Virginia Regional Commission (NVRC)	Virginia
	Washington Metropolitan Area Transit Authority (WMATA)	Regional
	Washington Suburban Sanitary Commission (WSSC Water)	Maryland

COG and TPB Committees

- Built Environment and Energy Advisory Committee (BEEAC)
- Chief Equity Officers Committee (CEOC)
- Climate Energy and Environmental Policy Committee (CEEPC)
- Food and Agriculture Regional Member (FARM) Policy Committee
- Metropolitan Washington Air Quality Committee (MWAQC)
- Metropolitan Washington Air Quality Committee Technical Advisory Committee (MWAQC-TAC)
- National Capital Region Transportation Planning Board (TPB)
- Regional Electric Vehicle Deployment (REVD) Working Group
- Transportation Planning Board Community Advisory Committee (TPB-CAC)
- Transportation Planning Board Technical Committee (TPB-Tech)

Industry, Utilities, Other Government Partners, and Stakeholders

- D.C. Sustainable Energy Utility (DCSEU)
- District of Columbia City Council
- Dominion Energy
- Potomac Electric Power Company (Pepco)
- Frederick County Division of Solid Waste and Recycling
- Fredericksburg Planning Commission
- Georgetown, George Mason, George Washington, and Catholic Universities
- Greater Washington Region Clean Cities Coalition (GWRCCC)
- George Washington Regional Commission
- Institute for Local Self-Reliance
- Maryland Clean Energy Center (MCEC)

- Maryland Department of Agriculture
- Maryland Energy Administration (MEA)
- Maryland Energy Innovation Institute
- Maryland Forestry Foundation (MFF)
- Montgomery County Solid Waste Advisory Committee
- Neighborhood Sun
- Northern Shenandoah Valley Regional Commission
- NVRC
- Members of the public
- Prince George's County Solid Waste Advisory Commission
- Prince William County Public Schools (PWCPS)
- Rappahannock Electric Cooperative
- Southern Environmental Law Center (SELC)
- Virginia Clean Cities Coalition
- Virginia Department of Environmental Quality (DEQ)
- Virginia Energy
- Virginia Property Assessed Clean Energy (PACE) Authority
- Washington Gas (WGL)
- Washington Metropolitan Area Transit Authority (WMATA)
- WSSC Water
- Agricultural, Working Lands, Food, and Solid Waste regional stakeholder group

LIDAC-Related and Equity Focused Organizations

- Common Grain Alliance (CGA)
- Faith Alliance for Climate Solutions (FACS)
- GWRCCC
- Hola Cultura
- Institute for Local Self-Reliance (ILSR)
- Montgomery County Food Council (MoCoFC)
- Neighborhood Sun
- Prince George's County Food Equity Council
- Prince George's Soil Conservation District
- Sierra Club, Virginia Chapter
- Southern Environmental Law Center
- University of Maryland (UMD)
- Voters for Animals

Tribal Representatives

- Accokeek Foundation
- Patawomeck Indian Tribe in Virginia