PRIORITY CLIMATE ACTION PLAN

For the Seattle-Tacoma-Bellevue Metropolitan Statistical Area (MSA), on behalf of all cities and counties in the four-county Puget Sound Region of King, Kitsap, Pierce, and Snohomish Counties

FINAL VERSION 2024.03.01

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Purpose

The Seattle-Tacoma-Bellevue Metropolitan Statistical Areas (MSA), as well as the State of Washington, received Phase 1 funding through the U.S. Environmental Protection Agency (EPA) Climate Pollution Reduction Grant (CPRG) to develop plans to reduce greenhouse gas (GHG) emissions and other harmful air pollution. The CPRG planning grant enables states, MSAs, and tribal governments to develop a Priority Climate Action Plan (PCAP), followed by a Comprehensive Climate Action Plan (CCAP) and Status Report, over a four-year period through 2027. EPA requires that all PCAPs include a Greenhouse Gas Inventory, quantified priority GHG reduction measures, a Low Income/ Disadvantaged Communities (LIDAC) Benefits Analysis, as well as a review of authority to implement each priority measure.

The Puget Sound Clean Air Agency (Agency or PSCAA) is serving as the Lead Entity for the Phase 1 CPRG Planning Grant on behalf of the Seattle-Tacoma-Bellevue MSA, which covers all cities and counties in the four-county region of King, Kitsap, Pierce, and Snohomish counties. This Seattle-Tacoma-Bellevue MSA PCAP presents a focused list of measures to reduce GHG emissions and harmful air pollution and maximize the benefits of climate action in overburdened communities in the Puget Sound. Many of the quantified priority measures in this PCAP are based on the wedge analysis from the Puget Sound Region Emission Analysis (PSREA) Project completed in 2022, which provides comprehensive GHG emissions data and innovative tools to advance local climate action for each of the four counties in the region.

The list of priority measures included in Section 4 of this PCAP is not intended to be inclusive of all possible emissions reduction actions available to local jurisdictions. Instead, these priority actions focus on measures for which an eligible entity is planning to seek Phase 2 CPRG funding. The Agency will explore a comprehensive list of GHG reduction measures in the CCAP, including consideration of additional measures submitted as part of informal comments received on the PCAP. A summary of these comments can be found in **Appendix F**.

This PCAP was informed by, and is a continuation of, the many climate planning efforts already underway by regional, county, and local jurisdictions across the Puget Sound. The Agency also coordinated closely with the Washington State Departments of Commerce and Ecology, as well as the Governor's Office, in the creation of the PCAP. This PCAP serves as a resource and guide for implementing near-term priority GHG reduction strategies and actions in furtherance of CPRG Phase 2 Implementation Grants for the MSA.

Section 1: Introduction

The Puget Sound Clean Air Agency (Agency or PSCAA) has collaborated with multiple local partners across the Seattle-Tacoma-Bellevue Metropolitan Statistical Area (MSA) and the Bremerton-Silverdale-Port Orchard MSA to produce this Priority Climate Action Plan (PCAP). This PCAP is designed to support investment in policies, practices, and technologies that reduce greenhouse gas (GHG) and other pollution emissions, create high-quality jobs, spur economic growth, and enhance the quality of life for all communities and residents of the Puget Sound region. This project has been funded wholly or in part by the United States Environmental Protection Agency (EPA) under assistance agreement #5D - 02J38301. 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 priority GHG measures contained within this PCAP should be construed as broadly available to any entity in the MSA eligible for receiving funding under the EPA's Climate Pollution Reduction Grants (CPRG) program and other funding streams, as applicable.

This PCAP is organized into nine sections:

1. Introduction
2. GHG Emissions Inventory
3. GHG Emissions Projections and Reduction Targets
4. Quantified Priority GHG Reduction Measures
5. Benefits Analysis
6. Low-Income and Disadvantaged Community Benefits Analysis
7. Workforce Planning Analysis
8. Stakeholder Engagement Activities
9. Summary and Next Steps

State Policy Landscape

The State of Washington has established itself as a state leader in the fight against climate change over the past several decades. Recently, beginning in 2019, the Washington Legislature passed a historic set of environmental regulations with the goal of achieving net-zero carbon emissions by 2050 while also ensuring that environmental justice for the state's most overburdened communities remains at the heart of the new policy landscape.

In 2019, the State Legislature passed the Clean Energy Transformation Act (CETA), which requires Washington's electric utilities to eliminate carbon emissions from their energy resources by 2045. CETA also requires that all electric utilities eliminate coal-fired generation serving Washington state customers by the end of 2025, be GHG neutral by 2030, and generate 100% of their power from renewable or zero-carbon resources by 2045.

In 2019, the Clean Buildings Act was signed into law and later expanded in 2022. The Act created energy performance standards for certain commercial and multifamily buildings with the goal of lowering costs

and pollution from fossil fuel consumption in the state's existing buildings. Additional information can be found on the State Clean Buildings Performance Standard website.

In 2020, the Legislature passed the Motor Vehicle Emission Standards – Zero-Emission Vehicles Law directing Washington to adopt California's vehicle emission standards. This includes new requirements to gradually increase the number of new zero-emission vehicles (ZEV) sold in Washington, until all new vehicles meet the ZEV standard starting in 2035. In 2021, the Legislature adopted new zero-emission and low-emission vehicle standards which will take effect in 2024, with the release of model year 2025 vehicles.

In 2021, the Legislature passed the Climate Commitment Act (CCA), a sweeping bill that directs the state Department of Ecology (Ecology) to design and implement a Cap-and-Invest program to reduce statewide GHG emissions and reduce criteria air pollutants (e.g., particulate matter) in overburdened communities highly impacted by air pollution.

The Healthy Environment for All (HEAL) Act was passed by the Legislature in 2021 and is the first statewide law to create a coordinated and collaborative approach to environmental justice. The HEAL Act requires Ecology and several other state agencies to develop and implement a community engagement plan; develop and implement Tribal consultation frameworks; and incorporate environmental justice into strategic plans, budget development processes, and funding and grant decisions.

In 2021, the Legislature also adopted the Clean Fuel Standard, a law requiring fuel suppliers to gradually reduce the carbon intensity of transportation fuels to 20% below 2017 levels by 2034. The Clean Fuel Standard is designed to decrease the carbon intensity of Washington's transportation fuels by providing an increasing range of low-carbon and renewable alternatives that reduce dependency on petroleum and improve air quality.

Also in 2021, the Legislature passed the Hydrofluorocarbons (HFC) Emissions Reduction Law (Chapter 70A.60 RCW), which expands on the State 2019 HFC restrictions and bans the sale and purchase of certain HFC refrigerants with high-global-warming potential. The law requires Ecology to establish maximum global warming potential (GWP) thresholds for new stationary refrigeration and air conditioning equipment sold in Washington and to establish a refrigerant management program to reduce HFC leakage.

In 2022, the Legislature passed a 16-year transportation package that supports mode shift, electrification of major transportation modes, and reductions in vehicle miles traveled (VMT) along with their associated emissions. It also established the Interagency Electric Vehicle Coordinating Council (EV Council) and a non-binding statewide target of reaching 100 percent new electric passenger vehicle sales by 2030. In 2023, the EV Council adopted the Washington Transportation Electrification Strategy (TES), which outlines policy recommendations and implementation timelines for meeting the state's clean transportation objectives.

Regional Policy Landscape

Our jurisdiction, consisting of King, Kitsap, Pierce, and Snohomish counties, is also a leader in local action against the contributors to, and impacts of, climate change.

Puget Sound Regional Council (PSRC) is the region's Metropolitan Planning Organization (MPO), designated with developing policies and coordinating decisions about regional growth, transportation, and economic development across the four-county region. PSRC is composed of nearly 100 members, including the four counties, cities and towns, ports, state and local transportation agencies and Tribal governments within the region.

The region is expected to grow by 1.5 million people by 2050, reaching a total population of 5.8 million. An anticipated 1.1 million more jobs are forecast by 2050. PSRC, in collaboration with its member jurisdictions, developed VISION 2050, the region's long-range framework for how and where development occurs and how the region supports efforts to manage growth. Required under the State's Growth Management Act, the multicounty planning policies in VISION 2050 address land use, economic development, transportation, public services, and environmental planning. VISION 2050 calls for concentrating growth within the region's designated urban growth area and limiting development in natural resource and rural areas.

Climate change is a cross-cutting topic across a variety of regional planning issues, and VISION 2050 provides guidance in all policy sections of the plan for reducing emissions and protecting the climate. Additional policies throughout VISION 2050 also address important climate-related activities, such as protecting forest lands and tree canopy, promoting a multimodal transportation system, encouraging use of alternative modes of transportation, advancing electrification of public and private vehicles, increasing energy efficiency and renewable energy sources, and addressing resilience of infrastructure and communities.

The Regional Transportation Plan (RTP) implements VISION 2050 and provides a blueprint for improving and coordinating mobility, providing transportation choices, addressing specialized mobility needs, moving the region's freight, and supporting the region's economy and environment. The region has committed to unprecedented levels of investment to support the safe and efficient movement of people and goods. A centerpiece of the emerging transportation system is an integrated local and regional high-capacity transit network of light and heavy rail, ferries, and bus rapid transit, which supplements the roads, rail, and maritime transportation system. The RTP includes the adopted "Four-Part Greenhouse Gas Strategy," recognizing that decisions and investments in the categories of land use, transportation choices, pricing, and technology are the primary factors that influence GHG emissions from on-road transportation and are factors for which PSRC's planning efforts have either direct or indirect influence.

The Northwest Ports Clean Air Strategy (NWPCAS), identifies important cross-cutting efforts to reduce emissions in and beyond the Puget Sound. The 2020 NWPCAS, adopted by the Northwest Seaport Alliance (NWSA), Port of Seattle, Port of Tacoma, and Port of Vancouver, British Columbia, sets a goal to phase out emissions from seaport-related activities by 2050. Key operational sectors in the strategy include ocean-going vessels, drayage trucks, cargo-handling equipment, rail, harbor vessels and port administration facilities.

Tribal Partnerships

The central Puget Sound region is a part of a larger area that has been the traditional aboriginal territory of the Coast Salish peoples since time immemorial. While each Coast Salish Tribe is unique, all share in having a deep historical connection and legacy of respect for the land and natural resources. It is imperative that local and state governments collaborate with Tribal nations to shape the region's future.

There are currently nine federally recognized tribes in the central Puget Sound region: Muckleshoot Indian Tribe, Nisqually Indian Tribe, Port Gamble S'Klallam Tribe, Puyallup Tribe of Indians, Sauk-Suiattle Indian Tribe, Snoqualmie Indian Tribe, Stillaguamish Tribe of Indians, Suquamish Tribe, and Tulalip Tribes. The Agency, State, and all CPRG partners are committed to working closely with tribes in the region and state to ensure tribal voices are considered and integrated into both the CPRG planning and implementation processes. The Agency looks forward to participating in the State's monthly CPRG Tribal Coordination Workgroup to maintain a high level of coordination throughout the four-year grant.

Local Climate Action Plans and Comprehensive Plans

Of the 86 jurisdictions in the region represented by PSRC, 19 have climate action plans (CAPs), and many others are in the process of writing plans. King and Pierce counties also have adopted CAPs, which affect all residents of those counties and particularly those living in unincorporated areas of these counties. In total, approximately 53% of the four-county Puget Sound region's population is covered by a finalized CAP. In addition, the three largest port districts in the region – the ports of Seattle and Tacoma and the Northwest Seaport Alliance – implement the NWPCAS, a joint clean air and climate action plan addressing seaport-related emissions. A summary of jurisdictional CAPs in the region can be found in **Appendix A**.

Many communities have also incorporated climate-friendly policies into their comprehensive plans including mixed-use development, complete streets, and urban canopy development, and 45% mention climate action specifically. By the end of the decade, all municipalities will be required to incorporate climate change mitigation and adaptation into their comprehensive plans, increasing this percentage to 100%. For example, as part of its 2024 comprehensive plan update, Snohomish County has drafted a Climate Change and Resiliency Element that adopts the PSCAA regional GHG emissions reduction target; tree canopy polices, and a Subarea Plan Element to comprehensively plan for two new light rail stations including bus rapid transit routes, a mixed-use corridor, and multimodal infrastructure connectivity. Puget Sound region communities that have CAPs outline different strategies for reducing GHGs and, while most are aligned on key goals and policies, the extent of those goals differ. Generally, cities and counties with CAPs divide goals and strategies into four major categories: Buildings and Energy, Transportation, Green Space, and Waste and Operations. Broad, region-wide alignment exists on several CAP strategies to address climate change, particularly those that both mitigate climate change and increase quality of life. Aligned strategies include:

1. Mixed-use and transit-oriented development projects that encourage transit ridership, foster walkability, and operate efficiently.
2. Complete streets goals focused on encouraging sustainable transportation.
3. Carbon sequestration targets through urban forestry to reduce heat islands and improve mental health.
4. Increased energy efficiency and renewable energy development.
5. Support for electric vehicle (EV) charging infrastructure.
6. Enhancing green government operations and reducing waste.

To provide examples of specific strategies undertaken by jurisdictions with CAPs, seven jurisdictions were selected with the goal of representing the full diversity of jurisdictions in the region based on size, geography, and income/resource level. They are Bainbridge Island, Buckley, Burien, Everett, Lake

Stevens, Pierce County, and Seattle. The majority of these jurisdictions have a goal of a more than 40% reduction in GHGs by 2030 and are pursuing innovative strategies to accomplish this goal. The following list presents examples of climate strategies for each of these jurisdictions:

- Bainbridge Island: Developing a Green Energy and Building Fund to assist homeowners and residents in retrofitting their buildings while banning new propane, oil, and wood heating in all new developments; increasing electrification of public and private vehicles with associated charging infrastructure; requiring incorporation of non-motorized transportation options into all new development; and increasing transit options and incentives for non-SOV travel.
- Buckley: Allowing middle housing in its single-family zones, leading to more efficient and denser development.
- Burien: Implementing an EV charging infrastructure strategy, identifying needs by location, and requiring charging at all new multifamily and commercial developments.
- Everett: Establishing itself as a green economic hub by focusing economic development incentives on businesses with little to no impact on the environment.
- Lake Stevens: Developing several permitting reforms, rebates, and development benefits to incentivize local renewable energy development.
- Pierce County: Conducting end of life assessments for facilities, assets and appliances to plan for electrification; Conducting retrofit projects and instituting energy performance requirements in leasing contracts.
- Seattle: Using its Urban Village/Center development framework to concentrate growth in population, transit service, and pedestrian and bike infrastructure with a goal of 45% of residents living in an urban village or center by 2030.

Local jurisdictions across the Puget Sound are considering and adopting innovative approaches that contribute directly to the State's ambitious climate action goals. For more information, please refer to Appendix A.

Identifying Overburdened Communities

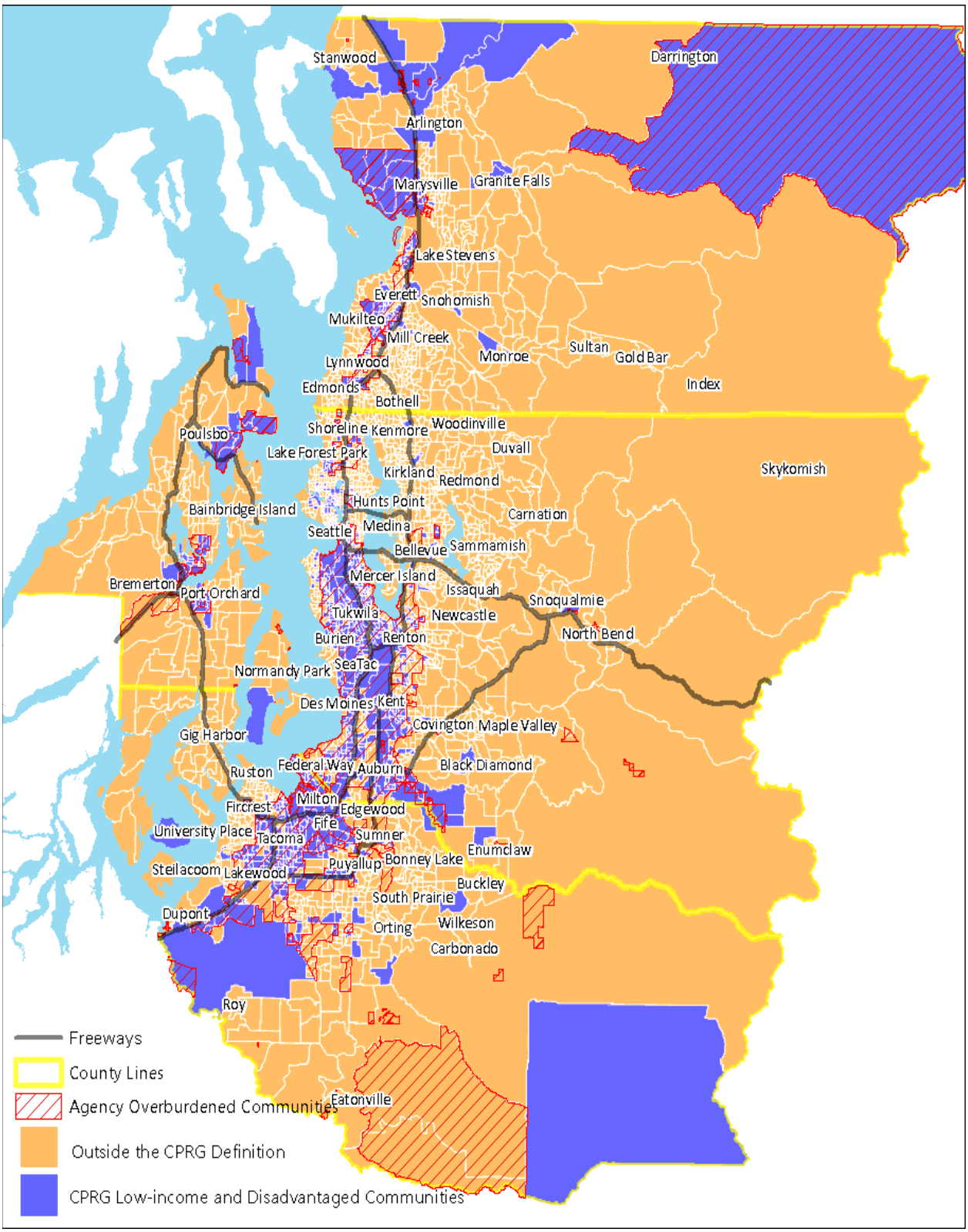
Chapter 70A.02 of the revised code of Washington (RCW) defines an overburdened community as "a geographic area where vulnerable populations face combined, multiple environmental harms and health impacts, and includes, but is not limited to, highly impacted communities as defined in RCW 19.405.020." Based on the state's Environmental Health Disparities Map, overburdened communities are defined through 19 indicators across four themes: environmental exposure, environmental effects, sensitive populations, and socioeconomic factors. Environmental exposure and environmental effects represent threat indicators in a community, whereas sensitive populations indicators and socioeconomic factors represent the vulnerability of a community.

The Agency has adopted a map defining "overburdened communities" within the four-county Puget Sound region. The map overlays four environmental justice maps:

- Washington State Environmental Health Disparities Map - Rank 9 & 10
- Ecology's Climate Commitment Act Overburdened Communities
- The Agency's Community Air Tool - Top 20%
- Justice 40 Climate & Economic Justice Screening Tool

For the purposes of CPRG, EPA defines a Low-Income and Disadvantaged Community (LIDAC) as a community that scores above the 90th percentile in one of the following burden indicators using the Climate and Economic Justice Screening Tool (CEJST): climate change, energy, health, housing, legacy pollution, transportation, water and wastewater, and workforce development. To further identify smaller disadvantaged areas within a larger non-disadvantaged area, the EPA recommends using its Environmental Justice Screening and Mapping Tool (EJScreen). According to the EPA, EJScreen provides several capabilities including mapping, reports for selected areas, and comparisons of environmental and demographic indictors showing how a selected area compares to the state, EPA region, or the nation. **Figure 1** illustrates the Puget Sound region's LIDAC that EPA's CPRG process defines (in blue) and also shows the Agency's overburdened communities (red hashed). The Agency's overburdened communities are identified using multiple maps with similar environmental, health, and socioeconomic factors included. A list of Census Tracts in the MSA that are defined by EPA as LIDAC are included in **Appendix E** of this PCAP.

Figure 1. Map of Puget Sound Low-Income and Disadvantaged Communities and Overburdened Communities



Equity Plans and Approaches Across the Puget Sound

Recognizing equity as a key tenet of government processes is not new for municipalities and jurisdictions across the Puget Sound. Existing strategies and resources across the region include data and tools to identify solutions for root causes, highlight community leadership, ensure language access, build capacity, develop equitable climate futures, align initiatives with equity, and build equitable practices. An overview of the range of these existing equity strategies and resources can be found in **Appendix G.**

Key themes in the Equity Plans and Approaches table in Appendix G include:[1]

- Community leadership & community-driven policy making;
- Community capacity development; equitable green jobs & pathways;
- Community health & emergency preparedness; food systems & food security;
- Housing security & anti-displacement;
- Energy justice & utilities;
- Transportation access & equity

Addressing root causes of inequities is essential for equitable GHG reductions, and therefore requires approaches that consider factors such as racial segregation, poverty, and income disparities, among others. To better understand how equity considerations impact communities and their ability to pursue CPRG and other funding opportunities, the CCAP will explore additional analyses related to emissions and air quality, race, and the distribution of resources.

Utility Considerations

The Puget Sound region is fortunate to be relatively well-poised to transition to an electrified future given our non-emitting hydroelectric resources and the passage of the Clean Energy Transformation Act (CETA), which requires utilities to distribute 100% carbon-neutral electricity by 2030 and 100% carbon-free electricity by 2045. However, this energy transition will require thoughtful planning and implementation, taking into account energy challenges that largely fall to electric utilities to address. It is necessary that utilities be central to electrification planning to ensure that electricity in the region remains safe, reliable, and affordable. Utilities have indicated they are faced with the following challenges as the region moves to an electrified future and confronts climate change:

1. Comprehensive transportation and building electrification will significantly increase electric demand.
2. The region is experiencing increased and shifting electricity demand from increasing adoption of air conditioning as summer temperatures rise and extreme heat and wildfire smoke events become more common.
3. Power supply forecasting is increasingly difficult due to: increased demand for carbon-free and renewable energy to meet clean energy mandates and increased energy demand; increasing extreme weather events; anticipated climate change impacts to the region's hydroelectric

[1] Stroble, J., S. Rahman (eds.), and the Climate Equity Community Task Force. 2020. Section II: Sustainable & Resilient Frontline Communities. In: King County 2020 Strategic Climate Action Plan. [King County Climate Action Team (eds.)]. King County, Washington.

resources; and variable energy resources (e.g., wind and solar) replacing predictable and on-demand resources (e.g., natural gas and coal generation).
4. Grid maintenance and operational costs will increase as electric loads increase and infrastructure ages.
5. Lag in transmission development restricts access from rural renewable energy production to urban centers.

Just as our region is fortunate from clean energy supply and policy standpoints, we also have a rich and successful history of conservation leadership that has resulted in avoiding costly and environmentally impactful energy development over the last several decades. Successes and lessons learned from this history can inform mitigation of demand from increased electrification. Our conservation history has set a precedent for utilities partnering with customers and communities to collaborate on energy and environmental goals that often have far-reaching benefits beyond energy conservation (i.e., improved health, comfort, safety, and financial outcomes). Opportunities to continue to partner with customers and communities to achieve smart and beneficial electrification goals abound including:

1. Increased emphasis on energy efficiency and conservation, particularly as consumers purchase and install electrified equipment in homes and businesses.
2. Transportation electrification planning that results in managed and bi-directional EV charging strategies.
3. Expanded implementation of demand-response programs, including rate design, that encourages energy consumption at times of low demand.
4. Expansion of local distributed energy resources, including solar installations paired with battery energy storage.
5. Development of public-private partnerships to implement innovative load management projects in concert with electrification to optimize grid operations.
6. Broad stakeholder engagement to ensure electrification opportunities are accessible across all demographics and to avoid system-wide cost-shifts to overburdened households and communities.
7. Broad access to funding, technical resources, grant administrative assistance, and installer networks to lower barriers to implementing the above.

Financial Challenges Associated with Grid Decarbonization

Decarbonizing the Northwest's electricity grid presents a substantial financial challenge, as estimated by the Clean Energy Institute in 2019. Costs are expected to peak at 16.1% ($9.8 billion) above Business as Usual in 2038, decreasing to 8.3% ($6.1 billion) higher in 2050. Utilities in the MSA intend to work with the State to consider the development of a revolving clean energy and infrastructure fund to help accelerate Washington's clean energy transition.

In parallel with the CPRG process, such a fund is one strategic approach that aims to mitigate upfront capital costs necessary for the widespread adoption of the clean energy resources required by CETA. By providing no-/low-cost financing and maximizing IRA clean energy credits, such a fund would accelerate the clean energy transition, minimize rate impacts, and enhance long-term affordability, with a focus on benefiting environmental justice communities. Such a fund would also:

- Support initiatives like utility-scale renewable generation.

- Help to develop distributed or community-scale renewable energy generation.
- Lay the foundation for reducing emissions in other sectors, such as transportation, industrial, and the built environment.
- Provide low to zero-cost loans to non-profits and local governments.
- Lower operational costs for important municipal facilities (e.g., churches, schools, food pantries, etc.) that serve as safe havens during climate-induced weather events and enhance grid resiliency and reliability.

Section 2. GHG Inventory

Puget Sound Regional Emissions Analysis Project

The most recent comprehensive GHG emission inventory in our region was completed in 2022 for the inventory of 2019 calendar-year emissions. This inventory project, the Puget Sound Regional Emissions Analysis (PSREA), was led by King County, and provided GHG emissions data for the region including King, Kitsap, Pierce, and Snohomish counties. The project also provides detailed GHG data for each of the 39 cities in King County, including the City of Seattle, the largest city in the MSA.

The PSREA presented comprehensive GHG emissions data and innovative tools to advance local climate action for cities and counties across the central Puget Sound region. The PSREA was developed in close partnership with the King County-Cities Climate Collaboration (K4C), Kitsap County, Pierce County, Puget Sound Clean Air Agency, Puget Sound Regional Council, City of Seattle, and Snohomish County. The PSREA developed four reports for the individual counties, and the Agency compiled them into a single (four-county) report.

The PSREA includes both a geographic and consumption-based emissions analysis for each county. The majority of the data provided in this PCAP are focused on the geographic-based emissions analysis. We have included some data and reflections on consumption-based emissions as well.

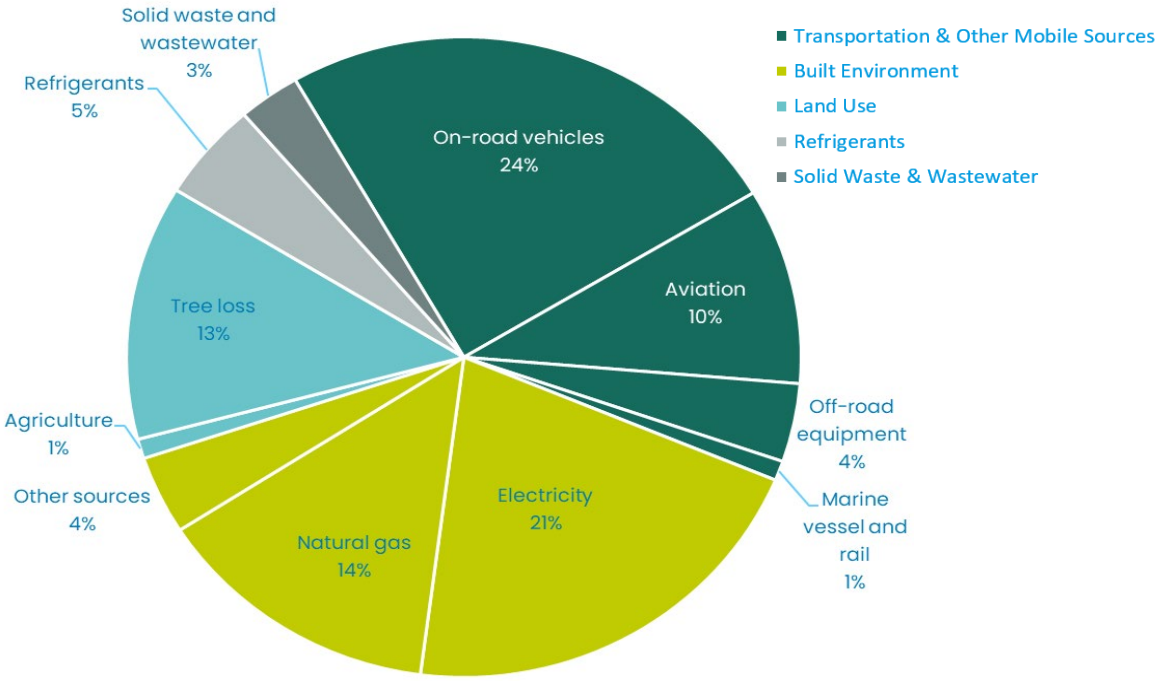
Geographic Inventory

The PSREA geographic inventory includes the following gases: Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases (F-gases) including hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3)

Further details on the methodology and quality assurance procedures for preparation of this inventory are contained in **Appendix B**.

Figure 2 shows a summary pie chart of geographic emissions for 2019. The five largest sectors are on-road vehicles, electricity (generation), natural gas (use), tree loss, and aviation (fuel consumption).

Figure 2. Sources of geographic-based GHG emissions for PSCAA counties in 2019 (Total = 48 million MTCO2e).



The geographic inventory methodologies include regulatory and EPA approved tools such as the "Motor Vehicle Emission Simulator" (MOVES) for mobile sources, and National Emissions Inventory defaults when local data weren't available. **Table 1** details GHG emissions in metric tons (MT) of carbon dioxide equivalents (CO2e) for all economic sectors.

Table 1. GHGs (MT CO2e) for all economic sectors in the Puget Sound region.

GHG Emissions by Sector (MTCO2e)	King County	Pierce County	Snohomish County	Kitsap County	Total
Built Environment	**12,336,188**	**3,697,758**	**1,406,787**	**1,517,808**	**18,958,541**
Electricity	**7,109,886**	**1,551,948**	**147,356**	**1,175,620**	**9,984,810**
Commercial	3,608,823	580,325	51,522	424,904	4,665,574
Industrial	641,667	220,406	13,916	5,689	881,678
Residential	2,859,396	751,217	81,918	745,027	4,437,558
Natural gas	**4,110,659**	**1,514,712**	**1,064,127**	**258,151**	**6,947,649**
Commercial	1,441,544	447,907	324,877	134,934	2,349,262
Industrial	701,922	422,019	138,607	4,985	1,267,533
Residential	1,967,193	644,786	600,643	118,232	3,330,854
Other sources	**1,115,643**	**631,098**	**195,304**	**84,037**	**2,026,082**
Fuel oil	334,738	62,535	56,763	27,917	481,953
Industrial processes	668,383	519,097	37,885	1,377	1,226,742
Residential propane	112,522	49,466	100,656	54,743	317,387
Transportation & Other Mobile Sources	**11,683,116**	**3,333,435**	**3,052,659**	**920,711**	**18,989,921**
On-road vehicles	**6,470,836**	**2,506,507**	**2,294,251**	**619,457**	**11,891,051**
Passenger vehicles	5,119,314	2,070,016	1,874,559	538,664	9,602,553
Freight & service vehicles	1,201,724	416,807	408,960	75,040	2,102,531
Transit vehicles	149,798	19,684	10,732	5,753	185,967
Aviation	**3,998,546**	**304,802**	**327,239**	**100,672**	**4,731,259**
Off-road equipment	**1,016,406**	**378,224**	**335,284**	**99,071**	**1,828,985**
Marine vessels and rail	**197,328**	**143,902**	**95,885**	**101,511**	**538,626**
Solid Waste & Wastewater	**564,503**	**388,415**	**338,755**	**105,831**	**1,397,504**
Solid waste generation & disposal	**513,096**	**338,607**	**254,433**	**86,781**	**1,192,917**
Landfill	465,699	301,296	228,881	83,496	1,079,372
Compost	47,397	37,311	25,552	3,285	113,545
Wastewater process emissions	**51,407**	**49,808**	**84,322**	**19,050**	**204,587**
Refrigerants	**1,185,036**	**472,512**	**435,490**	**143,674**	**2,236,712**
Refrigerants	**1,185,036**	**472,512**	**435,490**	**143,674**	**2,236,712**
Land Use	**1,341,477**	**2,974,912**	**1,611,977**	**544,333**	**6,472,699**
Tree Loss	**1,220,000**	**2,930,000**	**1,410,000**	**538,000**	**6,098,000**
Agriculture	**121,477**	**44,912**	**201,977**	**6,333**	**374,699**
Total Emissions	**27,110,320**	**10,867,032**	**6,845,668**	**3,232,357**	**48,055,377**

Consumption Inventory

In addition to the conventional geographic-based inventory, the PSREA also developed a consumption-based inventory. The consumption-based analysis was prepared by EcoDataLab and Stockholm Environment Institute using the best available approach from the CoolClimate Network at UC Berkeley.

The PSREA consumption-based emissions inventory (CBEI) estimated GHG emissions generated by the activity of all residents in the four-county region. As examples, this CBEI estimated emissions associated with the food Puget Sound residents eat, products they buy, travel by residents outside the region, and the emissions associated with homes, no matter where these emissions are produced. The geographic-based emissions inventory does not include GHG emissions generated by the goods and services that are not produced locally. When viewed alongside a geographic emissions inventory, the CBEI analysis provides a complementary understanding of GHG impacts and reduction opportunities.

Inventory by Sector

Built Environment and Energy Consumption

The built environment sector can be divided into three building or activity types: residential, commercial, and industrial. Currently, the main activity that causes GHG emissions in the residential and commercial sectors is building and water heating with natural gas and electricity. Industrial emissions vary greatly depending on the process and whether natural gas, fuel oil, other petroleum products, or electricity is used.

When parsed by fuels, the major groups are electricity, natural gas, and other petroleum products. Roughly half of the electricity supplied to the four-county region is renewable and has very low GHG emissions. The remaining portion is generated with coal or natural gas combustion. State law requires that coal combustion end in 2025, and that electricity production be GHG neutral by 2030. The natural gas used for the built environment is primarily used for space and water heating. Natural gas use in industry is tied closely to the specific industrial process, but is generally used in boilers, power generation, or other heating or drying operations. The third group, miscellaneous petroleum products, are primarily used by industry. Their use covers a range of operations including, but not limited to, steam or heat generation and other applications.

Transportation and Land Use

Transportation and other mobile sources can be divided into several sub-sectors. On-road vehicles are the largest source of emissions, followed by aviation, and then off-road vehicles and equipment. On-road vehicles are dominated by light-duty (gasoline) passenger vehicles and heavy-duty (diesel) vehicles. The heavy-duty on-road sector is primarily freight and service vehicles, although there is a contribution from public transit vehicles which are inventoried separately because of their differing roles and controls.

Aviation is primarily commercial passenger (jet) aircraft with some commercial freight. There is not a clear technical consensus on the scope of the aviation emissions, so this inventory quantified the emissions using multiple approaches. Historically, emissions were only included if they were within the geographic limits (the four-counties). For aircraft, this amounted to about 10% of the total fuel that was loaded onto the planes. This is called the landing and take-off (LTO) portion. National and international consideration of the aircraft sector indicated that LTO accounting missed a significant portion of the emissions. The PSREA inventory used a passenger-based approach that included all trips taken by residents, employees, and visitors within the geographic area. This approach captured about 60% of all the fuel dispensed in the geographic area.

Off-road equipment is the third major sub-category and includes a range of construction equipment, generators, off-road vehicles, farm equipment, and miscellaneous equipment.

Materials and Waste

In a geographic-based emissions analysis, materials and waste management includes the handling of solid and liquid waste. Solid waste emissions come from the transport of waste to landfill facilities, and any CH_4 and CO_2 that is released as a result of natural breakdown of waste materials. Liquid waste (wastewater) includes both sewer and septic systems and is primarily due to the biologic processing of organic material in the water. Some treatment facilities capture a portion of their emissions, with the primary GHG being CH_4. Methane that is captured is usually combusted and thus still has measurable, but significantly smaller, emissions when compared to CO_2.

Natural Resources

Here, natural resources refer primarily to emissions due to tree cover loss. When a tree is cut down or dies, the soil and roots under the tree release carbon to the air resulting in GHG emissions. The loss of trees can result from a range of actions including harvesting/clearing, fire, disease, and storm damage.

Other Sectors

The last two important sectors are agriculture and refrigerants. Agriculture emissions are primarily CH_4 and N_2O from livestock digestion and manure management. Refrigerant emissions are primarily due to leakage of chemical refrigerants, primarily hydrofluorocarbons (HFCs), from air conditioners, heat pumps, and refrigeration equipment.

Consumption Emissions

Major Categories of Consumption Emissions

Major categories of consumption emissions include:

- Transportation (consumption-based): The transportation category includes gasoline usage, vehicle purchases and maintenance, and air travel.
- Housing (consumption-based): Household energy use, home construction, and home maintenance (“shelter”), and water usage make up the Housing category.
- Food (consumption-based): The Food category includes all food consumed by residents, broken down by meat, dairy, fruits and vegetables, and other foods consumed at home, as well as eating out.
- Goods (consumption-based): Goods includes all physical items purchased by the household (excluding items in other categories).
- Services (consumption-based): Services includes the emissions associated with things like healthcare, education, insurance and finance, and entertainment experiences like concerts and museums.

Consumption Emissions by County

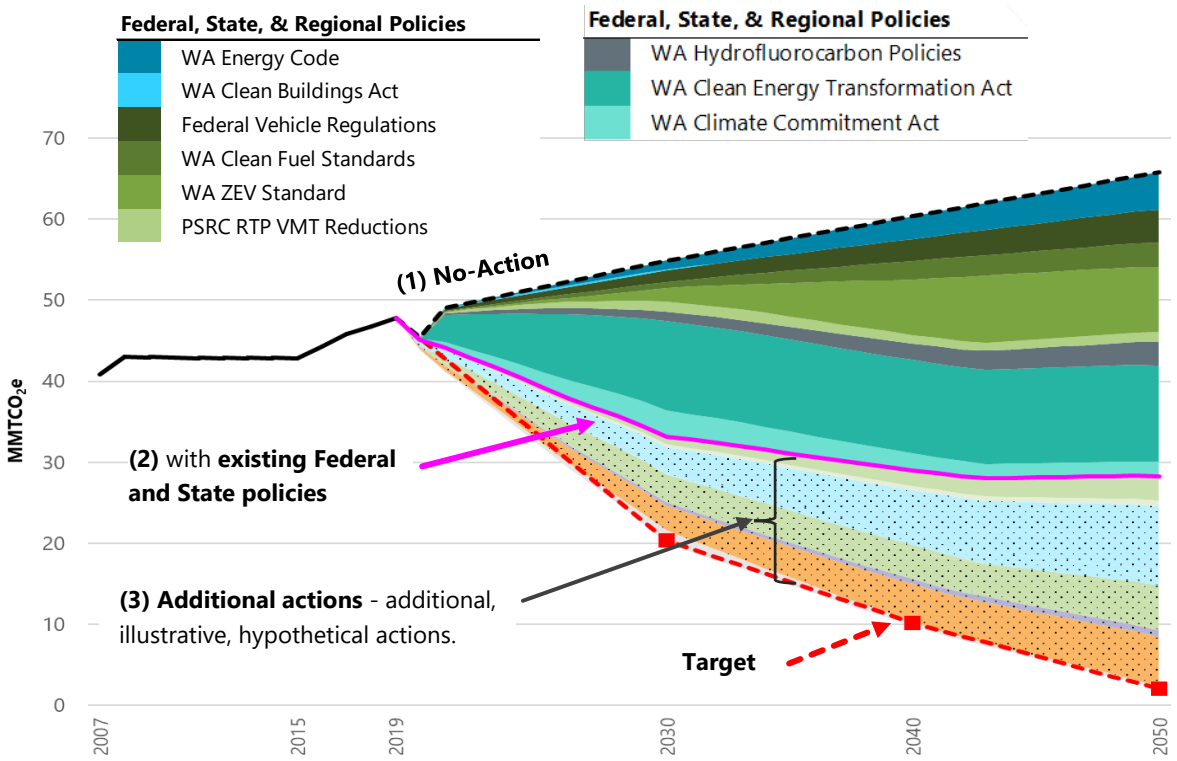
For consumption emissions, transportation emissions were the largest source for all four counties (ranging from 34-40% of total emissions). Food was the second biggest source in King and Snohomish counties, and third biggest in Pierce and Kitsap counties. Housing and services were also among the top three sources of emissions, depending on the county. The following provides a high-level summary of the largest sources of consumption emissions for each county:

- King County – transportation (34%), food (20%), and services (19%)
- Kitsap County – transportation (34%), housing (20%), and food (18%)
- Pierce County – transportation (34%), housing (21%), and food (18%)
- Snohomish County – transportation (40%), food (21%), and services (19%)

Section 3. GHG Emissions Projections and Reduction Targets

A core activity of the PSREA project was to project emissions to target years, compare emissions to the targets, and evaluate options for addressing any gaps. The first step in the projection was to calculate a baseline or "No-action future" where current emissions rates and activities are held constant with the exception of forecasted population growth. The second step in the projection was to reduce the baseline emissions due to anticipated impacts of all the existing federal, state, and regional policies. This includes federal vehicle regulations, multiple state policies and regulations covering vehicles and energy, and regional transportation and land-use policies. These existing policies bring the overall GHG emissions down to about 24% below 1990 levels in 2030, and about 35% below 1990 levels in 2040 and 2050. The third step in the PSREA emissions projection was to identify the size of hypothetical actions in each subsector that would be needed to reach the state's GHG goals in 2030, 2040, and 2050. This is referred to as a wedge analysis. These illustrative actions are the basis for the candidate measures or priority actions contained elsewhere in the PCAP. The regional emissions projections along with the targets discussed below are shown in **Figure 3**. The dotted areas with shades of green, blue, and orange are additional hypothetical actions to reach the goal, and do not represent actual forecasted values for any specific actions.

Figure 3. Forecasted regional GHG emissions and reductions under three scenarios.



Washington State Targets

In 2020, the Washington Legislature set new greenhouse gas emission limits to combat climate change.[2] Under the law, the state is required to reduce emissions levels:

- 2020 - reduce to 1990 levels.
- 2030 - 45% below 1990 levels.
- 2040 - 70% below 1990 levels.
- 2050 - 95% below 1990 levels and achieve net zero emissions.

Puget Sound Region Targets

The following goals are established in the Puget Sound region:

- PSCAA (Goal): Reduce the region's GHG emissions to 50% below 1990 levels by 2030 (and the region is on a trajectory to achieve the state goal of 95% below 1990 levels by 2050).[3]
- King County and King County Cities (Goal): Reduce GHG emissions, compared to a 2007 baseline, by 50% by 2030, 75% by 2040, and 95%, including net-zero emissions through carbon sequestration and other strategies, by 2050.[4]
- Pierce County (Goal): Reduce countywide GHG emissions as well as the County's operational emissions 45% below 2015 levels by 2030.[5]
- Snohomish County (Goal): Reduce the region's GHG emissions to 50% below 1990 levels by 2030.[6]

[2]https://apps.leg.wa.gov/rcw/default.aspx?cite=70A.45.020
[3]https://pscleanair.gov/DocumentCenter/View/5038/2030-Strategic-Plan-Final-
[4]https://your.kingcounty.gov/dnrp/climate/documents/2022/king-county-geographic-ghg-emissions-inventory-and-wedge-report-09-2022.pdf
[5]https://www.piercecountywa.gov/DocumentCenter/View/128310/Sustainabilityplanandappendices_-2023-Update_-Final
[6] Planning Commission Briefings | Snohomish County, WA - Official Website (snohomishcountywa.gov).

Section 4. Quantified Priority GHG Reduction Measures

The CPRG program allows for identifying and priming GHG reduction measures for implementation. The PSREA wedge analysis in Figure 3 (above) identifies new local, state, and federal energy policies that will significantly reduce regional emissions through 2030 and beyond and serves as the foundation for our identification of priority GHG measures for this PCAP. These measures are identified as "priority measures" for the purposes of pursuing funding through CPRG implementation grants. This list is not exhaustive of the MSA's priorities.

The PSREA wedge analysis identifies potential GHG emission reductions for sectors of the economy and this chapter introduces priority GHG measures for some of these sectors. Each sector description includes a description of what has been done to date, funding intersections, the potential for transformative impact, and implementation actions including the carbon reduction potential for each priority measure. Entities with the authority to implement each action are also noted.

GHG emission reductions for priority actions are quantified based on the corresponding outputs those actions could reasonably be expected to produce. **Appendix C** details all assumptions, tools, citations, datasets, and methods used to estimate and quantify GHG emissions and co-pollutant reductions, as well as information on the consumption-based GHG inventory. It also includes information on metrics for tracking progress and timelines for each measure. For each of the measures described in the tables below, the activity is assumed to ramp or curve to the target year (e.g. 2030 or 2050) from previous years. The cumulative GHG reduction is a sum of the individual years. The geographic scope of all measures is the four-county region of King, Kitsap, Pierce, and Snohomish counties.

Built Environment Priority Actions

Current Status of Built Environment Actions

The Built Environment GHG emissions sector is dominated by natural gas use for building and water heating for residences and commercial spaces, and by natural gas for various commercial and industrial processes. There is also a smaller contribution from the combustion of other fossil fuels (e.g., fuel oil) for a range of industrial and commercial processes. The region's electricity supply is already about 50% zero emissions, and the recent Clean Energy Transformation Act (CETA) will require 100% carbon-free electricity by 2045. By the end of 2025, in-state utilities can no longer own or contract from coal-fired generation. By 2030, 100% of utility-supplied electricity must be GHG-neutral. Thus, the groundwork has been set for electrifying the built environment.

In recent years, several state and regional policies have been enacted to limit new natural gas devices. In 2023, the State Building Code Council updated the state's energy codes for new residential and commercial buildings. The new codes can be readily met by current electric heat pumps but would require significant improvements in energy efficiency to be met with natural gas devices; thus, it is anticipated that most new building will select electric-fueled appliances due to the reduced expense of this construction method. Even buildings that opt for natural gas will have a significant reduction in their natural gas consumption, and therefore GHG emissions, compared to prior building code due to the increased efficiency requirements.

Intersection with Other Funding

There are multiple federal and state funding streams available for measures in the built environment. These include, but are not limited to, the following:

- DOE Energy Efficiency and Conservation Block Program
- DOE Technical Assistance for the Adoption of Building Energy Codes
- DOE Weatherization Assistance Program
- USDA Rural Energy for America Program Renewable Energy Systems & Energy Efficiency Improvement Guaranteed Loans & Grants
- DOE Energy Efficiency Revolving Loan Fund
- DOE High Efficiency Electric Home Rebate Program – Section 50122
- USDA Energy Efficiency and Conservation Loan Program (EECLP)
- DOE Home Efficiency Rebates
- Federal Home Electrification and Appliance Rebates
- Energy Efficient Home Improvement Tax Credit
- Residential Clean Energy Tax Credit
- Sec. 179D Commercial Buildings Energy-Efficiency Tax Deduction
- Washington State's Clean Energy Fund
- State grants under development to support home electrification

Review of Authority to Implement

Authority exists to implement the priority measures listed in Table 2. Entities with existing authority are listed for each measure. Additional information on authority to implement each measure can be found in the region's Building Decarbonization Action Plan (BDAP) in **Appendix D**.

Potential for Transformative Impact

The potential for transformative impact is largely around five key, broad needs:

1. Converting existing buildings to heat pumps for space and water heating,
2. reducing the energy needs of existing buildings,
3. reducing the carbon intensity of electricity as rapidly as possible while growing low-carbon generation and storage,
4. supporting a circular economy for buildings and building materials, and
5. reducing the carbon intensity of building materials.

Additional, transformative, non-GHG impacts can occur in neighborhoods that currently have a high number of homes that use wood-burning for primary or supplemental heat in the winter. These neighborhoods regularly experience degraded air quality in the winter, with elevated fine particle pollution levels that impact respiratory and cardiovascular health.

Implementation Actions

Specific priority measures have been identified in Appendix D. The measures under consideration and development are:

SINGLE-FAMILY RESIDENTIAL

The following Priority Measures are identified for single-family homes:

Measure 1: Heat pump rebate program for single-family homes. Establish a rebate and/or installation program for heat pumps in single-family homes that have higher GHG-emitting or fossil fuel heating sources such as oil-, propane-, gas-, or wood-heat. Prioritize rebates or installations in low-income households; in overburdened communities; in households with vulnerable populations such as seniors or children; in hard-to-reach households, such as in first-language-not-English (FLNE) homes; and in rental homes with permission of the homeowner, who also agrees to some degree of rent protection for the tenants.

Measure 2: Water heating "tank swap" for single-family homes or small businesses. Establish a water heating "tank swap" program that provides rebates for heat pump water heaters to replace gas water heating in single-family homes or small businesses.

Measure 3: Whole-home decarbonization for single-family homes. Establish a whole-home decarbonization program for single family homes that may include, but is not limited to, providing rebates for and/or installing heat pumps, heat pump water heaters, weatherization, air sealing, ventilation, and air filtration. Limit the program to homes that have higher GHG-emitting or fossil fuel sources such as oil, propane, gas, or wood fuels. Prioritize rebates or installations in low-income households; in overburdened communities; in households with vulnerable populations such as seniors or children; in hard-to-reach households, such as in first-language-not-English (FLNE) homes; and in rental homes with permission of the homeowner, who also agrees to some degree of rent protection for the tenants. Also prioritize this program for single family homes that house community service businesses, such as in-home daycares and in-home senior care services.

MULTIFAMILY RESIDENTIAL

The following Priority Measures are identified for multifamily homes:

Measure 4: **Water heating "tank swap" for multifamily buildings and units.** Establish a water heating "tank swap" program that provides rebates for heat pump water heaters to replace gas water heating in multifamily units.

Measure 5: “Dryer swap" program for multifamily buildings and units. Establish a "dryer swap" program that provides rebates for electric clothes dryers to replace gas clothes dryers in multifamily units.

Measure 6: **Whole-building decarbonization for multifamily buildings**. Establish a whole-building decarbonization program for multifamily buildings that have onsite fossil fuel combustion, which may include, but is not limited to, providing rebates for and/or installing heat pumps, heat pump water heaters, electric clothes dryers, weatherization, air sealing, ventilation and air filtration, and solar if there would otherwise be electric bill impacts on residents. Prioritize rebates or installations in low-income multifamily buildings, defined as buildings where at least at least 50% of households have incomes less than 80% AMI (<80%). Also prioritize rebates or installations in buildings located in overburdened communities, that house four or more units, and/or that are not considered subsidized affordable housing. Include mixed-use buildings for decarbonization measures only for residential

building portions, and only when the buildings otherwise meet the criteria of this measure. Require that multifamily building owners agree to measures ensuring they do not indiscriminately increase rents, they do not displace or evict tenants as a result of the improvements, and they do provide enforcement of tenant protections. While it is projected that most multifamily buildings with onsite fossil fuel combustion are under 20,000 sf, or have between 10 – 20 units, buildings that exceed these size restrictions will not be excluded from this program.

Measure 7: **Multifamily technical assistance.** Establish a program that provides outreach, building benchmarking, and technical assistance supporting decarbonization and energy efficiency to multifamily buildings, as well as support for installation of solar, energy storage, and onsite electric vehicle charging where available. Limit the program to buildings where at least 50% of households have incomes less than 80% AMI (<80%), or that are subsidized affordable housing such as buildings receiving HUD subsidies, financing through the Low-Income Tax Credit Program, or other state or federal housing subsidies. Program support should include, but would not necessarily be limited to, replacing fossil fuel appliances, as well as uptake of federal IRA rebates, C-PACER programs, and other financing options to achieve decarbonization and energy efficiency improvements.

COMMERCIAL AND COMMUNITY BUILDINGS

For this measure, Commercial and Community Buildings are those that meet these criteria:

- The buildings can be either privately-owned, publicly-owned, or owned by a nonprofit entity.
- The buildings provide a community gathering space, or a community service. Examples include, but are not limited to: day cares; senior centers; houses of worship; community centers; libraries; Community Based Organizations (CBOs) or nonprofit buildings that provide direct community services or host community meetings; fire stations with public or community meeting spaces; community kitchens; food banks; schools; designated cooling centers; and buildings housing district energy systems serving one or several of these building types.

Measure 8: Community decarbonization grants. Establish a rebate, grant, and/or installation program to decarbonize building heating and/or mechanical systems, when such programs replace or reduce fossil fuel or GHG-intensive sources such as oil-, propane-, gas-, or wood fuels. Support air-sealing, ventilation, and high-efficiency air filtration in the program. Prioritize rebates, grants, and/or installations in buildings located in and/or serving overburdened communities; serving vulnerable populations such as seniors or children; or serving first-language-not-English (FLNE) community members. For all projects besides those in public ownership, prioritize including the option of technical assistance for assessments; engineering and design; support to connect building owners to relevant financial resources and external weatherization rebates and options as needed; as well as funding for direct capital improvements.

MULTI-SECTOR DECARBONIZATION

The following Priority Measures are identified to address building decarbonization across multiple sectors:

Measure 9: Embodied carbon program. Establish an Embodied Carbon program to pursue integrating embodied carbon requirements in state building codes, to reduce embodied carbon associated with construction projects, and to achieve GHG reductions in industrial buildings that manufacture products

in the construction building supplies chain. Absent state code adoption, adopt and support implementation of embodied carbon requirements for public projects, and integrate embodied carbon requirements in local buildings codes requiring limits for commercial and multifamily projects for large projects initially, phasing down to medium-sized projects. The program would initially support reporting, education and voluntary compliance for public projects with mandatory carbon limits for public projects, then phasing-in requirements for applicable private projects. The program would focus on cement, concrete and steel emission reductions, and possibly wood, as well as gypsum board and other finishes or products as deemed feasible through program research. The program could include, but would not necessarily be limited to, supporting education and outreach; code writing, research, and code implementation support for local building code amendments; research, feedback and implementation support for potential state building code amendments; supporting supplier development of Environmental Product Declarations (EPDs); testing of and researching of new lower-GHG emission materials; as well as programs to support or directly upgrade supplier facilities, manufacturing processes or fleets to reduce GHG emissions.

Measure 10: Circular economy salvaged lumber program. Establish a circular economy salvaged lumber program to support a central salvaged lumber warehouse that could include, but would not be limited to, manufacturer incentives for using salvaged lumber warehouse products; a deconstruction training and certification program for salvaged lumber harvesting; staff support for minimal processing and transportation to regional salvaged lumber suppliers and/or processors; and support for a community-centered salvaged lumber utilization program. Use of salvaged materials will offset virgin materials that have higher embodied carbon emissions; such materials can be used in both residential and commercial buildings.

Measure 11: Innovative financing program. Establish an innovative financing program to increase uptake of existing financing tools, and to research and develop additional financing options to leverage added capital to accelerate building decarbonization in the private sector for residential and commercial buildings. This program could include, but would not be limited to, outreach and education on C-PACER financing; research and development of a local GHG offset program to fund fossil fuel appliance replacements; researching funding models to support food service decarbonization; and funding options that may improve low income homeowner decarbonization activity such as interest rate buy down programs, and consolidated private financing of lease-to-own electric appliance programs with on-bill repayment options.

Additional information on priority measures for the built environment can be found in Appendix D.

Table 2. Built Environment Priority Actions.

Output	Cumulative GHG Emission Reductions (MTCO2e)		Co-pollutant Reductions 2024-30		Who has Existing Authority to Implement?
	2025-30	2025-50	PM2.5 (tons)	VOCs (tons)	
Heat pump rebate program for single-family homes	644	5,596	*	*	Local governments

Water heating "tank swap" for single-family homes& sm. business	684	6,282	*	*	Local governments
Whole-home decarbonization for single-family homes	1,757	16,202	*	*	Local governments
Water heating "tank swap" for multifamily buildings and units	684	6,282	*	*	Local governments
"Dryer swap" for multifamily buildings and units	1,125	11,155	*	*	Local governments
Whole-building decarbonization for multifamily buildings	2,308	21,894	*	*	Local governments
Multifamily technical assistance	1,035	9,989	*	*	Local governments
Community decarbonization grants	7,225	36,123	*	*	Local governments
Embodied Carbon program	79,100	133,350	*	*	Local governments
Circular economy salvaged lumber program	22,400	78,400	*	*	Local governments
Innovative financing program	1,599	14,815	*	*	Local governments
***Note that the co-pollutant reductions for these measures are not estimated because the range of potential reductions is very large and is dependent on the specific programs, facilities, and processes and so can't be accurately predicted.**					

Transportation Priority Actions

Current Status of Transportation Actions

Several recent state laws have provided a strong basis for a large-scale reduction in GHGs from the transportation sector. The most significant policies are the Zero-Emissions Vehicle (ZEV) mandate, the Advanced Clean Trucks Rule, the Clean Fuel Standard, and the Cap-and-Invest program (Climate Commitment Act or CCA). The ZEV mandate will require a minimum percentage of all vehicles sold in the state to be ZEVs. The percentage begins at 35% in 2026 and increases 6-8% each year until 2035 when it reaches 100%. The Clean Fuel Standard requires that the carbon intensity of transportation fuels must be reduced by 10% by 2030, and by 20% by 2034. The Cap-and-Invest program sets a limit (cap) on economy-wide emissions and reduces the cap (meaning less emissions) each year so the state can meet its GHG emissions targets 2030, 2040, and 2050. Cap-and-Invest will overlap to at least some degree with the ZEV mandate and Clean Fuel Standard, so it is difficult to forecast the outcome attributable to

each specific policy. Since the Clean Fuel Standard and Cap-and-Invest will apply to heavy duty, offroad, and aviation fuels, there will be incentive in all of those subsectors to find alternatives.

In addition to state legislation, as noted earlier in this document, the region's cities, towns, ports and transit agencies are also committed to reducing GHGs and investing in a cleaner, multimodal transportation system. The Washington State Ferries has an ambitious plan to decarbonize the ferry fleet, and the region's seven transit operators all have commitments to transition to zero-emission vehicles. The NWPCAS also includes an analysis of all maritime activities (with the exception of aviation activities at the ports of Tacoma, Seattle and the NWSA), and through these and other efforts ports are demonstrating their commitment to a cleaner energy future. PSRC's VISION 2050 and the strategies and investments identified in the Regional Transportation Plan commitments are summarized earlier in this document. In addition, PSRC and PSCAA have partnered since 2019 on a Regional EV collaborative, working to advance regional support and implementation of the vision for a decarbonized transportation future.

Intersection with Other Funding

There are a number of federal and state funding programs working to reduce GHGs from the transportation sector, particularly related to decarbonization of the transportation system. These include programs under the Bipartisan Infrastructure Law such as the Charging and Fueling Infrastructure Discretionary grant program, the Low or No Emission Bus competitive grants program and the National Electric Vehicle Infrastructure (NEVI) program. They also include programs under the IRA such as the Clean Ports Program. In Washington State, there are also a number of grant programs being deployed to support the transition to electric vehicles and invest in charging infrastructure. In addition to electrification efforts, there are also state and federal grants supporting active transportation, transit reliability and expansion, transit-oriented development, and operational efficiencies. The CCA noted earlier in this document, as well as the state's Move Ahead Washington transportation funding package passed in 2022, are examples of the state commitment to clean, multimodal transportation.

However, even with the substantial amount of federal and state funding made available for these efforts, demand far exceeds supply. To fully meet the state's ambitious GHG targets, aggressive implementation of the strategies and measures detailed here and in the PSREA must be pursued and additional funding obtained.

Review of Authority to Implement

Authority exists to implement the priority measures listed in Table 3. Entities with existing authority are listed for each measure.

Potential for Transformative Impact

A clean, multimodal transportation system has the power to transform communities in a number of ways. The region can expect to see improvements in public health, particularly for our historically marginalized and underserved communities who often face greater burdens from pollution and climate change. Achieving the vision for our transportation system will transform our communities into vibrant, walkable places with improved access to jobs, housing and community resources. Investing in a complete network of bicycle and pedestrian facilities, an integrated and expanded network of local and high-capacity transit, and the transition to zero emission vehicles and equipment across sectors, will

result in a healthier, more cost effective and more equitable transportation system with widespread benefits across the region's residents and economy.

Existing state and federal laws have set the groundwork for a large-scale reduction in GHGs from the transportation sector over the next 30 years. While this foundation is good, what is now necessary are more specific mechanisms to enable or catalyze the reductions, and to build public support for the transformations, in order to secure future commitments and stay on course to achieving our goals. To be truly effective, this work must include education and engagement and a continued collaboration across the region on identifying and implementing the most effective and equitable strategies.

Implementation Actions

The following measures within the transportation sector have been identified as the priority, near-term strategies that have the most potential for substantial GHG reductions and are ready for implementation within the next five years.

- Complete investments in the regional multimodal transportation system, specifically the active transportation and transit networks identified by 2030.

The region's Active Transportation Plan, an element of the Regional Transportation Plan, identifies numerous investments in regional trails, bicycle lanes and sidewalks, with a particular focus on access to schools and transit. The Regional Transportation Plan also includes a substantial commitment to expansion of local and high-capacity transit. By 2030, the system will include a total of 21 bus rapid transit routes, seven passenger-only ferry routes and 50 light rail stations serving 79 miles. In coordination with the focused regional growth strategy and pricing strategies, the Regional Transportation Plan anticipates these investments to result in more than a doubling of transit boardings and an increase in walk and bike trips of 46% by 2030. Given that the system functions in an integrated fashion, it is challenging to identify the benefits from individual elements; however, based on PSRC's 2030 and 2050 analyses an estimate of GHG reduction by 2030 from completion of these investments is about 250,000 MTCO2e cumulative through 2030.

- Invest in electric vehicle charging infrastructure for passenger vehicles throughout the four-county region and support convenient and affordable opportunities for the purchase of ZEVs, particularly for disadvantaged communities.

The region is committed to decarbonization of the regional vehicle fleet, in alignment with the state's ZEV mandate and the TES. This includes supporting the identification and implementation of necessary charging infrastructure throughout the region, in both public and private building and rights of way. For example, this would include encouraging changes in state and local building and zoning codes to support charging infrastructure in multifamily housing; establishing charging infrastructure at municipal and community buildings, employment centers, etc.; and supporting the purchase of new and used ZEVs in the most affordable and convenient manner possible. By 2035, apart from single family houses (non-SFH), the region needs an estimated 600,000 chargers in multifamily housing, places of work, and public places – each of these makes EVs possible for one or more vehicle owners. The anticipated reduction in GHGs through 2030 for non-SFH charging infrastructure is about 2,000,000 MTCO2e.

- Transition the region's transit fleet to ZEV, including buses, ferries, streetcars, vanpools, specialized transportation vehicles, light rail, and commuter rail, etc., including supportive charging

infrastructure and maintenance and operations base improvements. Support and implement the State's TES Strong Electrification Policy, which identifies 50% ZEV transit buses by 2030.

The region's transit agencies are committed to transitioning their fleets and infrastructure to ZEV. For example, King County Metro has a target of 100% zero emissions fleet by 2035 and Community Transit in Snohomish County anticipates that 30% of their fleet will be zero emission by 2029. The anticipated reduction in GHGs through 2030, to achieve the 50% aggregated ZEV goal for transit buses in the TES, is 120,000 MTCO2e. Community Transit, Everett Transit, King County Metro, Kitsap Transit, Pierce Transit and Sound Transit are each pursuing various components to electrify their fleet and operations. This includes the acquisition of battery electric buses and corresponding charging infrastructure at stations and bases; electric passenger only ferries and shore-side charging infrastructure; zero emission locomotives; and other zero emission improvements at maintenance and operation bases.

- Transition the region's medium and heavy-duty vehicle fleet and equipment to ZEV, including port drayage trucks and other seaport- and airport- related vehicles, equipment, and infrastructure. Support and implement the State's TES Strong Electrification Policy, which identifies 68% ZEV medium and heavy-duty vehicles by 2030.

The Northwest Seaport Alliance, Port of Seattle (including Sea-Tac Airport), Port of Tacoma, and Port of Everett all have made commitments to decarbonize port-related vessels, vehicles, equipment, and infrastructure. These efforts include: installing shore power infrastructure on cargo and cruise terminals; facilitating the transition to zero-emission drayage trucks, cargo handling equipment, and light-, medium-, and heavy-duty vehicles serving the seaports and airports (e.g. shuttles, delivery trucks, motor coaches, etc.); and supporting the development of the charging and fueling infrastructure necessary to facilitate that transition. The Northwest Seaport Alliance (NWSA) this year is launching a Zero Emission Drayage Demonstration Program to incentivize the deployment of zero emission drayage trucks serving the ports of Seattle and Tacoma, including charging infrastructure. NWSA is also launching a new Clean Cargo Handling Equipment Program to incentivize deployment of non-road equipment and charging infrastructure at port terminals. The Port of Everett is pursuing electric vehicle charging stations for marina fleets and buses. The Port of Seattle is pursuing an incentive program for medium-duty and non-road equipment, vehicles and charging infrastructure on its airport and maritime properties, serving a variety of affected industries and port partners. The ports have long-standing experience with these types of programs, which will leverage other funding and existing programs and partnerships. The Seattle-Tacoma-Bellevue MSA team is working closely with the State team to ensure that these measures will complement, and not duplicate, the commercial vehicle scrap-and-replace measure proposed in the State's PCAP.

Table 3. Transportation Priority Actions.

Output	Cumulative GHG Emission Reductions (MMTCO2e)		Co-pollutant Reductions 2024-30		Who has Existing Authority to Implement?
	2024-30	2024-50	PM2.5 (tons)	VOCs (tons)	
20% VMT reduction for passenger vehicles by 2030	9.3	18	640	18,000	MPOs, local governments

Complete investments and commitments in the regional pedestrian, bicycle, and transit networks	0.25	1.9	2.5	71	MPOs, local governments
20% VMT reduction for freight and service vehicles by 2030	2.5	6.8	280	650	MPOs, local governments
68% of new passenger vehicles sold are EVs by 2030**	4.6	13	310	9,100	State
Invest in EV charging infrastructure for passenger vehicles and support convenient and affordable opportunities for the purchase of ZEVs, particularly for disadvantaged communities.	2.0	15	19	550	Local governments, transit agencies
25% of new freight and service vehicles sold are EVs by 2030	2.5	6.3	50	110	State
NWSA: Incentives for zero-emissions drayage trucks (~150), CHE, and charging equipment	0.02	0.17	0.45	7.9	Local governments
Transition the region's transit fleet to ZEV, including buses, ferries, streetcars, vanpools, specialized transportation vehicles, light rail, and commuter rail, etc., and infrastructure	0.12	0.92	2.4	5.5	Local governments, transit agencies, ports
Kitsap Transit: Electrify passenger ferry	0.016	0.079	0.32	3.6	Transit agency
Pierce Transit: Battery buses (~20) plus charging infrastructure	0.0055	0.042	0.11	1.9	Transit agency
King County Metro: Electrify 2 Passenger Ferries and infrastructure	0.019	0.14	0.38	6.7	Transit agency
King County Metro: Acquisition of 20 battery electric buses	0.0055	0.042	0.11	1.9	Transit agency

Port of Seattle: Airport transit bus electrification (~35), plus charging equipment	0.0066	0.051	0.13	2.3	Local governments, port
Sound Transit: Stride and double decker buses (~15 total) and charging infrastructure	0.0041	0.031	0.082	1.44	Transit agency
Port of Seattle: Electrify port owned fleets (243) plus charging equipment	0.0013	0.010	0.03	0.46	Local governments, port
Port of Everett: Electrify maintenance fleet (~40)	0.0003	0.0025	0.01	0.11	Local governments, port
20% reduction in GHGs from offroad equipment by 2030	3.5	38	400	910	Local governments, ports
Transition the region's medium and heavy-duty vehicle fleet to ZEV, including port drayage trucks and other seaport and airport vehicles, equipment, and infrastructure	0.55	4.4	11	26	Local governments, ports
Port of Seattle: Medium duty vehicle electrification, incentives (for about 80) and charging depot	0.0079	0.060	0.16	2.8	Local governments
20% reduction in fuel carbon intensity for aviation fuels	6.5	55	430	*	State, ports
10% reduction in aviation fuel use	3.7	16	290	5,700	Local governments, ports
***Note that VOC emissions reductions from the reduction in the carbon intensity of aviation fuels could not be calculated due to a lack of reliable emissions factor data. **This action is legislated to occur through the ZEV mandate.**					

Solid Waste & Wastewater Priority Actions

Current Status of Solid Waste & Wastewater Actions

Solid waste emissions are covered, in part through Chapter 70A.540 RCW (Methane Emissions) and Engrossed Second Substitute House Bill 1799 which addresses diversion of organic materials from landfills to productive uses and requires methane monitoring from certain landfills. Solid waste and

wastewater emissions are also covered indirectly through the ZEV mandate, the CFS, and the Cap-and-Invest program. The major activities in these subsectors that have the greatest GHG emissions are transporting solid waste to the landfill, and the release of CH_4 as materials decompose. Transportation vehicles and fuels will be addressed by the ZEV mandate and CFS. For both solid waste and wastewater, CH_4 from the decomposition can be captured, cleaned, and sold for fuel, or burnt for energy production or heat-electricity co-generation.

Intersection with Other Funding

There are a number of federal funding programs working to reduce GHGs from the solid waste sector. These include programs under the BIL such as the Solid Waste Infrastructure for Recycling Grant Program and the Consumer Recycling Education and Outreach Grant Program. They also include programs under the IRA such as the Embodied Carbon in Construction Materials Grants. Other federal programs include Regional Sustainable Materials Management Grants and Composting and Food Waste Reduction Grants Program.

Review of Authority to Implement

Local governments have significant authority to implement the solid waste implementation actions, however the efficacy of such actions depends substantively on consumer behavior and choices. For example, counties and cities can establish curbside collection policies, but following those policies to increase recycling and diversion is also dependent on individual consumer choices.

Seattle Municipal Code sections 21.36.082 and 21.36.083 require that residents and businesses do not put food scraps, compostable paper, yard waste, and recyclables in their garbage.

King County Code (KCC) 10.14.020 requires zero waste of material resources through prevention, reuse and reduction of solid wastes to landfill. Pursuant to KCC 18.25.010, a goal of zero food waste in landfill by 2030 has been set to help meet other climate goals.

Potential for Transformative Impact

The greatest potential for this category related to geographic emissions would be to 1) reduce the total amount of waste material sent to landfills, and 2) ensure that as much as possible of the generated CH_4 is captured and used in the most beneficial way. This would likely be as a replacement for existing non-renewable fuel. Some CH_4 capture and supply as fuel could be stimulated by the CFS, but the scale is unclear. In these uses, captured CH_4 would displace fossil diesel, so the lifecycle carbon intensity could be negative – preventing both fossil diesel use and CH_4 emissions.

There are also significant consumption-based emissions associated with materials and solid waste. Diverting solid waste from landfill, recycling, composting, and most importantly preventing waste in the first place, are critical to address these emissions. For example, preventing food waste or reusing building materials can both have high emissions impacts. More details on consumption actions are provided in “Consumption Priority Actions” below.

Implementation Actions

Table 4. Solid waste priority actions.

Output	Cumulative GHG Emission Reductions (MMTCO2e)		Co-pollutant Reductions 2024-30		Who has Existing Authority to Implement?
	2024-30	2024-50	PM2.5 (tons)	VOCs (tons)	
85% of construction and demolition materials diverted from landfills by 2030	0.01	0.03	*	*	Local governments
50% of other recyclable and compostable waste diverted from landfills by 2030	4.2	26	*	*	Local governments
Decrease household food waste by 50% by 2030 and eliminate it by 2050**	4.6	39	*	*	Local governments
King County and Seattle food waste diversion (to compost) pilot programs[7]	32,000 MTCO2e (2025-2030)	220,000 MTCO2e (2025-2050)	*	*	King County and City of Seattle
King County and Seattle food waste prevention pilot programs[8]	168,000 MTCO2e (2025-2030)	1,223,000 MTCO2e (2025-2050)	*	*	King County and City of Seattle
Seattle low carbon food procurement pilot program[9]	6,000 MTCO2e (2025-2030)	32,000 MTCO2e (2025-2050)	*	*	City of Seattle

*** Note that the co-pollutant reductions could not be calculated due to the large range of possible actions and a lack of reliable data on their specific impacts.**
**** GHG estimates for this action are based on the lifecycle related GHG emissions reductions associated with avoided food waste. According to the USDA, at the household level, around 21% of purchased food is wasted. Detailed assumptions and references are documented in the tool here.**

Table 4 includes actions related to efforts by King County and the City of Seattle to address GHG emissions in the state's most populous region. These actions use a whole supply chain approach to pilot new methods that reduce emissions from regional food systems including local food procurement, compost market creation, and next generation organics management.

[7] King County Food Waste: 10% of non-edible food and 10% of mixed organics (garbage stream only for each) is instead composted; Seattle Food Waste 5% of total divertible tonnage (inedible in garbage + edible in garbage) is diverted each year; estimated using EPA WARM model
[8] King County: 10% of edible food (from both organics recovery and garbage streams) is reduced/prevented and Seattle assumes 2% of total preventable tonnage (edible in organics + edible in garbage) is prevented each year; estimated using EPA WARM model
[9] 8% reduction in meat served each year at 8 large institutions and resulting emissions reductions; estimated using EPA WARM model

Land Use & Sequestration Priority Actions

Current Status of Land Use & Sequestration Actions

Under the broad umbrella of land use and sequestration we have agriculture, tree loss, and land carbon sinks. There are currently no state, regional, or county level actions targeting agricultural emissions. Indirectly, the CFS could incentivize some collection of manure methane emissions because of its potential to generate significant credits. There are also no state, or regional level actions addressing tree loss and land carbon sinks. There are a number of individual efforts at tree planting that have occurred, and continue with King County, Snohomish County, several cities, and a number of businesses and community organizations.

Intersection with Other Funding

The IRA and BIL provides funding for land use sequestration measures including the Urban and Community Forestry Grants Program and the Reconnecting Communities and Neighborhoods (RCN) Program. The Washington State Climate Action Fund provides funding through the Department of Natural Resource's Urban and Community Forestry Assistance Grant program.

Review of Authority to Implement

Authority exists to implement the priority measures listed in Table 5. Specific entities with existing authority are listed for each measure.

Potential for Transformative Impact

There is tremendous potential for both reduction in tree loss, and in preservation - and even enhancement – of land carbon sinks. There is a strong need for improved accounting and tracking of tree cover, and in coordinated preservation and enhancement efforts. There is also great potential for land carbon sinks through carbon management and enhancement of farmland, which could also help support sustainable, local farmers.

Implementation Actions

Table 5. Land-use and sequestration priority actions.

Output	Cumulative GHG Emission Reductions (MMTCO2e)		Co-pollutant Reductions 2024-30		Who has Existing Authority to Implement?
	2024-30	2024-50	PM2.5 (tons)	VOCs (tons)	
50% reduction in tree loss by 2030	6-30	40-190	*	*	Local governments
100% of land carbon sinks protected by 2030	0 (to 70*)	0 (to 260**)	*	*	Local governments
***Note that the co-pollutant reductions could not be calculated due to the large range of possible actions and a lack of reliable data on their specific impacts. ****Not a current emission, but is a major sink that could, hypothetically, be lost.**					

Refrigerants Priority Actions

Current Status of Refrigerant Actions

Refrigerants as a category have received relatively little attention as they are about 5% of the region's total GHG emissions. The only significant recent state-level action was in 2023, when Ecology adopted new HFC rules that require registration of most commercial and industrial systems, limit the Global Warming Potential (GWP) for refrigerants in new equipment, require automatic leak detection systems or a removal of high-GWP refrigerants for the largest commercial users, and limit the sale of replacement (recharging) refrigerants.

Intersection with Other Funding

The IRA includes funding through the Hydrofluorocarbon Reclaim and Innovative Destruction Grant Program.

Potential for Transformative Impact

The recent HFC rules represent important steps for addressing the largest emissions from this sector for the longer-term timeframe (10-20 years), and for addressing the most potent refrigerants. Nonetheless, they still allow refrigerants that have GWPs much greater than 1, they don't address existing (legacy) equipment, and don't offer significant mitigation if there is substantial growth in equipment requiring refrigerants in the next 10-20 years. Since shifting residential and commercial heating from fossil-fuels to heat-pumps is a key strategy to reduce fossil fuel consumption, it is reasonable to expect a substantial growth in this type of equipment and the consumption of refrigerants.

Transformative impact could occur through 1) assisting disadvantaged businesses, government, and non-profit organizations in replacing and upgrading equipment, 2) educating and training technicians to inspect, repair, and better maintain refrigeration equipment, and 3) sponsoring development of newer technologies that either reduce the GWP of the refrigerants that are needed or significantly reduce leaks and loss of currently used high GWP refrigerants.

Implementation Actions

There are currently no priority implementation actions for refrigerants in this PCAP.

Consumption Priority Actions

Current Status of Consumption-related Actions

A range of existing policies and goals at local, state, national, and international levels can be expected to reduce Puget Sound household consumption-based emissions. These include many of the same policies whose effects are estimated in the PSREA geographic wedge analysis. For the consumption-based analysis, they include:

- Federal vehicle fuel efficiency (CAFE) standards
- Washington State clean energy, clean fuel, energy efficiency, electric vehicle, and carbon pricing policies
- PSRC's plans for reducing average household passenger car travel
- International aviation industry goals for reducing air travel GHG emissions

Under the PSREA consumption wedge tool's default assumptions, existing policies and goals are estimated to reduce King County household consumption-based emissions by 30% in 2050, relative to the reference case.

Intersection with Other Funding

Please refer to the Solid Waste & Wastewater Priority Actions Sections for relevant funding options for consumption-related measures.

Review of Authority to Implement

Please refer to Table 4 for solid waste consumption-related priority actions and a review of authority to implement them.

Potential for Transformative Impact

The consumption-based emissions inventory for our region highlights the continued importance of our efforts around transitioning away from fossil fuels in our transportation and buildings sectors, and shines a light on the opportunity to reduce GHGs from the food we eat, the things we buy, and the materials that we use to build our homes.

Although existing policies will help to reduce consumption-based emissions, there is much more that can be done to reduce emissions associated with the consumption of energy, housing, transportation, food, and goods in ways that would substantially reduce associated GHG emissions. These include steps to reduce waste, use goods and energy more efficiently, and shift consumption. Key strategies to reduce consumption emissions include to:

- Promote smaller, more efficient housing that uses fewer, and less carbon-intensive, materials
- Use alternative transportation options and accelerate the shift to electric vehicles
- Promote more plant-based foods in diets (as opposed to meat and dairy consumption), and reduce household food waste
- Address waste and rethink how we consume - sharing or renting goods, and purchasing goods with greater reusability and durability

Under the PSREA consumption wedge tool's default assumptions, these additional shifts in consumption could reduce household carbon footprints by more than an additional 20% in 2050.

Implementation Actions

Please refer to Table 4 for solid waste consumption-related priority actions in this PCAP that also help address consumption-related emissions.

Section 5. Benefits Analysis

The implementation of the measures included in this PCAP are anticipated to have a broad range of benefits beyond GHG emission reductions.

Emission reductions in the built environment sector are primarily due to replacing natural gas combustion in building heating uses. Likewise, reductions in the transportation sector are primarily due to replacing diesel/gasoline combustion with cleaner alternative fuels. While the benefits are difficult to quantify without specific activity and location information, some broad benefits are likely, based on regional patterns and activities. Natural gas combustion for building heat does not have a detectable or uniquely identifiable impact on criteria and toxics pollutant concentrations in our region. Instead, any benefit would primarily be identifiable as reductions in the overall emissions inventory.

For the transportation sector, diesel trucks and cars are routinely identified as main contributors to fine particulate, NOx, black carbon, and VOC emissions. Thus, a reduction in diesel fuel consumed will reduce the fine particulate, NOx, black carbon, and VOC emissions and ambient concentrations near those activity locations. Diesel particulate is the single leading toxics risk in our region, accounting for more than 70% of the total airborne toxics cancer risk, and even more near major roads.

Tables 2 and 3 above show the estimated co-pollutant (fine articulate matter and VOCs) reductions for the priority actions in the built environment and transportation sectors. It is not possible to estimate the co-pollutant reductions for waste and land-use sectors (Tables 4 and 5) at this time because they would vary considerably depending on the specific action that would be implemented.

Section 6. Low-Income & Disadvantaged Communities Benefits Analysis

Implementation of the measures included in this PCAP are anticipated to provide significant benefits to LIDACs. This section identifies LIDACs within the jurisdiction covered by this PCAP and provides a qualitative description of the benefits that could be expected.

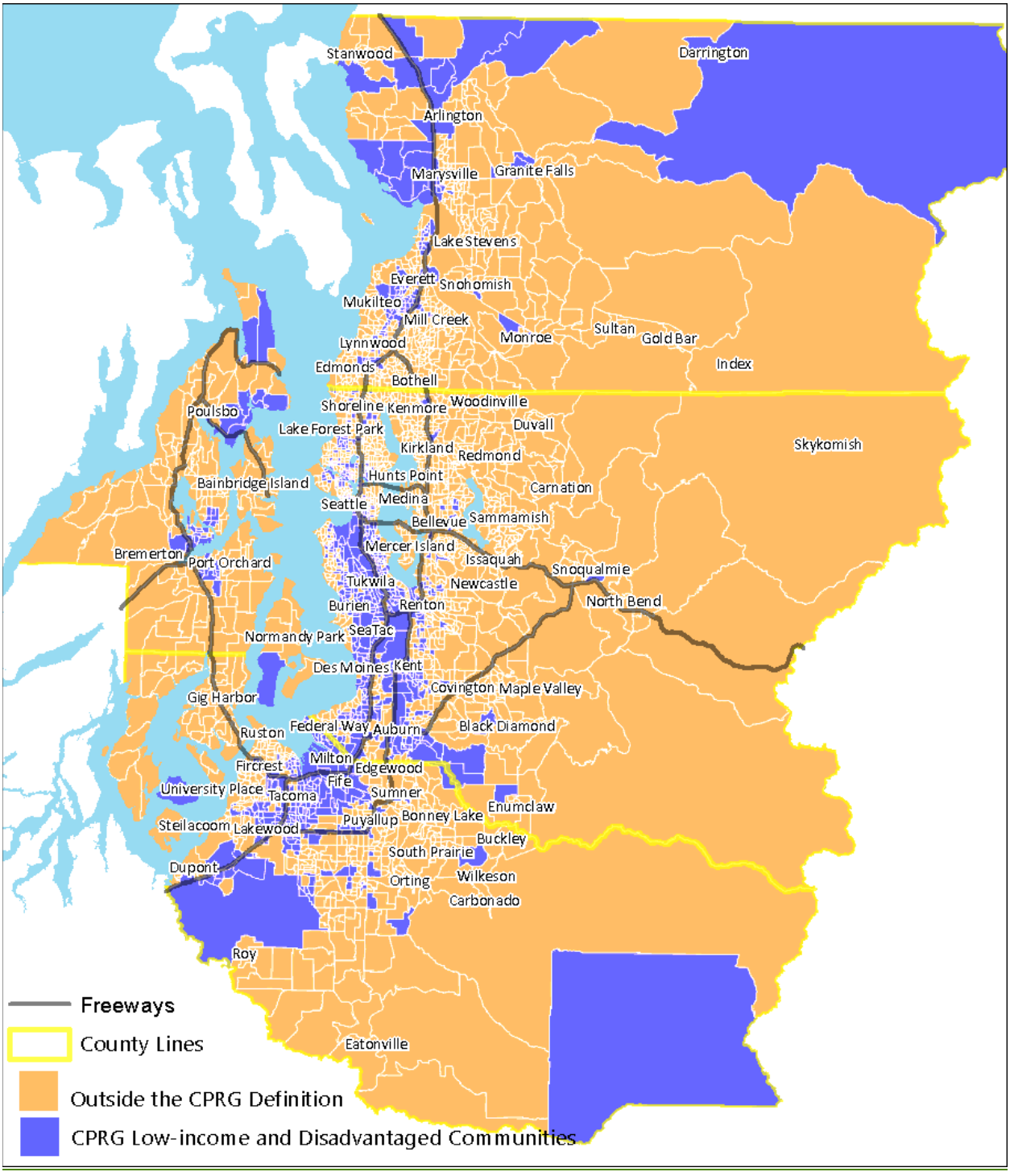
Qualitative LIDAC Benefits Analysis

Based on analyses that have been conducted by the Agency[10] and the Washington State Department of Health[11], neighborhoods that are most impacted (i.e., those near transportation emissions from highways and ports and industrial sources) have a significantly higher proportion of low-income and disadvantaged people. This pattern is reflected in identified 'overburdened communities' shown in Figure 1. EPA's LIDAC communities in the Puget Sound region are illustrated in **Figure 4**.

[10] https://pscleanair.gov/DocumentCenter/View/2323/Highly-Impacted-Communities-HI-C-ReportPDF

[11] https://fortress.wa.gov/doh/wtnibl/WTNIBL/

Figure 4. Map of Puget Sound region with federally designated LIDACs.



Many LIDACs are adjacent to major highways in the region including I-5, SR-165, and SR-512. The areas include the cities of Lynwood, Everett, Seattle (south of downtown), Tukwila, Burien, Renton, SeaTac, Des Moines, Federal Way, Auburn, Milton, Fife, Tacoma, and Lakewood as well as unincorporated areas. Thus, most transportation priority actions in this PCAP will result in a benefit to LIDACs because of their

proximity to major highways. Diesel particulate matter will also have greater impacts in industrial areas, ports, and distribution centers with non-road mobile sources. These areas are also much more likely to be defined as LIDAC, and are found in the Duwamish Valley, near the Port of Tacoma, and in some of the previously mentioned cities near major highways. The more affluent demographics tend to live further from the major highways. Individuals whose work uses diesel equipment/trucks are more likely to be from LIDAC and therefore any work that reduces the amount of diesel fuel combusted to run the equipment will provide a greater benefit for LIDACs.

For the Built Environment sector, much of the GHG emissions, and thus a large chunk of potential GHG reduction actions, are from residential and commercial space heating. The criteria and toxics emissions from these uses are relatively small (per gram of CO_2 or unit of energy compared to diesel fuel) except for the small fraction of homes that heat primarily with wood. Thus, the direct actions of electrification and reduction in natural gas consumption for residential and commercial heating are unlikely to have significant secondary air quality benefits for LIDACs. Small amounts of heating oil are used in some commercial and residential buildings, so any conversion of these devices would provide some air quality benefit to the local neighborhoods and nearby LIDAC groups.

Air quality and home heating cost benefits will be achieved through changeouts or energy efficiency programs which aim to switch wood heating, residential oil, or old inefficient natural gas furnaces to more efficient electric heating options. As these older and less-efficient devices are less likely to be updated in residences with lower incomes, there will likely be concentrated benefit from these types of programs when prioritizing lower income households.

Determinants of Environmental Justice & Additional CCAP Analysis

The EPA defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." (Environmental Justice |USA EPA, 2023). This definition is broad and intended to address a host of factors that accelerate the risk of environmental exposure, including race. Environmental justice (EJ) as a concept and movement was formally established in the 1980s by communities of color experiencing disproportionate environmental pollution burdens while also having limited recourse for legal protection and political influence. Since then, the U.S. has garnered political support for addressing EJ at local, state, and federal levels. As described in Section 1, the Healthy Environment for All (HEAL) Act, adopted by the Washington State Legislature in 2021, is a key example of this action supporting environmental justice.

In 2015, the EPA published the EJScreen tool which includes Environmental Justice (EJ) & Supplemental Indexes that are a combination of environmental and socioeconomic information. This tool was updated in 2022 (EJScreen 2.1) with new data. Each index is combined with demographic factors which include people of color populations and low-income populations to result in an environmental indicator value. For PCAP and CCAP climate action prioritization and analysis, EPA requires applicants to use the Climate and Economic Justice Screening Tool (CJEST), which excludes race as a determining factor.

Several different maps were included in our Agency's development of the geographic boundaries of "overburdened communities." These maps include underlying datasets that highlight the patterns of disparity in health outcomes, environmental exposures, and socioeconomic barriers across communities. These maps are tools that allow us to prioritize the areas and communities most in need

of relief from these disparate exposures to air pollution. EPA's CJEST is one of the map layers the Agency includes, in addition to two state and one local map layer. This gives the Agency maximum flexibility to serve its communities by leveraging federal, state, and local funding opportunities to create equitable outcomes in emission reduction.

The CJEST is an important tool to identify LIDAC communities (those in blue areas of Figures 1 and 4) for EPA's CPRG. The tool incorporates 21 factors correlated with high exposure risk but, unlike the other maps that the Agency uses, it excludes race. EPA prioritizes LIDAC areas (blue) for CPRG Phase 2 funding. For overburdened communities not included in LIDAC, the Agency is committed to identifying other funding opportunities to reduce emissions and disparities.

As shown in Figure 1, there is substantial overlap between EPA's LIDAC communities (blue) and the Agency's more broadly defined overburdened communities (hashed). This high correlation between race, income, proximity to pollution sources, and other factors is a legacy of racism that the Agency seeks to address. To better understand how LIDAC and overburdened communities are benefiting from CPRG and other funding opportunities or not, the CCAP will explore additional analyses related to emissions and air quality, race, and the distribution of resources. The Agency will use that analysis to ensure LIDAC and overburdened communities benefit from CPRG programs as well as other funding sources.

Section 7. Workforce Planning Analysis

Existing Workforce Analyses

Several efforts are already underway in the state and region which can help the MSA to identify workforce development priorities that will result from the GHG reduction measures identified in this PCAP. A summary of these existing analyses, as well as how they support equitable workforce planning efforts, is included below.

King County Green Jobs Strategy

In 2023, King County developed its Green Jobs Strategy which aims to "connect frontline communities to living wage employment opportunities to build a skilled and diverse workforce across the career spectrum." The Green Jobs Strategy emphasizes integrating workforce development into current climate initiatives, and collaborating with regional partners to grow green jobs through sectors essential to clean energy deployment.

The goals of the Strategy include:

1. Partner regionally to grow green jobs through climate initiatives.
2. Facilitate a green jobs pipeline for frontline communities.
3. Invest in local high-demand industry sectors.
4. Support greening the County workforce.

Snohomish County Workforce Planning

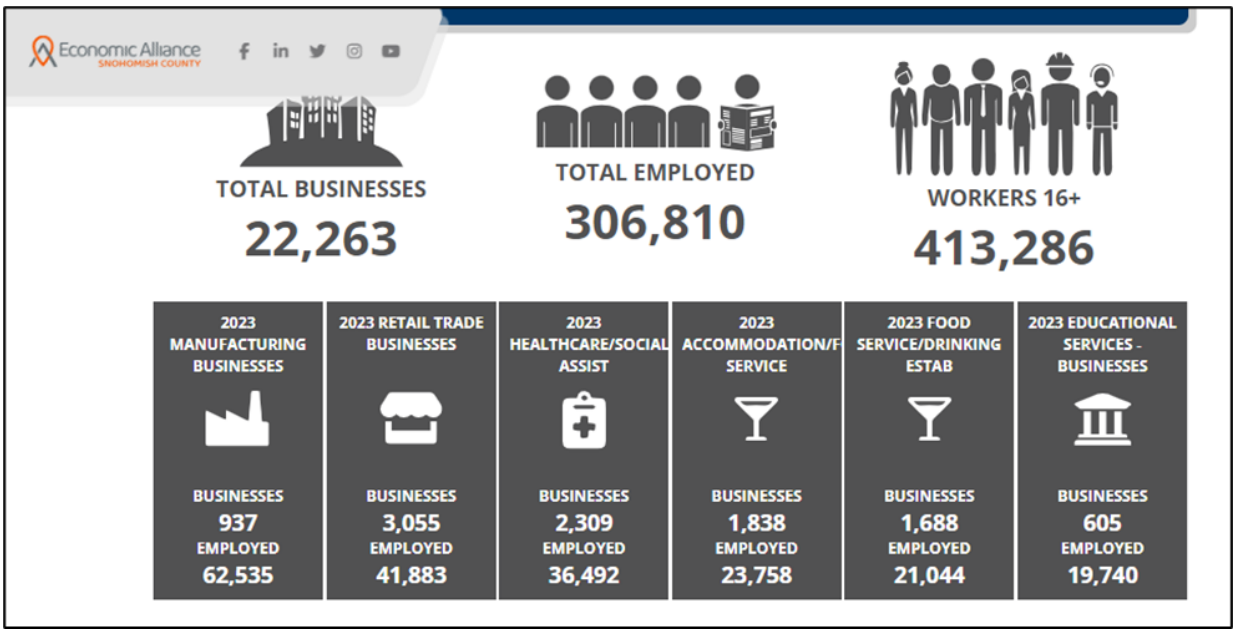
One of Snohomish County's highest priorities is to develop, proactively and equitably, a-workforce equipped to respond to a changing climate. This is also a priority of the Future Workforce Alliance (FWA) which serves as the local workforce development board for Snohomish County. Beyond the benefit of working towards a cleaner climate, these efforts will result in the creation of high quality, well-paying jobs. The County is a hub for the aerospace, manufacturing, retail, healthcare and distribution and logistics industries, including maritime. Based on the November 2020 Clean Jobs Washington Report from E2, there were 7,877 cleantech jobs in Snohomish County in 2019. The number of cleantech jobs is expected to grow as the region implements state and local climate and energy mandates.

As the region focuses on transitioning to clean energy sources in building and transportation, leaders such as Paine Field and Snohomish County PUD are developing programs and their workforces to meet the demands. A world-leading Research and Development (R&D) Center focused on Sustainable Aviation Fuels (SAF) and hydrogen-powered aviation is being developed at Paine Field Airport in partnership with Washington State University (WSU). The proposed facility could offer significant career opportunities for underrepresented populations in the aerospace sector. Snohomish County PUD is also developing a Secure Modern Automated and Reliable Technology (SMART) Project to provide improved grid reliability, increased system resiliency, and mitigation of wildfire impacts to vulnerable communities.

To meet the demand for clean energy jobs and workforce development, Snohomish County invested $4.3 million from ARPA funds in seven workforce development and job pathways programs. Those projects intentionally focus on highly impacted populations including youth, immigrants and refugees, and people with disabilities. The County is also working to expand its Regional Apprenticeship Pathways

(RAP) Program, a county-wide state-certified pre-apprenticeship program located at Marysville-Pilchuck High School. RAP helps connect students with apprenticeship opportunities leading to trained professional positions in the building trades. Additionally, other county programs facilitate skill development of the existing area workforce, as well as recruit and develop new workers, including Sno-Isle Skill Center and the Incumbent Worker Training. The FWA is in the process of redeveloping its Local Area Plan, a state-required document that provides a blueprint for building a strong workforce system with federal workforce dollars. The Local Area Plan identifies key industries and in-demand occupations in Snohomish County, including those tied to SAF and clean technology. Once approved, the Local Area Plan will poise the county for providing targeted training and educational opportunities to meet specific industry needs.

Meanwhile, the non-profit Economic Alliance Snohomish County (EASC) serves as a countywide chamber and economic development organization with the purpose of building and enhancing a strong economy while providing legislative engagement in Snohomish County in addition to providing networking events for industry innovators.



Seattle Jobs Initiative

The Seattle Jobs Initiative (SJI) is a 501(c)(3) developed in 1997 to function as a workforce development intermediary to create equitable workforce systems and develop impactful partnerships to address structural racism. SJI recently completed the Port of Seattle Career Pathways: Maritime & Green Jobs Report (2022), aimed at identifying and supporting the Port of Seattle's workforce development strategies and guiding future investments in maritime and green jobs training programs. This report identifies the following primary career pathways for each of these activities:

- Maritime: Maritime deck crews from Ordinary Sailors to Captains, and Maritime Engine crews from Wipers to Chief Mechanical Engineers.

- Green Jobs: Electricians, from Electrician Helpers/Apprentices to Master Electricians; and Heating, Ventilation, and Air Conditioning (HVAC) Mechanics and Installers and Insulation Workers.

The Maritime Sector is one of the Port's main branches of activity and includes passenger and cargo transportation, and commercial fishing. There has been a decline in worker supply in recent years which led to a strong labor shortage and high turnover rates in the Maritime Sector. Supporting maritime career pathways and increasing labor availability will provide individuals with strong career prospects. Estimated projected employment needs in the Maritime Sector for King County are summarized below:

Projected Growth for King County Maritime Sector			
Occupational Title	Employment 2020	Projected 2030	Percent Change
Sailors & Marine Oilers	1,572	1,591	1%
Captains, Mates, & Pilots	950	951	0.1%
Ship Engineers	707	680	-4%
Source: Port of Seattle Career Pathways: Maritime & Green Jobs report (2022)			

In the Green Jobs Sector, Electricians, HVAC, and Insulation Workers are among the occupations with the largest expected job creation through 2030. These positions also have some of the largest employment pools in King County; however, not all these positions are entry-level as many require licensing. Estimated projected employment needs in the Green Jobs Sector for King County are summarized below:

Projected Growth for King County Green Jobs Sector			
Occupational Title	Employment 2020	Projected 2030	Percent Change
Construction and Building Inspectors	1,685	1,819	8%
Electricians	7,496	8,896	19%
Solar Photovoltaic Installers	115	216	88%
Helpers--Electricians	86	100	16%
HVAC and Drywall & Insulation Contractors	15,780	17,162	9%
Helpers--Installation, Maintenance, & Repair Workers	612	666	89%
Maintenance and Repair Workers, General	12,504	14,057	12%
Insulation Workers, Floor, Ceiling, & Wall	469	559	19%
Insulation Workers, Mechanical	263	321	22%
Heating, Air Conditioning, & Refrigeration Mechanics & Installers	1,910	2,171	14%
Construction & Building Inspectors	1,685	1,819	8%
First-Line Supervisors of Mechanics, Installers, & Repairers	4,240	4,691	11%
Source: Port of Seattle Career Pathways: Maritime & Green Jobs report (2022)			

SJI also completed the King County Green Sectors & Occupations Study (2022), which influenced the development of and was cited in the King County Green Jobs Strategy (2023), all of which will serve as a good starting point for the MSA's regional workforce planning analysis.

Tacoma Green Economic Development Strategy

In 2023, the City of Tacoma developed its Green Economic Development Strategy, with the goal of enabling the City to seize new market opportunities available through its efforts to decarbonize the economy. The strategy aims to shift the composition and orientation of the economy so that it can create more and better green jobs over time. The strategy identifies six initiatives that are designed to address three key imperatives: helping existing businesses and industries evolve to take advantage of green economy opportunities, preparing workers with the skills they need to secure high-wage jobs in the green economy, and creating new businesses and industries in Tacoma. These six initiatives are included below. For each of these initiatives, the strategy identifies the opportunities from implementation, key next steps, and measures to track success.

1. Innovate: Accelerate the greening of mid-sized firms in key industries.
2. Retool: Help small contractors prepare to respond to regional green demand.
3. Upskill: Create inclusive green apprenticeships and scale adoption in mid-sized firms.
4. Network: Develop a hyper-connected corps of sustainability professionals.
5. Deploy: Make Tacoma a real-world testbed for green technologies and services.
6. Attract: Leverage logistics strengths and policy to attract circular economy business.

Clean Energy Career Training Program

Seattle's Office of Sustainability & Environment partners with the Department of Finance & Administrative Services and the Office of Economic Development to support investments in a workforce that can help address climate change. Workforce development is a critical strategy of Seattle's Green New Deal, which aims to address the climate crisis by investing in a low-carbon economy. The City's aim is to advance an equitable transition from fossil fuels to renewable energy by prioritizing investments in communities historically most harmed by economic, racial, and environmental injustices.

As part of this work, the City of Seattle has invested $1 million in 2023 in Clean Energy Career Training programs across six workforce development organizations: ANEW, Northwest Carpenters Institute of Washington, Seattle Central Pre-Apprenticeship Training (PACT), Sphere Solar Energy, YouthCare's YouthBuild, and Emerald Cities Collaborative. In 2024, the City of Seattle has increased the Clean Energy Careers Training Program funding to $4M and as of January 2024 is seeking competitive bids from local workforce development organizations to meet these expanded services.

Climate Workforce Action Plan

The Climate Workforce Action Plan (CWAP) was created over the course of 2023 in partnership with city-wide workforce development staff, and with input by 33 local labor, business, contractor, and workforce development organizations throughout Seattle, as well as input from the Green New Deal Oversight Board. CWAP includes 8 different actions with $760k in funding in 2024 to leverage new and existing workforce development programs and resources to strengthen Seattle's green economy and ensure BIPOC workers thrive in the clean energy transition through high wage jobs and business ownership and development.

Coalition for Climate Careers (C3)

C3 is a strategic collaboration among public and private organizations and frontline communities, dedicated to establishing an inclusive and prosperous green workforce in King County. C3 focuses on fostering regional alignment in green jobs programming, providing competitive advantages in public and private funding opportunities, and building a broad coalition to ensure grant funding is released quickly and effectively to service providers. C3 was formed through collaboration with community partners, the King County Executive's Climate Office, the Port of Seattle, and the City of Seattle's Office of Economic Development (OED) and aims to harness substantial federal and state funding for climate adaptation, mitigation, and clean energy deployment as equitable workforce development opportunities. This initiative ensures enduring positive effects on our regional economy, with a specific focus on ensuring frontline communities most impacted by climate change have access to training opportunities in careers focused on mitigating and adapting to climate change. The organization is led by a 15-member Executive Steering Committee, with half of the seats dedicated specifically for frontline community members, including two youth from BIPOC communities. To ensure smooth operations and alignment with community needs, economic demands, and execution capabilities, the committee hires dedicated coordinators. These coordinators act as a vital link between the committee and the broader coalition, keeping everyone informed and working towards shared goals.

Washington State Workforce Training and Education Coordinating Board (Workforce Board)

Workforce planning and analysis completed as part of the CPRG program will ensure consistent coordination with the State's recently developed Workforce Training and Education Coordinating Board (Workforce Board). The Workforce Board aims to support an equitable clean energy transition by identifying future industry occupations and skill needs, the existing workforce's transferrable skills to meet those needs, and the gaps that need to be addressed through training and education.

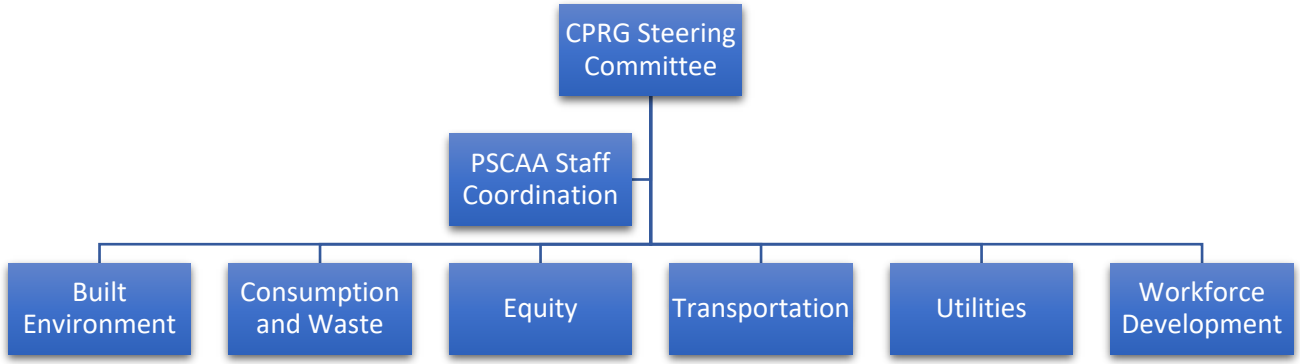
Section 8. Stakeholder Engagement Activities

The Agency and CPRG partners across the MSA conducted extensive intergovernmental coordination and stakeholder outreach in the development of this PCAP. This section describes the framework the Agency used to support this engagement.

Governance Structure

The Agency established a governance structure to help manage the CPRG process in early 2023. Shown in **Figure 5,** this governance structure ensures that all regional perspectives are considered in the development of CPRG Phase I planning documents.

Figure 5: MSA CPRG Governance Structure



The governance structure is comprised of the following groups:

- **CPRG Steering Committee**: The CPRG Steering Committee serves as the primary decision-making body for Phase I activities including the development and review of all required EPA deliverables. This group is comprised of representatives from all counties and major cities in the MSA including Bainbridge Island, Bellevue, Bremerton, Everett, Seattle, and Tacoma, King County, Kitsap County, Pierce County, Snohomish County. PSRC and the Agency also serve on the Steering Committee. The Steering Committee is responsible for ensuring jurisdictional collaboration, approving CPRG deliverables, directing stakeholder engagement activities, and ensuring that Elected Officials are kept informed of CPRG efforts.
- **PSCAA Staff Coordination**: As the MSA lead entity for Phase 1, the Agency is responsible for the overall management and administration of the CPRG program. The Agency is responsible for developing all CPRG deliverables, serving as CPRG technical lead, administering the EPA contract including contractors and subawards, ensuring meaningful engagement with communities, and designing and implementing broader communication of CPRG activities.
- **Working Groups**: The Agency established six working groups to help guide technical aspects of the CPRG process. These working groups are comprised of government and jurisdiction staff from across the region are responsible for reviewing and advising on CPRG deliverables and providing subject matter expertise on focused topics. Working groups include:

- Built Environment (led by King County)
- Consumption and Waste (led by PSCAA)
- Equity (led by PSCAA)
- Transportation (led by PSRC)
- Utility (led by PSCAA)
- Workforce Planning (led by PSCAA)

Identification of Stakeholders and other Planning Partners

The Agency, the CPRG Steering Committee, and CPRG partners identified stakeholders and partner representative of the entities, groups, and individuals who may be impacted by implementation of this PCAP. These entities include, but are not limited to:

- State agencies and tribes
- Metropolitan planning organizations
- Local government agencies
- Environmental advocates
- Community-based organizations
- Utilities
- Ports
- Transit Agencies
- Private sector representatives
- Other interested organizations
- Residents of Washington
- Members of the public

To identify stakeholders and planning partners, the Agency relied on the extensive networks of elected officials, CPRG Steering Committee members, working group members, jurisdictional groups and other organization interested in clean energy and climate policy and programs in the region and state.

Outreach and Coordination

Table 6 below provides a log of interagency and intergovernmental coordination, and stakeholder and public engagement efforts associated with development of this PCAP.

Table 6: Outreach and Coordination Log

Date(s)	Topic	Organizations/# individuals Involved	Outreach Method/ Location	Outcome(s)/Objectives
January 2023-April 2024 (monthly) and as needed after	CPRG Steering Committee meetings	CPRG Steering Committee	Zoom	• Ongoing CPRG coordination
June 22, 2023	PSRC Executive Board Meeting	Executive Board	Zoom	• CPRG overview • Reminder about September 21 public meeting
July 25, 2023	CPRG Program Overview	King County Climate Change Cities (K4C), PSCAA	Zoom	• CPRG overview • Reminder about September 21 public meeting
August 2023-April 2024 (weekly)	CPRG State/MSA Coordination meetings	PSCAA, Department of Commerce	Zoom	• CPRG outreach and engagement planning and coordination
September 13, 2023	CPRG Program Overview	PSCAA Advisory Council	Zoom	• CPRG overview • Reminder about September 21 public meeting
September 21, 2023	Phase I Public Stakeholder Meeting	>50 in-person attendees >20 virtual attendees	Seattle Public Library (in-person & virtual Zoom option)	• Share information and build awareness around the CPRG program. • Build relationships with regional and local entities. • Connect people to existing climate resources. • Ensure all stakeholders have the same information. • Provide awareness around key CPRG deliverables and timelines Issue identification and future coordination meetings
September 28, 2023	CPRG Program Overview	PSCAA Board of Directors	Zoom	• CPRG overview
October 12, 2023	PSRC Regional Transportation Board (TPB) Meeting	TPB	Zoom	• Share information and build awareness around the CPRG program

Date(s)	Topic	Organizations/# individuals Involved	Outreach Method/ Location	Outcome(s)/Objectives
October 19, 2023	PSRC Regional Staff Committee Meeting	Regional Staff Committee	Zoom	• Share information and build awareness around the CPRG program
November 3, 2024	SeaShore Transportation Forum Meeting	SeaShore Transportation Forum	Zoom	• Share information and build awareness around the CPRG program
November 14, 2023	Phase II Public Stakeholder Meeting	>350 virtual attendees	Zoom	• Provide an opportunity to learn about GHG reduction measures. • Work with others across the state to identify measure priorities. • Provide an opportunity to identify partners who align with measure priorities (i.e., coalition building) • Distribute a follow-up survey with more specific questions on GHG measure identification and potential for partnerships.
November 15, 2023	Phase II Working Session I	Governor's Office, Commerce, Ecology, PSCAA, Cascadia Consulting	Zoom	• Share information, questions, and emerging ideas from across the state on Phase 2 proposals. • Identify Governor office priorities for GHG reduction measures. • Develop a process for developing statewide application(s) and supporting/coordinating other applications
November 16, 2023	CPRG Phase 2 Program Overview	PSCAA Board of Directors	Zoom	• CPRG Phase 2 updates
November 21, 2023	South County Airea Transportation Board Meeting	South County Airea Transportation Board	Zoom	• Share information and build awareness around the CPRG program
December 15, 2023	Phase II Working Session II	Governor's Office, Commerce, Ecology, PSCAA, Cascadia Consulting	Zoom	• Strategy development for State and MSA Phase 2 applications.

Date(s)	Topic	Organizations/# individuals Involved	Outreach Method/ Location	Outcome(s)/Objectives
December 21, 2023	Phase II Working Session III	CPRG Steering Committee (MSA), Department of Ecology	Zoom	• Strategy development for State and MSA Phase 2 applications.
January 4, 2024	PSRC Equity Advisory Committee Meeting	Equity Advisory Committee	Zoom	• Share information and build awareness around the CPRG program
January 24 - February 7, 2024	PCAP Informal Comment Period	All stakeholders	Website	• Seek feedback on the draft PCAP with a focus on priority GHG reduction measures.

Future Outreach and Coordination

The Agency has hired a consultant to assist with the creation of a Community and Stakeholder Engagement Strategy to inform future development and implementation of the CCAP, with a focus on LIDAC and overburdened communities. The Community and Stakeholder Engagement Strategy is currently under development and will be finalized in May 2024. The strategy will include important elements such as engagement goals and objectives, roles and timelines, key messages, key audiences and partners, language needs and community context, engagement methods, and metrics to measure success.

The Agency and Department of Commerce currently host bi-weekly Community Engagement & Event Planning meetings to ensure alignment on future communication, outreach, and engagement efforts associated with CPRG. **Table 7** below outlines some of the planned community and stakeholder engagement events to support CCAP development over the next year.

Table 7: Future Outreach and Coordination Log

Date(s)	Topic	Organizations	Outreach Method	Outcome(s)/Objectives
April 29, 2024	Joint State/MSA CPRG CCAP Community Engagement Kickoff Meeting	Commerce, PSCAA	Zoom	• Share information and build awareness around the CPRG program. • Build relationships with regional and local entities. • Connect people to existing climate resources.

				• Ensure all stakeholders have the same information. • Provide awareness around key CPRG deliverables and timelines Issue identification and future coordination meetings
Fall 2024	MSA Stakeholder and Community Workshop 1	PSCAA	Zoom and/or in-person (TBD)	• CPRG outreach and engagement to inform CCAP development
Winter 2024	MSA Online Open House	PSCAA	Zoom	• CPRG outreach and engagement to inform CCAP development
Spring 2025	MSA Stakeholder and Community Workshop 2	PSCAA	Zoom and/or in-person (TBD)	• CPRG outreach and engagement to inform CCAP development

Section 9. Summary and Next Steps

The priority action measures identified in this PCAP represent concrete steps to support GHG emission reductions in the Seattle-Tacoma-Bellevue MSA, and many are replicable to other areas across the State of Washington. These and other climate mitigation efforts are essential to maintaining the health and well-being of the region's communities and will be especially impactful in those communities already overburdened by environmental inequities. In close collaboration with State agencies, these initial measures will also complement the numerous policies and programs already underway to meet the region and State's ambitious 2030 and 2050 GHG reduction targets.

Looking ahead, the Agency and CPRG partners across the State will continue to pursue additional federal and state funding to support all climate mitigation efforts in Washington. The Agency will also support eligible entities with grant writing support where possible. Lastly, the Agency is finalizing a Stakeholder Engagement Strategy to ensure all communities, and especially overburdened communities, are aware of the CPRG program and have access to apply for the significant amounts of funding available.

The MSA looks forward to the next steps in the CPRG process, including development of the CCAP. In line with CPRG requirements, we will update the region's GHG inventory, implement the Stakeholder Engagement Strategy, and further identify economy-wide emission reduction measures beyond the priorities already noted in this PCAP. We will also continue to work closely with the State and EPA Region 10 over the next two years to deliver a meaningful CCAP and leverage additional funding sources to support its recommendations.

Appendix A: MSA Jurisdictions with CAPs and Climate Change/Resiliency Projects

Jurisdiction	Population	CAP?	Climate Component	Equity	Goal 2030	Buildings and Energy						Transportation					Green Space			Waste and Services		
						Electrification & Efficiency	Mixed-use	Design Stands.	Middle Housing	Renew. Energy	Charging	Transit Investment	Complete Streets	Micromobility	Parking Reform	Telework	TDM	Sequestration/Urban Canopy	Green Government	Offsets	Green/Circular Economy	Waste Reduction	Local Food Production
King County	2,266,789	Yes	Yes	Yes	70%	Yes	Yes	Yes		Yes	Yes	Yes	Yes					Yes	Yes		Yes	Yes	Yes
Pierce County	927,380	Yes	Yes	Yes	45%	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes			Yes	
Snohomish County	840,079	No	Yes (2024 Comp. Plan)		N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Seattle	749,256	Yes	Yes	Yes	58%	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes				Yes			Yes	
Kitsap County	277,673	No			N/A	Yes	Yes			Yes		Yes	Yes				Yes						
Tacoma	221,776	Yes	Yes	Yes	33%	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes			Yes	Yes		Yes	Yes	Yes
Bellevue	152,767	Yes	Yes	Yes	50%	Yes	Yes	Yes		Yes	Yes	Yes	Yes					Yes	Yes			Yes	
Kent	134,392	No			N/A	Yes	Yes		Yes	Yes			Yes				Yes					Yes	
Everett	111,337	Yes	Yes	Yes	50%	Yes	Yes				Yes	Yes	Yes	Yes				Yes	Yes	No	Yes	Yes	
Renton	104,047	No		Yes	N/A		Yes						Yes				Yes	Yes				Yes	
Federal Way	97,863	No	Yes		N/A		Yes		Yes				Yes				Yes	Yes					
Kirkland	92,151	Yes	Yes	Yes	50%	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes			Yes	Yes		Yes	Yes	Yes
Auburn	84,858	No			N/A		Yes		Yes		Yes	Yes	Yes				Yes					Yes	
Redmond	76,732	Yes	Yes	Yes	50%	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes		Yes	Yes	
Marysville	72,275	No	Yes		N/A		Yes		Yes				Yes				Yes	Yes	Yes				
Sammamish	65,845	Yes	Yes		50%	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			Yes		Yes	Yes	Yes	Yes	Yes	
Lakewood	62,572	No	Yes		N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				Yes	Yes	Yes			Yes	
Shoreline	59,690	Yes	Yes	Yes	50%	Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes			Yes	Yes			Yes	
Burien	50,806	Yes	Yes	Yes	50%	Yes	Yes		Yes	Yes	Yes	Yes	Yes					Yes	Yes		Yes	Yes	
Bothell	49,017	No	Yes		N/A		Yes					Yes	Yes				Yes	Yes					
Bremerton	45,415	No	Yes		N/A	Yes	Yes		Yes				Yes					Yes	Yes				
Lynnwood	43,212	No	Yes	Yes	N/A		Yes			Yes		Yes	Yes				Yes	Yes	Yes			Yes	Yes
Edmonds	42,593	Yes	Yes	Yes	50% 2035		Yes				Yes	Yes	Yes	Yes				Yes	Yes	Yes	No		
Puyallup	42,452	No	Yes		N/A	Yes	Yes						Yes					Yes					
Lake Stevens	39,848	Yes		Yes	N/A	Yes	Yes				Yes	Yes	Yes					Yes	Yes		Yes	Yes	
Issaquah	39,344	Yes	Yes	Yes	50%	Yes	Yes	Yes	Yes	Yes	Yes	Yes				Yes		Yes	Yes			Yes	
University Place	34,634	No	Yes		N/A	Yes	Yes		Yes		Yes	Yes	Yes		Yes		Yes	Yes	Yes				
Des Moines	32,408	No			N/A		Yes		Yes		Yes		Yes				Yes		Yes			Yes	
SeaTac	30,525	No	Yes		N/A		Yes		Yes	Yes	Yes		Yes				Yes	Yes	Yes			Yes	
Maple Valley	28,220	No			N/A	Yes							Yes				Yes					Yes	
Mercer Island	25,172	Yes	Yes	Yes	50%	Yes				Yes	Yes	Yes	Yes	Yes				Yes	Yes		Yes	Yes	
Bainbridge Island	24,494	Yes	Yes	Yes	65% 2035	Yes	Yes		Yes	Yes	Yes	Yes			Yes	Yes		Yes	Yes			Yes	
Kenmore	23,478	Yes	Yes	Yes	50%	Yes	Yes		Yes	Yes	Yes		Yes			Yes		Yes	Yes		Yes	Yes	

Seattle-Tacoma-Bellevue MSA

Priority Climate Action Plan

Jurisdiction	Population	CAP?	Climate Component	Equity	Goal 2030	Buildings and Energy						Transportation					Green Space			Waste and Services		
						Electrification & Efficiency	Mixed-use	Design Stands.	Middle Housing	Renew. Energy	Charging	Transit Investment	Complete Streets	Micromobility	Parking Reform	Telework	TDM	Sequestration/Urban Canopy	Green Government	Offsets	Green/Circular Economy	Waste Reduction	Local Food Production
Bonney Lake	22,885	No	Yes		N/A		Yes		Yes		Yes	Yes	Yes				Yes	Yes				Yes	Yes
Mountlake Terrace	21,543	No			N/A	Yes	Yes		Yes		Yes	Yes	Yes				Yes	Yes					
Tukwila	21,377	No	Yes		N/A	Yes	Yes		Yes		Yes	Yes	Yes	Yes			Yes	Yes	Yes			Yes	Yes
Covington	21,374	No	Yes		N/A		Yes		Yes			Yes	Yes				Yes	Yes	Yes			Yes	
Mukilteo	21,096	No			N/A		Yes					Yes	Yes				Yes	Yes				Yes	
Arlington	21,059	No			N/A	Yes	Yes		Yes	Yes		Yes	Yes	Yes				Yes					
Mill Creek	20,828	No			N/A		Yes					Yes	Yes										
Monroe	19,243	No			N/A		Yes						Yes										
Port Orchard	17,089	No			N/A		Yes		Yes		Yes		Yes				Yes						
Snoqualmie	13,621	No	Yes		50%	Yes	Yes		Yes	Yes	Yes	Yes	Yes				Yes	Yes	Yes			Yes	Yes
Woodinville	13,261	Yes	Yes	Yes	50%	Yes	Yes				Yes		Yes	Yes				Yes	Yes		Yes	Yes	
Lake Forest Park	13,186	No	Yes		N/A	Yes	Yes		Yes	Yes			Yes				Yes	Yes	Yes			Yes	
Newcastle	12,902	No			N/A		Yes						Yes				Yes	Yes				Yes	
Edgewood	12,896	No			N/A		Yes		Yes				Yes					Yes					
Enumclaw	12,721	No			N/A		Yes		Yes			Yes	Yes				Yes						
Gig Harbor	12,484	Yes	Yes	Yes	45%	Yes	Yes			Yes	Yes	Yes	Yes					Yes	Yes			Yes	
Poulsbo	12,039	No			N/A		Yes		Yes	Yes			Yes				Yes	Yes	Yes				
Fife	10,809	No			N/A								Yes				Yes	Yes					
Sumner	10,595	No	Yes		N/A	Yes	Yes		Yes	Yes			Yes				Yes	Yes	Yes			Yes	
Snohomish	10,150	No			N/A	Yes	Yes		Yes		Yes	Yes	Yes					Yes	Yes			Yes	
DuPont	9,884	No	Yes		N/A	Yes	Yes	Yes			Yes	Yes	Yes				Yes	Yes					
Orting	8,954	No			N/A		Yes						Yes				Yes						
Stanwood	8,804	No			N/A		Yes		Yes				Yes				Yes					Yes	Yes
Milton	8,768	No			N/A	Yes	Yes		Yes			Yes	Yes				Yes						
Duvall	8,434	No			N/A		Yes		Yes			Yes	Yes				Yes	Yes				Yes	
North Bend	7,902	No	Yes		N/A		Yes		Yes	Yes	Yes		Yes				Yes	Yes				Yes	
Pacific	7,022	No			N/A	Yes	Yes		Yes	Yes		Yes	Yes					Yes	Yes				
Fircrest	6,998	No			N/A		Yes		Yes		Yes		Yes				Yes						
Steilacoom	6,727	No	Yes		N/A		Yes						Yes					Yes					
Normandy Park	6,607	No			N/A		Yes				Yes	Yes	Yes				Yes						
Brier	6,463	No			N/A							Yes	Yes			Yes	Yes	Yes					
Black Diamond	6,336	No	Yes		N/A	Yes	Yes	Yes	Yes	Yes		Yes	Yes				Yes	Yes				Yes	
Sultan	6,205	No			N/A		Yes		Yes			Yes	Yes				Yes					Yes	
Buckley	5,295	No			N/A		Yes		Yes			Yes	Yes									Yes	Yes
Granite Falls	3,364	No			N/A		Yes		Yes			Yes	Yes				Yes	Yes					
Algona	3,220	No	Yes		N/A		Yes		Yes				Yes					Yes					
Clyde Hill	3,110	No			N/A														Yes			Yes	

Seattle-Tacoma-Bellevue MSA

Priority Climate Action Plan

Jurisdiction	Population	CAP?	Climate Component	Equity	Goal 2030	Buildings and Energy						Transportation					Green Space		Waste and Services			
						Electrification & Efficiency	Mixed-use	Design Stands.	Middle Housing	Renew. Energy	Charging	Transit Investment	Complete Streets	Micromobility	Parking Reform	Telework	TDM	Sequestration/Urban Canopy	Green Government	Offsets	Green/Circular Economy	Waste Reduction	Local Food Production
Medina	2,920	No			N/A								Yes					Yes					
Eatonville	2,845	No			N/A		Yes			Yes	Yes		Yes					Yes					
Gold Bar	2,403	No			N/A		Yes		Yes				Yes										
Carnation	2,158	No			N/A		Yes		Yes			Yes	Yes				Yes	Yes					Yes
Darrington	1,460	No			N/A	Yes			Yes	Yes			Yes				Yes	Yes					Yes
Woodway	1,320	No			N/A								Yes				Yes	Yes					Yes
Yarrow Point	1,130	No			N/A																		
Ruston	1,055	No	Yes		N/A		Yes		Yes				Yes										
Roy	816	No			N/A		Yes		Yes		Yes		Yes				Yes						
Carbonado	734	No			N/A	Yes	Yes		Yes				Yes				Yes	Yes					
Wilkeson	499	No			N/A																		
Hunts Point	457	No			N/A																		
South Prairie	373	No			N/A																		
Beaux Arts Village	317	No			N/A																		
Skykomish	158	No			N/A	Yes						Yes	Yes										
Index	155	No			N/A	Yes						Yes	Yes						Yes				

Appendix B: GHG Inventory Methodology and Quality Assurance Procedures

Overview

The GHG Emissions Inventory referenced in this PCAP was the result of the Puget Sound Regional Emissions Analysis (PSREA) project. The project was led by King County in partnership with the Puget Sound Regional Council, Puget Sound Clean Air Agency, Seattle Public Utilities, King County Cities Climate Collaboration (K4C), Kitsap County, Pierce County, and Snohomish County.

For more details, see the four-county PSREA full report at:
https://pscleanair.gov/DocumentCenter/View/5361/2019-Four-County-GHG-EI-FINAL

Below is an overview of the methodology and quality assurance procedures.

Approach

The 2019 GHG emissions inventory was prepared in accordance with the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions and the Global Protocol for Community Scale Greenhouse Gas Emission Inventories (ICLEI 2013). Inventory data was gathered for the 2019 calendar year. It accounts for emissions from the activities of the four PSCAA counties' residents, businesses, employees, and visitors within or originating from within the county boundaries. This inventory does not include "upstream" GHG emissions related to the consumption of goods and services; those sources are estimated in the Consumption Inventory, which is discussed in greater detail in Appendix C.

Data Sources

The calculation of emissions generally requires activity and emissions factors. Activity data quantify levels of activity that generate GHG emissions, such as miles traveled and kWh of electricity consumed. Emission factors translate activity levels into emissions (e.g., MTCO2e per kWh).

The table below summarize the activity and emissions factors.

Sector	Activity	Emissions Factors
Transportation		
On-road vehicles	Modeled vehicle miles traveled by passenger and service/freight vehicles (PSRC, 2022)	Modeled emissions from VMT, vehicle makeup, and speed assumptions in the MOVES model (PSRC, 2022)
Aviation	Sea-Tac and Boeing Field fuel data	EPA emissions factors for jet fuel and aviation gas (USEPA, 2021)
Non-road vehicles and equipment	Emissions from non-road vehicles (USEPA, 2020)	
Freight and passenger rail	Emissions from Puget Sound Maritime Air Emissions Inventory (PSEI), attributed by tons of cargo (Starcrest Consulting, 2018)	

Sector	Activity	Emissions Factors
Marine vessels	Emissions from Puget Sound Maritime Air Emissions Inventory (PSEI), attributed by vessel calls (Starcrest Consulting, 2018) Ferry fuel consumption estimates by route	Ferry emission factors from Ports Emissions Inventory Guidance: Methodologies for Estimating Port-related and Goods Movement Mobile Source Emissions (USEPA, 2020) EPA emissions factors for ferry fuels (USEPA, 2021)
Building Energy		
Electricity	Electricity consumption (Snohomish – PUD; Kitsap – PSE, King - SCL and PSE; Pierce - PSE, Tacoma Power, Peninsula Light Company, Lakeview Light & Power)	Utility-specific emissions factors (SnoPUD, PSE, SCL, Tacoma Power, Peninsula Light Company, Lakeview Light & Power; The Climate Registry 2021)
Natural Gas	Natural gas consumption (PSE – Snohomish, King and Pierce; Cascade Natural Gas - Kitsap)	Utility-specific emissions factor (Puget Sound Energy, 2021)
Residential fuel oil	Washington state fuel sales (EIA, 2019)	EPA emissions factors for distillate fuel oil no.1 (USEPA, 2021)
Residential propane	Western region fuel sales (EIA, 2021)	EPA emissions factors for propane (USEPA, 2021)
Industrial processes	Facility emissions collected by the EPA FLIGHT tool (USEPA FLIGHT, 2019)	
Solid Waste & Wastewater		
Solid waste generation & disposal	Annual tons disposed and composted, as reported by state waste characterization study[12] (WA Dept. of Ecology, 2020) [13]	EPA WARM v15 model
Wastewater process emissions	Treatment process and population data provided by wastewater treatment plants and in public records	U.S Community Protocol methodology and emissions calculations for wastewater treatment plants (ICLEI, 2013)

[12] Snohomish County was the only County that was sampled in the Puget Sound region for the 2020-21 WA statewide waste characterization study (see map below). All 52 samples for Puget Sound region were collected within Snohomish County. Therefore, the composition data (%) reported for Puget Sound can also be used to show the composition for Snohomish County.

[13] Kitsap County was the only County that was sampled in the Puget Sound region for the 2015-16 WA statewide waste characterization study (see map below). All 58 samples for Puget Sound region were collected within Kitsap County. Therefore, the composition data (%) reported for Puget Sound can also be used to show the composition for Kitsap County.

Sector	Activity	Emissions Factors
Refrigerants		
Fugitive emissions of CFCs, HFCs, HCFCs from refrigeration systems and heat pumps.	Nationally reported fugitive gas emissions, scaled by population (USEPA, 2021)	
Land Use		
Agriculture	Acres of cropland and number of livestock (USDA, 2019)	Emissions per animal or per acre (USDA, 2019) (USEPA, 2021) (ICLEI, 2013)
Tree cover loss	Acres of tree cover loss (Global Forest Watch, 2021)	Emissions due to tree cover loss (Global Forest Watch, 2021)
Sequestration		
Solid waste disposal	Landfill carbon sequestration	EPA WARM v15 model
Forest sequestration	$MTCO_2e$ sequestered by forest (Global Forest Watch, 2021)	

Quality Assurance

The quality assurance procedures used in the inventory preparation are discussed in the four-county PSREA report and are referenced in the PCAP/CCAP Quality Assurance Project Plan (QAPP) prepared by the Agency and approved by EPA on October 30, 2023. The QAPP also describes quality assurance procedures to be used in the PCAP and CCAP analyses and reports. Briefly, the four-county inventory was conducted by Cascadia Consulting and used establish protocols for activity levels and emissions factors. The data obtained were reviewed by a steering committee of independent professionals. The results were also critically compared to previous years' inventories. For the PCAP and CCAP analysis, when possible, data will be taken from existing sources that have already been vetted and checked. All values will be reviewed internally by a separate staff member who has equal or greater experience and any discrepancies will be resolved or noted.

Appendix C: Quantified Priority GHG Reduction Measures

Built Environment

GHG Emissions Estimates and Assumptions

In the Built Environment, the GHG emissions currently come primarily from natural gas combustion, either on-premises for space or water heating, or from a natural gas fired utility used to generate electricity. Therefore, the GHG reductions and co-benefits can be calculated by assuming the energy delivered by natural gas combustion is instead supplied by (near) zero emission sources. Please refer to Appendix D for specific information on GHG reduction estimates and assumptions made for the priority measures identified in this PCAP.

Metrics for Tracking Progress

- Percent reduction in energy use for existing residential, commercial, and industrial buildings by 2030
- Percent electrification of existing residential, commercial, and industrial buildings by 2030
- Megawatts of local solar developed by 2030 (for PSE areas)
- Percent reduction of industrial GHG emissions by 2030
- Percent of salvaged lumber reused by 2030
- Percent increase in whole building, and building material, reuse by 2030
- Percent increase in commercial buildings designed for disassembly by 2030
- Program enrollment numbers including number of rebates provided, total equipment swapped/replaced, etc.
- Number of individuals and buildings reached through outreach and technical assistance programs

Implementation Timeline

Most priority measures would require hiring new staff to provide program oversight, and the execution of one or more contracts for services. These processes typically take 9 months when combined, as the new staff would typically be in charge of contract development. Sometimes this timing can be reduced to 7 months if existing staff have capacity to support the initial phase of advertising for contract services. The timing of these activities is reviewed below, and integrated in most measures listed in Appendix D as “Baseline Timing.”

<u>Hire Staff (3-4 months)</u>

- Month 1: Develop position description and obtain approval to post.
- Month 2: Advertise the position, and review candidate applications.
- Month 3: Conduct 1st and 2nd interviews of candidates and extend position offer.
- Month 4: Provide time for leave notice to previous employer, and complete onboarding.

Milestone: Staff position hired.

<u>Retain Contract Services (4-5 months)</u>

- Month 1: Develop RFQ. Invite selection panel members.

- Month 2: Review of RFQ, obtain approval to publicly post, and complete posting.
- Month 3: Pre-proposal conference, receive & develop public answers. Receive submittals.
- Month 4: Score proposals, interview top scorers, selection panel final meeting.
- Month 5: Negotiate contract amendments; obtain procurement approval; execute contract.

Milestone: Contract services retained.

Please see Appendix D for more specific information on the implementation timeline of each built environment priority measure.

Transportation

GHG Emissions Estimates and Assumptions

In the transportation sector, most GHG emissions come from the combustion of either gasoline, diesel, or jet fuel. The GHG emission reduction numbers were obtained from the PSREA wedge analysis. The baseline annual activity and PM (or VOC) emissions were obtained from EPA's COBRA model (https://www.epa.gov/cobra) by zeroing out the respective vehicle or fuel type in that subsector. The stated activity reduction was applied to the baseline annual emissions values and summed over the respective number of years. A representative equation is:

PM(or VOC) reduced = (% reduction in activity * PM(or VOC) from baseline emissions) * number of years

For the Active Transportation Plan, bike/pedestrian project, the GHGs and benefits were calculated by applying the percent increase in walk or bike trips to the current number and length of walk and bike trips. The current walk/bike trips and profile comes from the PSRC Regional Household Travel Survey from 2021. The walk/bike trip mileage was assumed to be substituting for gas vehicle driven trips. Emissions from gas vehicles for those miles was estimated using typical mileage per gallon and standard emission factors.

For the non-Single Family Housing (nSFH) charging measure, the GHGs were estimated from the total number of chargers needed by 2030 (200,000), which comes from the WA Transportation Electrification Strategy. Each charger is assumed to enable the equivalent of at least 1 gas car to be replaced with an EV. The annual emissions per car comes from typical use and mileage for our region. The total GHGs is then the sum of the annual emissions, which ramps up linearly from 2025 to 2030. A representative equation is:

Total GHGs = GHG/car/year * total car years (from 2025-2030) =

= GHG/(car*year) * (0.5 * 6 (years) * 200,000 (chargers))

For the transit and port heavy-duty electrification measures, GHGs were estimated based on the existing emissions from the 2019 inventory, for those respective vehicles. The reduction was then calculated as a sum of a linear ramp from 2025 to the stated target for 2030, for each subsector.

For the transit buses, medium duty vehicle electrification (including drayage trucks), fleet electrification, and ferry electrification: the total annual GHGs come from the number of vehicles, the total typical fuel consumption for each vehicle, and the emission factor for that fuel. The annual number is then ramped up or stepped up for the duration of 2025-2030, or 2025-2050. The PM2.5 and VOC emissions co-benefits are calculated by scaling the PM2.5 and VOCs using the GHGs from similar calculations.

Metrics for Tracking Progress

- Percent VMT reduction for passenger vehicles by 2030
- Updates on investments and commitments made in the regional pedestrian and bicycle transportation networks
- Percent VMT reduction for freight and service vehicles by 2030
- Percent of new passenger vehicles sold as EVs by 2030
- Amount of funding invested in EV charging infrastructure for passenger vehicles, particularly for disadvantaged communities.
- Percent of new freight and service vehicles sold as EVs by 2030
- Percent increase of new transit fleet vehicles to ZEV, including buses, ferries, streetcars, vanpools, specialized transportation vehicles, light rail, and commuter rail, etc.
- Percent reduction in GHGs from offroad equipment by 2030
- Percent increase of the region's medium and heavy-duty vehicle fleet transitioned to ZEV, including port drayage trucks and other seaport and airport vehicles and infrastructure
- Percent reduction in fuel carbon intensity for aviation fuels
- Percent reduction in aviation fuel use

Implementation Timeline

Successful implementation of transportation priority measures will involve partnerships between PSRC, Ports, transit agencies, equipment manufacturers, and various other stakeholders across the region. The timeline for different projects will vary; a high-level timeline is as follows:

- Year 1 (2025):
    - Task 1: Legal, engineering, and technical review of project designs
    - Task 2: Site design and utility consultation
    - Task 3: Equipment purchases
    - Task 4: Semi-annual CPRG reports
- Year 2 (2026):
    - Task 1: Installation of charging equipment
    - Task 2: Program administration
    - Task 3: Semi-annual CPRG reports
- Year 3 (2027):
    - Task 1: Program administration
    - Task 2: Semi-annual CPRG reports
- Year 4 (2028):
    - Task 1: Program administration
    - Task 2: Semi-annual CPRG reports
- Year 5 (2029):
    - Task 1: Program administration
    - Task 2: Semi-annual CPRG reports

Solid Waste and Wastewater

GHG Emissions Estimates and Assumptions

For the solid waste and wastewater sector, emissions are largely from transportation of waste, which will be addressed by the general transportation measures, or are from the specific processes. The reductions for GHGs are taken from the wedge analysis of the PSREA.

For the consumption-based decrease household food waste measure, GHG estimates are based on the lifecycle related GHG emissions reductions associated with avoided food waste. According to the USDA, at the household level, around 21% of purchased food is wasted. Detailed assumptions and references are documented in the King County Household Consumption-Based Emissions Abatement Analysis.

Metrics for Tracking Progress

- Percent of construction and demolition materials diverted from landfills by 2030
- Percent of other recyclable and compostable waste diverted from landfills by 2030
    - Tonnage diverted (reduction in food waste in garbage)
- Percent decrease of household food waste by 2030 and 2050
    - Tonnage (reduction in tonnage of food waste in garbage and increased compost production and use)
- Tonnage of food purchased shifting from higher to lower-carbon intensity foods, agricultural processes, and sources

Implementation Timeline

Successful implementation of solid waste measures will involve partnerships between the State, counties, cities, and public health agencies across the region. A high-level timeline is as follows:

- Year 1 (2025):
    - Task 1: Project and program design
    - Task 2: Site design and engineering review
    - Task 3: Outreach to cities and public health agencies
    - Task 4: Semi-annual CPRG reports
    - Task 5: Procurement: Confirm and kick off engagement of participating institutions & assess baseline GHGs emissions associated with menus at participating institutions
    - Task 6: Food Waste Prevention & Diversion: Identify high impact commercial establishments to engage with
    - Food Waste Prevention & Diversion: Develop and pilot commercial sector progressive enforcement program
    - Task 7: Compost Markets: Confirm and kick off engagement with partnering agencies and farmer organizations to share launch of voucher program and available technical assistance resources, with a particular focus on farmers from marginalized, frontline and refugee communities
- Year 2 (2026):
    - Task 1: Facility upgrades and construction
    - Task 2: Continued program design and implementation
    - Task 3: Semi-annual CPRG reports

    - Task 4: Procurement: Provide institutions with financial support and implementation support
    - Task 5: Procurement: Begin supplier/food producer engagement and provide mini-grants
    - Task 6: Food Waste Prevention & Diversion: Pilot compactor compliance audits and enforcement work
    - Task 7: Food Waste Prevention & Diversion: Behavior Change campaign research & planning
    - Task 8: Food Waste Prevention & Diversion: Continued engagement with targeted commercial establishments
    - Task 9: Food Waste Prevention & Diversion: Scale up of progressive compliance pilot
    - Task 10: Compost Markets: Scale up communications around available funding/resources, individualized technical assistance for farmers
- Year 3 (2027):
    - Task 1: Program administration
    - Task 2: Semi-annual CPRG reports
    - Task 3: Procurement: Continued implementation of menu changes
    - Procurement: Track, measure, and report on procurement changes and associated reductions in GHG emissions
    - Task 4: Food Waste Prevention & Diversion: Behavior change campaign implementation
    - Task 5: Food Waste Prevention & Diversion: Continued engagement with targeted commercial establishments
    - Task 6: Food Waste Prevention & Diversion: roll out of system-wide progressive compliance
    - Task 7: Compost Markets: Assess engagement reach and use of funds to inform continued engagement/recruitment efforts to utilize these funds/resources
- Year 4 (2028):
    - Task 1: Program administration
    - Task 2: Semi-annual CPRG reports
- Year 5 (2029):
    - Task 1: Program administration
    - Task 2: Semi-annual CPRG reports

Land Use & Sequestration

GHG Emissions Estimates and Assumptions

GHG emissions reductions for the land use and sequestration sectors come from the PSREA inventory. The reduction in tree loss assumes a linear ramp to zero tree loss by 2050, the total is then the sum of annual values for the stated years.

Metrics for Tracking Progress

- Percent reduction in tree loss by 2030
- Percent of land carbon sinks protected by 2030

Consumption

GHG Emissions Estimates and Assumptions

The GHG emissions for consumption come from the PSREA consumption wedge tool's scenario with existing priorities, measures, and goals. These occur in multiple sectors that are described in the geographic inventory. These actions are estimated to reduce King County household consumption-based emissions by 30% in 2050, relative to the reference case.

Appendix D: Existing Building Decarbonization Action Plan

Appendix D. Existing Building Decarbonization Action Plan

for King, Kitsap, Pierce and Snohomish Counties

February 29, 2024

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Acronyms, Abbreviations and Units List

AMI ..... area median income
BCA ..... benefit-cost analysis
BEPS ..... City of Seattle Building Emissions Performance Standard
BPS ..... Washington state Building Performance Standard
BRIC ..... Building Resilient Infrastructure and Communities
C-PACER ..... Commercial Property Assessed Clean Energy and Resilience
CCA ..... Washington state Climate Commitment Act
CBECS ..... Commercial Buildings Energy Consumption Survey
CBOs ..... community-based organizations
CERA ..... Carbon Emissions Reduction Account
CETA ..... Clean Energy Transformation Act
CEEP ..... Community Energy Efficiency Program
CIA ..... Climate Investment Account
CLF ..... Carbon Leadership Forum
CO_2 ..... carbon dioxide
CO_2e ..... carbon dioxide equivalent
Commerce ..... Washington state Department of Commerce
CRDZ ..... Community Disaster Resilience Zones
DES ..... District Energy Systems
DOE ..... U.S. Department of Energy
EC3 ..... Embodied Carbon in Construction Calculator
Ecology ..... Washington state Department of Ecology
ECJBG ..... Environmental and Climate Justice Block Grant
EECBG ..... Energy Efficiency and Conservation Block Grant
EIA ..... U.S. Energy Information Agency
EITE ..... emissions-intensive trade-exposed
EPA ..... U.S. Environmental Protection Agency
EPD ..... environmental product declaration
EUI ..... energy use intensity
FEMA ..... U.S. Federal Emergency Management Agency
FY ..... fiscal year
GHG ..... greenhouse gas
GWP ..... global warming potential
HEEHRA ..... High Efficiency Electric Home Rebate Act
HPWH ..... heat pump water heater
HUD ..... U.S. Department of Housing and Urban Development
HVAC ..... heating, ventilation and air conditioning
IRA ..... Inflation Reduction Act
kg ..... kilogram
kWh ..... kilowatt hours
LCA ..... life cycle assessment
LMI. ..... low- and moderate-income
LIHEAP ..... Low Income Home Energy Assistance Program
M ..... million
MIL-EMD ..... Washington State Military Department (MIL) Emergency Management Division

MMT ..... million metric tons
NOAH ..... naturally occurring affordable housing
NREL ..... National Renewable Energy Laboratory
PSCCU ..... Puget Sound Cooperative Credit Union
PUD ..... public utility district
PSE ..... Puget Sound Energy
PSREA ..... Puget Sound Regional Emissions Analysis
PSCAA ..... Puget Sound Clean Air Agency
RCW ..... Revised Code of Washington
RFQ ..... request for qualifications
SBCC ..... State Building Code Council
SEPA ..... State Environmental Policy Act
SES ..... State Energy Strategy
SIO ..... Switch is On
sf ..... square feet
TPU ..... Tacoma Public Utilities
U.S. ..... United States
WA ..... Washington state
WAP ..... Weatherization Assistance Program
WSEC ..... Washington state Energy Code
WSU ..... Washington State University
Wx ..... weatherization
Wx+H ..... Weatherization Plus Health
yr. ..... year

Executive Summary

This Building Decarbonization Action Plan assesses existing building greenhouse gas (GHG) emissions and identifies priority building decarbonization measures for four counties in the Puget Sound region, namely King, Kitsap, Pierce and Snohomish counties.

The Washington state Clean Energy Transformation Act (CETA) requires that electricity provided by utilities be GHG-neutral by 2030. While actions to increase renewable electricity sources or reduce electricity usage in buildings can result in GHG reductions from 2024-2030, but will not result in GHG reductions from 2030-onward due to CETA. As such, emissions from natural gas and other emission sources of onsite combustion – and the conversion of these appliances to electric fuel sources (also called electrification) – are a higher priority for long-term building GHG reductions.

The impacts of other state, federal and local legislation, fund sources, and programs are reviewed in this Plan, including:

- The state Clean Buildings Performance Standard, which will drive efficiency improvements in buildings over 20,000 square feet, but does not require onsite fossil fuel combustion reductions.
- The state Climate Commitment Act (CCA), which institutes a market-based cap and trade system to reduce emissions from large-scale GHG emitters. The Plan notes that, although CCA funds have resulted in a current $80 million electrification appropriation and a projected $50M allocation for multifamily buildings in the state budget, the long-term stability of the CCA as a funding source is currently unknown given a repeal initiative being undertaken within the state.
- The federal Inflation Reduction Act (IRA) which, among various subprograms, will provide up to $65M for electrification and efficiency rebates in Washington state.
- Federal and state weatherization funding, notably from Low Income Home Energy Assistance Program, the Weatherization Assistance Program, and state weatherization Plus Health funds. The Plan notes that for the 2023 – 2024 biennium, weatherization allocations were approximately $35 million, with similar projections for future biennia.
- Other programs and funding sources at multiple levels that could help advance fund building electrification, but are not required to be expended specifically towards the decarbonization of existing buildings.
- As well as additional decarbonization support programs, such as local building Accelerator Programs, rebate Navigator programs, and local government and utility incentive and financing programs.

The Plan builds on the above review by providing decarbonization targets for the commercial and residential buildings sector in the four counties covered by this Plan, based on the 2021 State Energy Strategy, and the Operation 2030 report that identifies statewide targets for these buildings sectors. For the four counties from 2025 – 2029, the Plan identifies a projected need for to decarbonize:

- 191,225 residential units, including 87,614 multifamily units, and
- 5,370 commercial buildings

The Plan assesses the existing and projected funding and regulatory requirements for 2025 – 2029 for the four counties, and determines these will likely support decarbonization of approximately:

- 22,576 residential unit decarbonization retrofits, including 5,110 multifamily units, and
- 289 commercial buildings

This indicates a decarbonization gap of 168,649 residential buildings and 4,716 commercial buildings that needs to occur from 2025 – 2029 in the four counties covered under this Plan to keep pace with state GHG reduction goals. The Plan also identifies gaps in financing support for needed GHG reductions, and in embodied carbon policy to support GHG reductions in the manufacture of building materials.

Per this analysis, the Plan identifies eleven priority measures to address the identified gap in needed GHG reductions for buildings in the four counties:

Appendix D. Measure 1: Heat pump rebate program for single-family homes
Appendix D. Measure 2: Water heating "tank swap" for single-family homes or small businesses
Appendix D. Measure 3: Whole-home decarbonization for single-family homes
Appendix D. Measure 4: Water heating "tank swap" for multifamily buildings and units
Appendix D. Measure 5: “Dryer swap" program for multifamily buildings and units
Appendix D. Measure 6: Whole-building decarbonization for multifamily buildings
Appendix D. Measure 7: Multifamily technical assistance
Appendix D. Measure 8: Community decarbonization grants
Appendix D. Measure 9: Embodied carbon program
Appendix D. Measure 10: Circular economy salvaged lumber program
Appendix D. Measure 11: Innovative financing program

Following identification of these Priority Measures, the Plan reviews the implementation authority of the four counties to pursue these Priority Measures, provides schedules and milestones to implement the identified Priority Measures, and concludes with GHG estimates for the identified Priority Measures.

This plan was developed by King County staff under the guidance of a Building Subcommittee in coordination with staff from Kitsap, Pierce and Snohomish Counties, with support from a Climate Pollution Reduction Planning grant from the U.S. Environmental Protection Agency (EPA).

Thank you to all the staff that contributed to the development of the Building Decarbonization Action Plan.

Introduction

This Building Decarbonization Action Plan is for four counties in the Puget Sound region, namely King, Kitsap, Pierce and Snohomish counties. This Plan will detail the current greenhouse gas (GHG) emissions of the four counties as it relates to buildings, review the landscape of existing building GHG reduction policies and programs, identify gaps, and prioritize specific measures to decarbonize buildings, or reduce or eliminate building GHG emissions.[14] This plan was developed by King County staff under the guidance of a Building Subcommittee in coordination with staff from Kitsap, Pierce and Snohomish Counties, with support from a Climate Pollution Reduction Planning grant from the U.S. Environmental Protection Agency (EPA).

1.0 Summary of Building Emissions

This section provides baseline information on the four counties and summarizes emissions by building type and end uses where available.

1.1 Counties in Context

The following information of the individual counties reviewed in this Plan helps to contextualize their different GHG emission patterns, namely baseline information on population, employment and housing.

Table 1.1 Basic County Demographics

County	2023 Population[15]	Nov 2023 Civilian Labor Force[16]	2023 Postcensal Estimate of Total Housing Units[17]
King	2,347,800	1,367,014	1,020,823
Kitsap	283,200	131,429	117,213
Pierce	946,300	467,271	372,113
Snohomish	859,800	464,494	336,690

In general, King County has a larger population and will show greater GHG emissions. However, there are variations in GHG intensity of fuel sources, as well as in levels of commercial and industrial activity between the counties. Total building emissions are reviewed, though emissions per capita are also provided to assess emission intensities regardless of population size.

1.2 PSREA Emission Profiles

In 2022 a regional partnership completed the Puget Sound Regional Emissions Analysis (PSREA), which provided comprehensive GHG emissions data for central Puget Sound cities and counties across King, Kitsap, Pierce, and Snohomish counties. This effort was in partnership with the King County-Cities

[14] California Energy Commission, "Building Decarbonization Assessment." [LINK]. Also, Elevate, "Building Decarbonization is Essential: Here's How it Works," February 10,2022. [LINK]. Accessed 2/29/2024.
[15] Washington State Office of Financial Management (WA OFM), "April 1, 2023 population of cities, towns, and counties used for the allocation of selected state revenues," April 1, 2023. [LINK]. Accessed 1/2/2024.
[16] Washington State Employment Security Department, "Labor force by county snapshot," December 26, 2023. [LINK]. Accessed 1/2/2024.
[17] WA OFM, "April 1, 2023 Housing Units," April 1, 2023. [LINK]. Accessed 1/2/2024.

Seattle-Tacoma-Bellevue MSA

Priority Climate Action Plan

Climate Collaboration (K4C), Kitsap County, Pierce County, the Puget Sound Clean Air Agency (PSCAA), Puget Sound Regional Council, City of Seattle, and Snohomish County.

The PSREA provides the following information about GHGs across the four counties for 2019, in million metric tons of carbon dioxide equivalent (MMTCO2e).

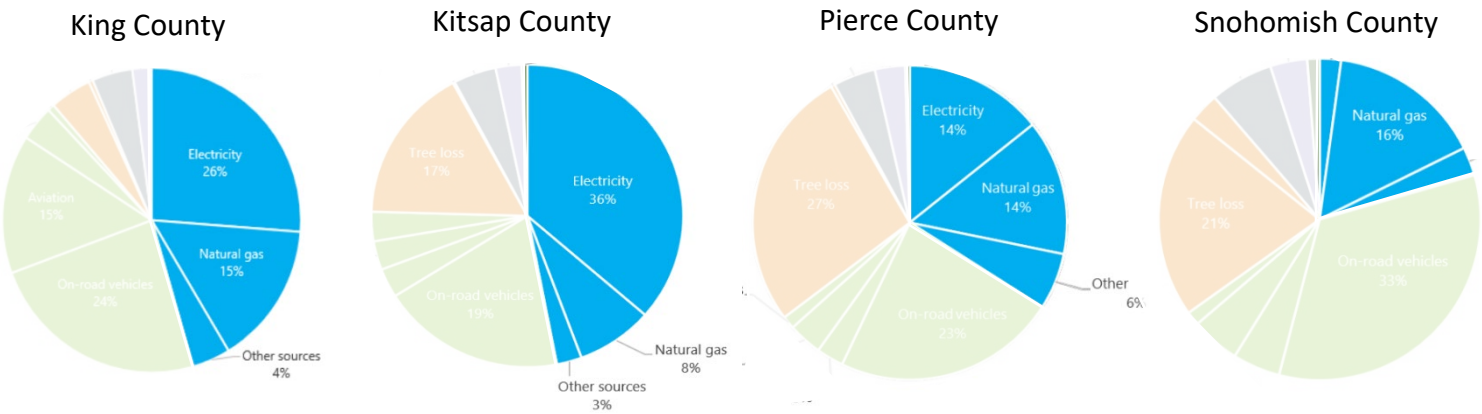
- King County annually emits 27.1 MMTCO2e annually, of which **12.3** MMTCO2e or roughly **45%** comes from buildings. After subtracting building emissions from electricity generation, approximately **5.2** MMTCO2e comes from fossil fuels and other sources.
- Kitsap County annually emits 3.2 MMTCO2e annually, of which **1.5** MMTCO2e or roughly **46%** comes from buildings. After subtracting building emissions from electricity generation, approximately **0.3** MMTCO2e comes from fossil fuels and other sources.
- Pierce County annually emits 10.8 MMTCO2e annually, of which **3.1** MMTCO2e or roughly **29%** comes from buildings. After subtracting building emissions from electricity generation, approximately **1.5** MMTCO2e comes from fossil fuels and other sources.
- Snohomish County annually emits 6.8 MMTCO2e annually, of which **1.8** MMTCO2e or roughly **26%** comes from buildings. After subtracting building emissions from electricity generation, approximately **1.7** MMTCO2e comes from fossil fuels and other sources.

This data is for the year 2019. Although data for the year 2020 was also collected it is not used in this Plan due to possible impacts of the global COVID-19 pandemic on long-term emissions sources and trends. These figures are also represented in graphic and tabular form below.

Table 1.2 Building GHG Emissions in 2019 in MMTCO2e

County	Total GHGs	Building GHGs	Building Fossil Fuels + Other
King	27.1	12.3	5.2
Kitsap	3.2	1.5	0.3
Pierce	10.8	3.1	1.5
Snohomish	6.8	1.8	1.7

Figure 1.1 Emissions Sources of the Four Counties



The following subsections break out emissions by fuel source for different built environment sectors, including electricity, natural gas, and other sources of emissions.

Building Emissions by Sector – Electricity

Table 1.3 shows 2015 and 2019 GHG emissions from electricity usage, including per-capita emissions relative to population. Most counties show increases in electricity emissions, which can be attributed to increased consumption and the carbon intensity of utility electricity fuel sources.

Table 1.3 Building GHG Emissions from Electricity by Sector in MTCO2e

County	2015	*per capita*	2019	*per capita*
King	**5,967,172**	***2.9***	**7,109,886**	***3.2***
Residential	2,515,936	*1.2*	2,859,396	*1.3*
Commercial	2,859,828	*1.4*	3,608,823	*1.6*
Industrial	591,408	*0.3*	641,667	*0.3*
Kitsap	**950,505**	***3.7***	**1,175,620**	***4.4***
Residential	609,750	*2.4*	745,027	*2.8*
Commercial	336,154	*1.3*	424,904	*1.6*
Industrial	4,601	*0.0*	5,689	*0.0*
Pierce	**1,206,004**	***1.5***	**1,551,948**	***1.7***
Residential	661,462	*0.8*	751,2217	*0.8*
Commercial	445,546	*0.5*	580,325	*0.7*
Industrial	98,996	*0.1*	220,406	*0.2*
Snohomish	**199,644**	***0.3***	**147,356**	***0.2***
Residential	99,395	*0.1*	81,918	*0.1*
Commercial	84,109	*0.1*	51,522	*0.1*
Industrial	16,140	*0.0*	13,916	*0.0*

The previous subsection highlighted building GHG emissions separate from electricity. This is due to the impacts of the Clean Energy Transformation Act (CETA), such that GHG emissions from gas and other onsite combustion sources are a higher priority for long-term building GHG reductions. For more information on CETA, see Section 2.1 of this Appendix.

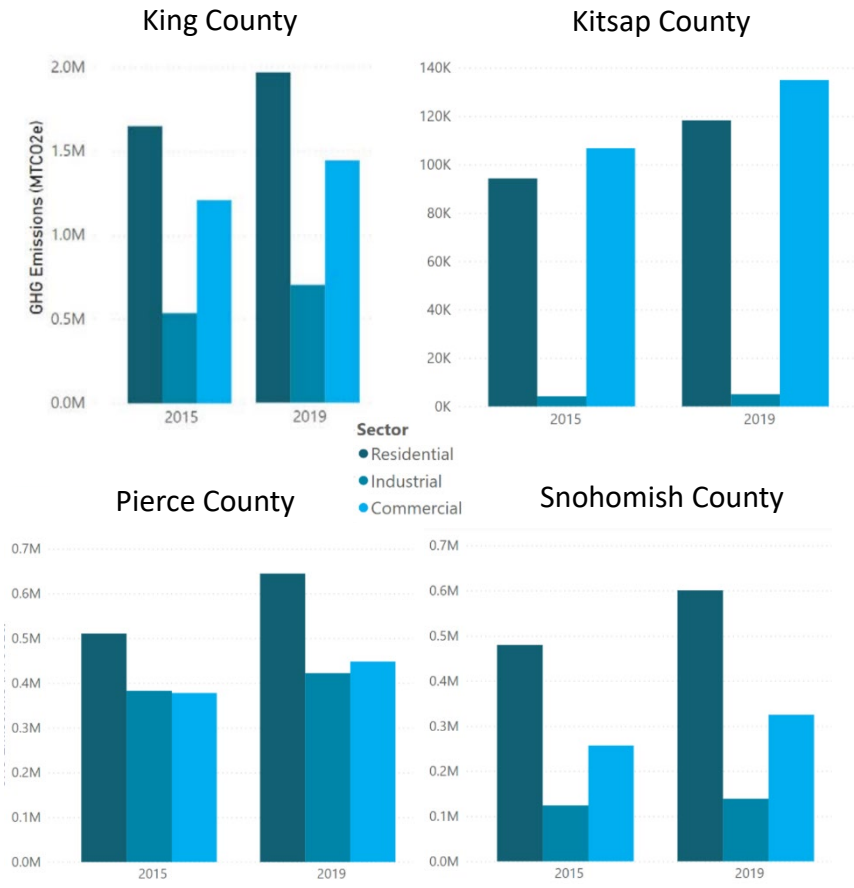
Building Emissions by Sector – Natural Gas

Table 1.4 shows 2015 and 2019 GHG emissions from natural gas usage, including per-capita emissions relative to population. All counties show increases in natural gas emissions, which can partially be attributed to an increased demand for heating fuels due to colder winter weather in 2019.

Table 1.4 Building GHG Emissions from Natural Gas by Sector in MTCO2e

County	2015	*per capita*	2019	*per capita*
King	**3,393,382**	***1.7***	**4,110,659**	***1.6***
Residential	1,650,087	*0.8*	1,967,193	*0.8*
Commercial	1,207,842	*0.6*	1,441,544	*0.6*
Industrial	535,453	*0.3*	701,922	*0.2*
Kitsap	**205,031**	***0.8***	**258,151**	***1.0***
Residential	94,200	*0.4*	118,232	*0.4*
Commercial	106,694	*0.4*	134,934	*0.5*
Industrial	4,137	*0.0*	4,985	*0.0*
Pierce	**1,270,787**	***1.5***	**1,514,712**	***1.7***
Residential	510,456	*0.6*	644,786	*0.7*
Commercial	377,698	*0.5*	447,907	*0.5*
Industrial	382,633	*0.5*	422,019	*0.5*
Snohomish	**859,353**	***1.1***	**1,064,127**	***1.3***
Residential	479,380	*0.6*	600,643	*0.7*
Commercial	256,498	*0.3*	324,877	*0.4*
Industrial	123,475	*0.2*	138,607	*0.2*

Figure 1.2 Gas Emissions of the Four Counties



Four Different Portraits on Gas

King and Kitsap Counties have very different natural gas usage profiles, primary due to differences in population size, with the King County population ten times that of Kitsap. However, it is notable that Kitsap has greater commercial gas emissions, and virtually no industrial gas, so natural gas initiatives may benefit from different foci.

In contrast to the above, Pierce and Snohomish Counties are of a similar population size, with relatively similar magnitudes of emissions from natural gas. One difference is in industrial gas emissions, with Pierce County showing the highest per capita ratio of industrial gas emissions (see Table 1.4 above). This again underscores the possible benefit of different foci for natural gas initiatives in the counties.

Building Emissions by Sector – Other Sources

Other sources of building emissions include emissions from residential propane, industrial processes, and from residential, commercial, and industrial fuel oil.

Table 1.5 Building GHG Emissions from Other Sources by Sector in MTCO2e

County	2015	*per capita*	2019	*per capita*
King	**1,163,670**	***0.6***	**1,115,643**	***0.5***
Fuel Oil	443,744	*0.2*	334,738	*0.1*
Residential Propane	66,124	*0.0*	112,522	*0.0*
Industrial Processes	653,802	*0.3*	668,383	*0.3*
Kitsap	**78,615**	***0.3***	**84,037**	***0.3***
Fuel Oil	34,962	*0.1*	27,917	*0.1*
Residential Propane	41,340	*0.2*	54,743	*0.2*
Industrial Processes	2,313	*0.0*	1,377	*0.0*
Pierce	**476,065**	***0.6***	**631,098**	***0.7***
Fuel Oil	90,604	*0.1*	62,535	*0.1*
Residential Propane	34,885	*0.0*	49,466	*0.1*
Industrial Processes	350,576	*0.4*	519,097	*0.6*
Snohomish	**178,766**	***0.2***	**195,304**	***0.2***
Fuel Oil	83,091	*0.1*	56,763	*0.1*
Residential Propane	68,850	*0.1*	100,656	*0.1*
Industrial Processes	26,825	*0.2*	37,885	*0.0*

It is worth noting that the PSREA provided distinct emission estimates for refrigerants, separate from buildings. As such, while many refrigerants do originate from building appliances, they are not included here as part of the building emissions.

For more information on data sources used to generate the PSREA, please see Appendix D.1 PSREA Emission Sources.

2.0 Existing Buildings Landscape Analysis

This section reviews the existing and expected policies, programs and funding sources driving existing building emissions reductions in the counties covered in this Plan, including state, local and federal laws, policies, programs funding sources, and key actors. As all of these inputs can drive existing building GHG emission reductions, these activities are grouped into state and local drivers, and federal drivers.

2.1 State and Local Drivers

This subsection summarizes and reviews the impacts of state and local drivers, namely CETA, the Climate Commitment Act (CCA), and other state programs; the State Clean Building Performance Standard (BPS) and the Seattle Building Emissions Performance Standard (BEPS); local accelerator and navigator programs; as well as local utility and local government programs and financing options.

Clean Energy Transformation Act (CETA)

Signed into law in 2019, CETA requires that electricity provided by utilities be coal-free by 2025; GHG-neutral by 2030, through offsets if necessary; and that there are no GHG emissions from electricity generation by 2045.[18] Actions to increase renewable electricity sources or reduce electricity usage in buildings can result in short-term GHG reductions from 2024-2030. However, such actions will not result in long-term GHG reductions from 2030-onward due to CETA. As such, emissions from natural gas and other emission sources of onsite combustion are a higher priority for long-term building GHG reductions.

Clean Buildings Performance Standard (BPS) & Local BEPS

Signed into law in 2019 and later expanded in 2022 and 2023, the state BPS was designed with the objective of lowering costs and improving energy efficiency in certain "covered" existing commercial and multifamily buildings as well as in district energy systems (DES).[19] The BPS program can be broken down into three tranches, namely tier 1, tier 2, and DES.

Tier 1 applies to commercial buildings (including non-residential, hotel, motel and dormitory buildings) with 50,000 square feet (sf) or more of conditioned space, with reporting periods for ≥220,000 sf, 90,000 sf and 50,000 sf buildings starting in 2026, 2027 and 2028 respectively.[20] For the four counties in this Plan, this applies to:

- 5,689 buildings in King County
- 317 buildings in Kitsap County
- 2,318 buildings in Pierce County, and
- 1,716 buildings in Snohomish County.[21]

[18] WA Commerce, "Overview, Clean Energy Transformation Act," 2023. [LINK]; and "Clean Energy Transformation Act," 2023. [LINK]. Accessed 1/2/2024.
[19] WA Commerce, "Clean Buildings," 2023. [LINK]. Accessed 1/3/2024.
[20] WA Commerce, "Clean Buildings Performance Standard," 2023. [LINK]; and "Clean Buildings - Frequently Asked Questions," 2023. [LINK]. Accessed 1/3/2024.
[21] WA Commerce, "Clean Buildings Legislative Report," January 25, 2022. [LINK]. Accessed 1/3/2024. Pg 8.

The BPS requires each building to meet an energy performance state or Energy Use Intensity (EUI) Target based on end uses and building type. Buildings above their EUI Target must follow BPS Investment Criteria to implement cost-effective energy efficiency measures.[22]

Tier 2 applies to commercial buildings with 20,001 to 50,000 sf, and multifamily buildings that have more than 20,000 sf, of conditioned space. The law requires benchmarking, energy management plans, as well as operations and maintenance programs with initial reporting expected July 1, 2027.[23] Rules for Tier 2 performance standards must be adopted by December 2030.

DES facilities applies to publicly-owned district energy systems serving at least three to five buildings with over 100,000 sf of conditioned space. The BPS requires a 15-year decarbonization plan, due for submission to Washington State Department of Commerce (Commerce) by June 30, 2025.[24]

No funds are reserved for DES facility upgrades, but other BPS early adopters may qualify for the following:

- Tier 1 and multifamily over 50,000 sf: A one-time payment of $0.85/sf (excludes parking, and un/semi-conditioned spaces), with total funds limited to $75 million.[25]
- Tier 2: An incentive program at a rate of $0.30/sf, with total funds limited to $150 million.[26]

It should also be noted that Washington's preliminary 2024 –2025 supplemental budget includes an additional $100 million for affordable multifamily buildings supporting BPS compliance, including benchmarking and retrofits for energy efficiency and electric appliances such as heat pumps.[27] Although this funding is still uncertain, it would affect funding available for multifamily buildings subject to BPS if approved.

Seattle BEPS

Similar to the state BPS, the Seattle BEPS applies to existing commercial and multifamily buildings larger than 20,000 sf.[28] However, unlike the state BPS which requires buildings to align with *energy efficiency* targets, the BEPS policy requires buildings in the City of Seattle to meet progressively lower *GHG emission* targets over time.

As noted in the above section on CETA, utility-provided electricity in the state of Washington will be GHG-neutral by 2030. As such, buildings subject to the state BPS may achieve compliance through improving their electrical efficiency, which would not reduce GHG emissions after 2030 due to the state-required clean energy grid. By focusing directly on GHG emissions, Seattle BEPS will ensure GHG emission reductions over the long term within the City of Seattle.

[22] Seattle City Light, "WA Clean Buildings Standard FAQ." [LINK]. Accessed 1/3/2024. Pg 8.
[23] WA Commerce, "Clean Buildings Performance Standard," 2023. [LINK]. Accessed 1/3/2024.
[24] Washington State (WA) Legislature, "Second Substitute House Bill 1390," 2023. [LINK]. Accessed 1/3/2024. Pg. 3.
[25] WA Commerce, "Early Adopter Incentive Program," 2023. [LINK]. Accessed 1/3/2024.
[26] WA Commerce, "Clean Buildings Performance Standard," 2023. [LINK]. Accessed 1/3/2024.
[27] OFM, "Proposed 2024 Supplemental Budget & Policy Highlights" December 2023. [LINK]. Accessed 1/4/2024. Pg 37 (PDF 41).
[28] Craighead, Callie, "Mayor Harrell Signs Building Emissions Performance Standard (BEPS) Legislation into Law," Seattle Office of the Mayor News Release, December 13, 2023. [LINK]. Accessed 1/3/2024.

The largest Seattle BEPS-covered buildings must begin reporting in 2027 and meet the first emission targets in 2031. All covered buildings are required to meet net-zero emissions by 2050, though BEPS has flexible compliance pathways, with low-income housing and human services given more preparation time.[29] Compliance is supported through multiple means, including the Seattle Clean Buildings Accelerator that provides technical support and upgrade funding, detailed more in the following subsection.

Local Accelerators & Local Navigators

Local governments, utilities and coalitions operate some programs that help to support groups of individual building owners and occupants, supporting compliance with laws or guiding owners toward voluntary upgrades that can result in reduced existing building emissions. Two types of active programs in the four counties covered in this Plan are Accelerator Programs and Navigator Programs.

Accelerator Programs

The term "Accelerator Program" is not consistently defined among non-profit, state, or federal entities. The federal Better Buildings Accelerator was developed to facilitate peer-to-peer learning to collaboratively discover solutions to specific policies or building approaches.[30] In contrast, local Accelerator Program examples are not peer-to-peer, but usually consist of technical consultants retained by a local government or utility that offer specific services to large commercial and multifamily building owners to improve efficiency and compliance with the state BPS. Guidance to existing or additional accelerator-only incentives are sometimes provided in the program. There are four known Accelerator Programs within the counties covered in this Plan:

Seattle Clean Buildings Accelerator, which provides technical support, light coaching, trainings and upgrade funding within the City of Seattle in King County.

Bellevue Clean Buildings Incentive Program, which provides complementary energy benchmarking supporting, building scoping assessments, and support in applying for state BPS early adopter incentives within the City of Bellevue in King County.

Puget Sound Energy (PSE) Clean Buildings Accelerator, which provides a four-month virtual training and year of support, coaching, and guidance for PSE energy-management and incentive programs. PSE provides electrical service to at least part of three of the counties save Snohomish, and gas to at least part of the three of the counties save Kitsap.

Snohomish PUD Clean Buildings Accelerator Program, which offers a four-month program with workshops, tailored coaching and virtual energy scans, as well as Operations and Management Tools. Snohomish PUD provides electrical services to all of Snohomish County.

Lastly, although Tacoma Public Utilities (TPU) in Pierce County does not have a full Accelerator Program per se, it offers high level electricity performance assessments. While TPU notes that this will not satisfy

[29] Craighead, Callie, "Mayor Harrell Signs Building Emissions …" ibid. [LINK]. Accessed 1/3/2024.
[30] U.S. Department of Energy (DOE) Better Buildings, "Accelerators Overview." [LINK]. Accessed 1/4/2024.

the BPS energy audits, it helps identify potential opportunities and provides a range of energy conservation rebates and incentives to help offset investment costs.[31]

Navigator Programs

The term "Navigator Program" is also not consistently defined among non-profit, state, or federal entities. The federal Better Buildings Financing Navigator was developed to help organizations find financing solutions for energy efficiency and renewable energy projects.[32] Local government or non-profit Navigator Programs similarly assist navigating financial resources for green projects, but they primarily help users to navigate rebates from several local sources, such as state, local and utility programs. They are typically oriented towards smaller existing building users, such as single-family homeowners and renters, and can also help users to find contractors; small multifamily and small commercial entities are sometimes also included.[33] These programs may also be called helpdesks, concierge services, or energy advisor services, and may include community ambassadors, or community members educated on climate issues providing voluntary or paid time for direct community outreach.[34]

In 2023, a bill that would have instituted a statewide Navigator Program failed to pass. House Bill 1391, the Energy Upgrade Navigator Program, would have created a central information hub for efficiency and electrification programs, helping building owners to access clean energy funds, connect with installers and energy auditors, and support outreach targeted to pollution-burdened communities.[35] This bill has been reintroduced in 2024 as 2SHB 1391, though its probability of passage is currently unknown.[36]

In the current vacuum of comprehensive guidance for residents and small business owners, several jurisdictions are collaborating to create an electrification campaign, The Switch is On (SIO) , modeled after the existing California program operated by the Building Decarbonization Coalition (BDC). The Washington program will provide Navigator services for a one-year pilot period using one-time funds, with a marketing and outreach focus to attract program users. Ideally, a robust Navigator bill will be passed in the 2024 legislative session that can sustainably fund an expanded, comprehensive Navigator platform to help guide users on existing rebates, and spur on additional home improvements that reduce GHG emissions. It is also notable that Washington's preliminary 2024 –2025 supplemental budget proposes $7 million to create a statewide Navigator program.[37] In the interim, SIO collaborators for the one-year pilot include two of the four counties addressed in this Plan, and some of their major cities, including King and Pierce Counties, and the cities of Seattle and Tacoma; other SIO partners include Thurston County and the City of Olympia.

[31] Tacoma Public Utilities (TPU), "Washington Clean Buildings Law," last updated 2024. [LINK]. Accessed 1/4/2024.
[32] DOE Better Buildings, "What is the Better Buildings Financing Navigator?" [LINK]. Accessed 1/4/2024.
[33] City of Boulder, "Energy Smart." [LINK]; HeatSmartCNY, "Enroll with Heat Smart CNY." [LINK]; Elevate, "Building Efficiency Hubs," 2024. [LINK]. Accessed 1/4/2024.
[34] The Switch is On, "Ambassador Interest Form." [LINK]. Accessed 1/4/2024.
[35] Robinson, Joelle, "WA folks can benefit from home energy incentives... but we need help," Climate Solutions, February 7, 2023. [LINK]. Accessed 1/4/2024.
[36] WA Legislature, "HB 1391 - 2023-24," 2024. [LINK]. Accessed 1/23/2024.
[37] OFM, "Proposed 2024 Supplemental Budget…," ibid. [LINK]. Accessed 1/4/2024. Pg 36 (PDF pf 40).

Local Utilities, Local Programs & Local Financing Programs

This subsection reviews local utility incentives, programs operated by local governments, and local financing initiatives with the potential to reduce existing building GHG emissions.

Local Utilities

Multiple utilities operate within the four counties covered by this Plan. Of these, only PSE offers both gas and electricity services, only Cascade Natural Gas offers only gas services, and the rest are solely electrical utilities. All of the utilities in operation offer incentives for both commercial and residential buildings, which can support energy efficiency. The operating utilities, links to incentive programs, and the counties included in their service territories, are noted in Table 2.1.

Table 2.1 Utility Operators and Energy Efficiency Incentive Programs of the Four Counties

Utility Operator	**Service Type**		**Incentive Programs**		**Service Territory Coverage**			
	Gas	*Electricity*	*Residential*	*Commercial*	*King*	*Kitsap*	*Pierce*	*Snohomish*
Cascade Natural Gas	X		X	X		X		X
Lakeview Light & Power		X	X	X			X	
Peninsula Light Company		X	X	X			X	
PSE								
Natural Gas	X		X	X	X		X	X
Electricity		X	X	X	X	X	X	
Seattle City Light		X	X	X	X			
Snohomish PUD		X	X	X				X
Tacoma Power		X	X	X			X	

Although most utilities offer incentives to install efficient heating, ventilation, and air conditioning (HVAC) and water heating systems, almost no utilities offer incentives for fuel switching – or changing a home fuel source from one type of fuel to another for items such as space or water heating appliances. There is a general prohibition against funding fuel switching for local governments, municipal utilities and state subdivisions if such entities sell or distribute energy per the state constitution.[38] It is notable that these prohibitions do not apply to co-ops and investor-owned utilities (such as PSE).[39]

Despite the limited regulatory framework, all utilities incentivize efficient electric equipment (e.g., heat pumps for space conditioning and heat pump water heaters). PSE, Seattle City Light, Snohomish PUD, and Tacoma Power participate in a regional midstream incentive program for efficient electric equipment that has a flat incentive regardless of existing fuel source.[40] TPU also offers $500 to $1,000 downstream rebates for heat pump installations for homes using natural gas heat.[41] And finally, due to a

[38] Washington State Constitution, Article 8, Section 10. [LINK]. Accessed 1/8/2024.
[39] American Council for an Energy-Efficient Economy (ACEEE), "State Policies and Rules to Enable Beneficial Electrification in Buildings through Fuel Switching," May 2020. [LINK]. Accessed 1/8/2024. Pg 14.
[40] Energy Solutions, "Pacific Northwest Midstream Programs" [LINK] Accessed 2/20/24.
[41] Beth Jarot, City of Tacoma Resilient & Green Building Specialist, email communication with author, January 10, 2024.

rate case settlement, PSE has launched a Targeted Electrification Pilot that includes a free home electrification assessment with a $50 participation incentive, and enhanced incentives for residential gas customers within PSE's electric and gas service area ($3,000 rebates for homes that switch to a qualifying electric heat pump and an additional $4,000 efficiency boost for low- and moderate-income homeowners).[42] While beneficial, it should also be emphasized that it is unknown if this rebate will become a permanent program. PSE has filed to extend and expand upon both these offerings; however, the future of PSE electrification funding is highly contingent on the future of CCA (see Section 2.1.e).

Local Government Programs

Several local governments have launched programs in recent years focused on incentivizing or installing electric heat pumps, some with an emphasis on switching off fossil fuel heating sources. This includes three programs within King County, and one set to launch within Kitsap County in 2024.

King County Energize! Pilot

The King County Energize! pilot program will install heat pumps in 120 – 150 single-family homes in the North Highline and Skyway-West Hill unincorporated areas in 2024, providing 100% cost-coverage for low-income residents, and 80% cost-coverage for moderate income residents. The program is open to homeowners, and rental households where the owner has agreed to improvements and signed an agreement to maintain three years of affordable rent. Homes with any heating fuel type may apply. The program also provides application support to weatherization agencies and utility discount programs.

Energy Smart Eastside Program

The Energy Smart Eastside program is jointly operated by the Cities of Bellevue, Issaquah, Kirkland, Mercer Island, and Redmond.[43] The program has four residential incentive and installation options:

- Distributor Incentive: Provides a $500 rebate when a heat pump is purchased through the Energy Smart Eastside dealer network, issued through the HVAC distributor Gensco;
- Fuel Switch Incentive: Provides an additional market-rate incentive of $1,500 for middle-income residents (80%-150% area median income (AMI)) who switch off of gas, oil or wood as a primary heating source;
- "Boost 100%" Cost Coverage: Fully funds heat pump installations for low-income single-family residents (>80% AMI), and connects homes to weatherization and energy bill services with partner organizations;
- Affordable Housing Weatherization & Heat Pumps: Leverages a partnership with the King County Housing Authority to coordinate heat pump installations and weatherization for multifamily buildings with permanent affordable housing stock at 100% cost coverage.[44]

[42] Puget Sound Energy (PSE), "Go electric: Switch to a heat pump," 2024. [LINK]. Accessed 1/10/2024.
[43] Energy Smart Eastside (ESE), "Who We Are." [LINK]. Accessed 1/10/2024.
[44] Sarah Phillips, Energy Smart Eastside Program Manager, email communication with author, October 10, 2023.

This program operates with the community partner Hopelink to administer the Boost program, and HVAC distributor Gensco to support incentive distribution and other program components.[45] As of October 2023, the program had achieved and anticipated the following:

- Distributor Incentive: Approximately 40 distributor $500 rebates have been redeemed;
- Fuel Switch Incentive: Marketing of this rebate is scheduled to launch the first quarter of 2024, with enough funding for 170 rebates;
- "Boost 100%" Cost Coverage: The first cohort of 21 home installations are anticipated to complete in the first quarter of 2024, with funding available for another 65-70 heat pumps;
- Affordable Housing Weatherization & Heat Pumps: 35 units have been retrofitted, 54 units are partially complete, and another 48 units are expected to complete in the first quarter of 2024.[46]

The program is funded by city dollars matched with grants from Commerce Clean Energy Fund and Washington State University (WSU) Community Energy Efficiency Program (CEEP); note that WSU CEEP funds are reviewed more in Section 2.1.f, Other State Programs.[47] Should additional funds be secured the program may continue to operate at the same capacity in future years, though the types of incentives available, and types of buildings targeted in the program, may morph depending on operator assessments of the initial program offerings.

Seattle Clean Heat Program

The City of Seattle Clean Heat program offers a $2,000 instant rebate for homes that switch from oil heating to a qualified energy-efficient electric heat pump.[48] This program includes a no-cost oil to heat pump conversion for income-qualifying customers offered through the City of Seattle Office of Housing.[49] Both programs require households to be within City of Seattle limits. As of January 2023, City of Seattle has provided over 1,000 rebates and no-cost upgrades for low- and moderate-income homes to transition from oil heat to electric heat pumps.[50] The Seattle City Council approved $2.6 million in its 2023 – 2024 budget for oil conversion incentives.[51] The City of Seattle's goal is to eliminate heating oil from use in Seattle by 2028. Based on program participation rates and naturally occurring conversions, Seattle expects to reach this milestone.[52]

[45] Energy Smart Eastside (ESE), "Who We Are." [LINK]. Accessed 1/10/2024.
[46] Sarah Phillips, Energy Smart Eastside Program Manager, email communication with author, October 10, 2023.
[47] Energy Smart Eastside (ESE), "Who We Are." [LINK]. Accessed 1/10/2024.
[48] Seattle Office of Sustainability and the Environment (OSE), "Seattle's Clean Heat Program." [LINK]. Accessed 1/10/2024.
[49] Seattle Office of Housing, "Oil-to-Electric (Clean Heat) Program." [LINK]. Accessed 1/10/2024.
[50] Schoeck, Michael, "Seattle surpasses 1,000 heat pump rebates as the city curbs emissions," PV Magazine, January 12, 2023. [LINK]. Accessed 1/10/2024.
[51] Benedict, David, "Seattle has reached a milestone of providing more than 1,000 rebates and no-cost upgrades to help low-to-middle income switch to an energy-efficient electric heat pump!" OSE Greenspace Blog, January 11, 2023. [LINK]. Accessed 1/10/2024.
[52] Christine Bunch, City of Seattle Climate & Energy Strategic Advisor, email communication with author, January 18, 2024.

Bainbridge Island Pilot

Within Kitsap County, the City of Bainbridge Island is launching a 2024 pilot heat pump installation program, targeting up to fifteen high-efficiency heat pump installations prioritized for low- and moderate-income households.[53] The program aims to replace or supplement inefficient electric, propane, fuel oil or wood stove heating, and will leverage existing utility programs and Trade Allies that support energy efficiency measures for Island homes.

Local Financing

There are several local financing options to support reducing existing building GHG emissions offered through the efforts of local governments and utilities, including C-PACER, forgivable loans, and low-interest lending.

C-PACER

In 2020, Washington state passed legislation that allowed counties to create and administer Commercial Property Assessed Clean Energy and Resilience (C-PACER) programs.[54] These programs allow property owners to access financing for qualifying building projects, including energy efficiency, renewable energy generation and storage, water conservation, and resiliency improvements.[55] C-PACER programs do not use any government funds; instead, these programs enable a specific type of loan agreement between a private lender and the property owner. The County records the loan as a lien on the property, such that if the property owner sells the building, the assessment (debt associated with the improvement) stays with the building.[56] Additional C-PACER financing benefits are that:

- Property owners can save money by lowering utility bills and energy costs;
- PACER projects can be cash-positive quicker than traditional loans due to longer payback terms;
- PACER loans rarely require cash up front, making them more accessible to property owners.

C-PACER loans are an option for building retrofits and new development projects for commercial, multifamily (five units or more), agricultural and industrial properties in the Counties that have adopted C-PACER ordinances, namely King, Pierce and Snohomish Counties.[57]

Forgivable Loans

A forgivable loan is one where either part or all of the loan repayment is not expected to be repaid, or "forgiven," if the borrower meets specific criteria within a period of time.[58] While not common within the four counties covered in this plan, forgivable loans are offered by TPU for rental properties serving

[53] Autumn Salamack, City of Bainbridge Climate Mitigation & Adaptation Officer, email communication with author, January 10, 2024.
[54] ShiftZero, "Commercial Property Assessed Clean Energy and Resilience (C-PACER) Financing in Washington." [LINK]. Accessed 1/4/2024.
[55] ShiftZero, "Commercial Property Assessed Clean Energy and Resilience (C-PACER)…," ibid. [LINK]. Accessed 1/4/2024.
[56] King County, "King County C-PACER Program." [LINK]. Accessed 1/9/2024.
[57] ShiftZero, "Commercial Property Assessed Clean Energy and Resilience (C-PACER)…,"ibid. [LINK]. Accessed 1/4/2024.
[58] Jones, Mel, " What is a Forgivable Loan," Experian, September 28, 2021. [LINK]. Accessed 1/10/2024.

income-qualified tenants.[59] These loans are available for upgrades such as insulation heat pumps, and heat pump water heaters, though the subject properties must primarily be heated through electric heat, and have four or less units per building.[60]

Low-Interest Lending

Some utilities, cities, counties, and even Washington state have partnered with non-profit lenders to secure more beneficial lending terms to finance energy improvements; such loans are typically available to single-family homeowners. The loan terms may have longer repayment terms, higher lending ceilings, more beneficial lending rates, or be available to those with lower credit scores than usual. Additionally, some utilities have agreements with lenders that allow for on-bill loan repayment. Some lower-interest financing options available in the four counties covered in this plan are reviewed in Table 2.2.

Table 2.2 Example Green Lending Options Within the Four Counties

Lender	Interest rate	Terms	Loan Ceiling	Notes
Craft 3	4.49% – 4.88%	Up to 20 yrs.	$50,000	For Seattle City Light customers
PSCCU	9.5% – 12.00%	Up to 10 yrs.	$35,000	Statewide
PSCCU	7.25% – 12.00%	Up to 20 yrs.	$85,000	Statewide
PSCCU	7.25% – 12.00%	Up to 15 yrs.	$50,000	Snohomish County

Climate Commitment Act (CCA)

Although the CCA does not directly affect existing buildings, there are three ways in which the CCA intersects with the existing building landscape, namely as a potential source of funds for actions that could affect existing buildings, and through limited industrial sector impacts. This subsection provides a brief background on the CCA and then reviews these specific intersections with existing buildings. It should also be noted that the CCA is facing a repeal initiative in the 2024 legislative session that may also affect the analysis in this subsection, discussed at the end of this subsection.

Background

The CCA establishes a statewide system to address large GHG emitters by instituting a market-based cap and trade system to reduce emissions from "covered" or non-exempt entities that annually emit at least 25,000 metric tons of GHGs.[61] This CCA threshold matches the federal reporting threshold, which required annual reporting from large GHG-emitters starting January 1, 2020, including suppliers of fossil fuels and industrial GHG-emitting entities.[62] Signed into law in 2021, CCA became effective in 2023.[63]

[59] Tacoma Public Utilities, "Incentives for Rental Properties Serving Income-Qualified Tenants." [LINK]. Accessed 1/10/2024.
[60] Tacoma Public Utilities, "Incentives for Rental Properties Serving Income-Qualified Tenants." [LINK]. Accessed 1/10/2024.
[61] WA Legislature, "Final Bill Report E2SSB 5126," Senate Bill Report. [LINK]. Pages 1, 2, 6, 20. Also WA Legislature, "Session Law. Certification of Enrollment: Engrossed Second Substitute Senate Bill 5126," Filed May 18, 2021. [LINK]. Pg 24, 54 (pdf pg 25, 55). Accessed 1/8/2024.
[62] DOE, "U.S. EPA Releases Greenhouse Gas Reporting Rules." [LINK]. Accessed 1/8/2024.
[63] WA Legislature, "Final Bill Report E2SSB 5126," Ibid. [LINK]. Pg 22, 25.

Funding

Funding from the CCA is expected to vary annually, and can be directed to fund multiple different climate activities. Although no amount is annually reserved to reduce existing building GHG emissions, recent CCA revenues and existing proposed building appropriations provide some examples of possible future allocations.

In 2023, the CCA raised $1.8 billion for climate, clean energy, and to protect water, air quality and forests, with an additional $376 million raised in consigned revenue.[64] The legislature may appropriate non-consignment funds between one of three primary CCA accounts, namely:

- CERA: Carbon Emissions Reduction Account (CERA) for transportation measures;
- CIA: Climate Investment Account (CIA) for energy, ecosystem, and sequestration measures; and
- AQHDIA: Air Quality & Health Disparities Improvement Account, to identify and reduce criteria pollutants and health disparities in overburdened communities.[65]

Each of the above accounts have their own allocation rules, though the CERA account receives some degree of prioritization over time.

> *This account is capped at $5.2 billion through fiscal year (FY) 2037, averaging over $350M per year from FY 2024 through FY 2037. From FY 2038, this account receives half of any auction proceeds. The remainder of auction proceeds are split between the Climate Investment Account and the Air Quality and Health Disparities Improvement Account.*[66]

After CERA allocations, CIA account deposits are first subject to covering CCA administration, up to 5% of auction revenues total. Once administrative costs have been addressed, the remaining proceeds are divided to two sub-accounts, namely:

- 75% is allocated to Climate Commitment Account, for projects that support the transition to a low-carbon economy, improve air quality, and increase access to clean energy; while
- 25% is allocated to the Natural Climate Solutions Account, for projects that protect fish and wildlife habitat, improve aquatic ecosystems and water quality, and protect against floods.[67]

Although CCA proceeds are divided between different climate priorities, there is still potential for allocated funds to be directed towards existing buildings through CIA Climate Commitment Account allocations. For instance, Washington state appropriated $80 million toward funding for rebates and heat pumps for low- and moderate- income households, as well as adult family homes and small commercial businesses, in the 2023 – 2024 fiscal year (FY). These are in addition to federal Inflation Reduction Act (IRA) rebates detailed in a subsequent subsection. Other potential near-term impacts from CCA revenues are noted in the Washington preliminary 2024 –2025 supplemental budget, namely:

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[64] Climate Solutions, "Looking Back on One Year of Washington's Transformational Climate Commitment Act," December 13, 2023. [LINK]; Clark, Kevin, "Washington raises estimated $1.8 billion in first year of carbon market," The Chronicle, December 14, 2023. [LINK]. Accessed 1/8/2024.

[65] Washington State Department of Ecology (Ecology), "Distribution of Funds from Climate Commitment Act Accounts Fiscal Year 2023," Publication 23-14-020, November 2023. [LINK] Pg 3. Accessed 1/8/2024.

[66] Tempest, Kevin , et. al, "Policy Brief: Washington State's Climate Commitment Act," September 2023, Clean and Prosperous Washington. [LINK]. Pg 6.

[67] Ecology, "Cap-and-Invest Auction Proceeds." [LINK]. Accessed 1/8/2024.

- $7 million to create a statewide Navigator program; and
- $100 million for affordable multifamily building BPS compliance, such as benchmarking, and retrofits for energy efficiency and electric appliances such as heat pumps.[68]
    - It should be noted that current state budget negotiations have this funding at closer to $50 million for affordable multifamily buildings.[69]

In addition to the above allocations from the overall revenues, the $376 million raised in consigned revenue may also affect existing buildings, with utilities able to direct consigned funds towards specific activities established in statute.[70] Consigned revenues stem from auctions of both electric and gas utility allowances and must be spent for ratepayer benefit, with varying details for gas and electric utilities.

Statutory direction for electricity consignment funds state that the funds, "must be used by consumer-owned and investor-owned electric utilities for the benefit of ratepayers, with the first priority the mitigation of any rate impacts to low-income customers."[71] Requirements for natural gas consignment funds provide more specific detail, stating that,

> *Revenues from allowances sold at auction must be returned by providing nonvolumetric credits on ratepayer utility bills, prioritizing low-income customers, or used to minimize cost impacts on low-income, residential, and small business customers through actions that include, but are not limited to, weatherization, decarbonization, conservation and efficiency services, and bill assistance.*[72]

Under this statute, while natural gas utilities would have the option to direct revenues towards bill credits, they could also direct funding towards activities or programs that could affect existing buildings, such as through weatherization and decarbonization efforts. Due to the uncertainties surrounding consignment revenue, these funds are not currently counted as specifically supporting redress of onsite fossil fuel combustion at this time.

Industrial Emissions

One notable GHG-emitting group treated differently under CCA are a group of covered industrial emitters or emissions-intensive, trade-exposed (EITE) facilities. The CCA conveys relatively low pressure on EITE facilities to reduce their GHG emissions, with free emissions allowances through 2026 equal to their 2015-2019 emissions baseline, with these free allowances reduced by:

- 3% from 2027 through 2030, and
- 6% from 2031 through 2040, and potentially onward.[73]

The term EITE facilities covers a wide range of industries, including manufacturing of aluminum, steel, cement, and wood products. As such, although the CCA may affect existing building GHG emissions for

[68] OFM, "Proposed 2024 Supplemental Budget…," ibid. [LINK]. Accessed 1/4/2024. Pg 36, 37 (PDF Pg 40, 41).
[69] Terence Sullivan, King County Climate & Energy Program Manager, email communication with author, February 28, 2024.
[70] Tempest, Kevin , et. al, "Policy Brief: Washington State's Climate Commitment Act," ibid. [LINK]. Pg 7.
[71] Revised Code of Washington (RCW) 70A.65.120(4). [LINK]. Accessed 1/8/2024.
[72] RCW 70A.65.130(2)(b). [LINK]. Accessed 1/8/2024.
[73] WA Legislature, "Final Bill Report E2SSB 5126," Ibid. [LINK]. Accessed 1/8/2024.Page 5, 9.

industrial buildings, the projected impacts are minor given EITE provisions. Individual entity reports may be viewed through the Washington State Department of Ecology (Ecology) GHG reporting site.

Possible Repeal

In November 2023, CCA opponents filed more than 400,000 signatures with the state supporting Initiative 2117 (I-2117) seeking to repeal the CCA.[74] If the legislature does not vote on the initiative, it will automatically go on the November 2024 ballot requiring a simple majority for approval.[75] As such, additional 2024 auctions will proceed and any approved allocations of 2024 auction revenues could affect existing building emissions, but CCA funding and its associated GHG emissions impacts in subsequent years is unknown.

2.2 Federal Drivers

This subsection summarizes and reviews the impacts of Federal drivers on existing buildings GHG emissions, namely IRA, WAP/LIHEAP, and other federal programs.

Inflation Reduction Act (IRA)

The IRA targeted $370 billion in investments to address climate change across multiple sectors.[76] This subsection reviews the IRA investments directly pertinent to reducing GHG emissions from existing buildings, namely the Home Energy Rebates, Energy Efficiency Tax Credits, Green & Resilient Retrofit Program, and the Greenhouse Gas Reduction Fund.

Home Energy Rebates

The IRA authorized $8.8 billion in home energy rebates, composed of the Home Efficiency Rebates and Home Electrification and Appliance Rebates; aside from funding for Indian tribes, these funds will be distributed through State Energy Offices.[77] Of these funds, Washington state will receive:

- $82.78 million in High Efficiency Electric Home Rebate Act Appliance Rebates, also known as HEEHRA rebates.[78]
- $83.27 million in Home Efficiency Rebates, also known HOMES rebates.[79]

Of the combined $166 million that Washington state will receive, the following are of note:

[74] Christensen, Eric, et. al, "Pacific Northwest Climate Law Update: Recent Developments Cloud the Future of Oregon and Washington Climate Programs," Beveridge & Diamond. JDSupra, January 8, 2024. [LINK]. Accessed 1/8/2024.
[75] O'Sullivan, Joseph, "Six measures Washington conservatives are pushing on 2024 ballots," Crosscut, December 22, 2023. [LINK]; Washington Secretary of State, "Initiatives & Referenda In Washington State." [LINK]. Page 4. Accessed 1/8/2024.
[76] U.S. Whitehouse, "Building a Clean Energy Economy: A Guidebook to the Inflation Reduction Act's Investments in Clean Energy and Climate Action," January 2023, Version 2. [LINK]. Accessed 1/4/2024. Pg 5.
[77] DOE State & Community Energy Programs (S-CEP), "Inflation Reduction Act Home Energy Rebates," Updated October 13, 2023 (Version 1.1). [LINK]. Accessed 1/3/2024. Pg 1 (PDF Pg 6).
[78] DOE S-CEP, "IRA Home Energy Rebates." [LINK]. Pg 2; Rewiring America, "The Electric Explainer: The Inflation Reduction Act," July 28, 2022. [LINK]. Accessed 1/3/2024. Pg 2.
[79] DOE S-CEP, "IRA Home Energy Rebates State Allocations." [LINK]; National Association of State Energy Officials (NASEO), "Inflation Reduction Act Summary of Residential Energy Efficiency and Electrification Provisions." [LINK]. Accessed 1/3/2024. Pg 1.

- Washington state may use up to 20%, or $33.2 million to administer the program.
- A minimum of $54.2 million must be expended for low-income allocations.
- A minimum of $13.3 million must be expended for low-income multifamily allocations, separate from and in addition to the above allocation for low-income households.[80]

Although administrative costs may be less (or low-income expenditures more), subtracting these leaves:

- $32.76 million in HEEHRA rebates.
- $32.56 million in HOMES rebates.

It should be noted, though, that Washington state approved another $80 million toward rebates and heat pumps for low- and moderate- income households, as well as adult family homes and small commercial businesses, from state CCA funds detailed in a previous subsection. These funds are not obligated to follow the same amounts or rules as the federal program.[81]

The HEEHRA and HOMES rebates have different requirements and resulting benefits, with differing rebate viability for low- and moderate- income (LMI) households, defined as homes earning up to 80% and 150% of the area median income, respectively. Unlike local utility rebates, there is also no concern with incentivizing fuel-switching (moving from changing a home fuel source from one type of fuel to another) in the application of these rebates. For additional review of this item, see Section 2.1.d, Local Utilities, Local Programs & Local Financing.

HEEHRA establishes point-of-sale consumer rebates for a range of electrification projects, covering 100% of project costs for low-income households and 50% of costs for moderate-income households, up to a maximum of $14,000 per household per the projects identified in Table 2.2.[82]

Table 2.3 HEERHA Rebates[83]

Upgrade Type	Qualified Product	Rebate Amount Maximum
Appliance	Heat Pump Water Heater	$1,750
	Heat Pump for Space Heating or Cooling	$8,000
	Electric Stove, Cooktop, Range, Oven	$840
	Heat Pump Clothes Dryer	$840
Building Materials	Electric Load Service Center (ex. breaker box)	$4,000
	Insulation, Air Sealing, and Ventilation	$1,600
	Electric Wiring	$2,500
Maximum Rebate		**$14,000**

[80] DOE S-CEP, "Inflation Reduction…" ibid [LINK]. Accessed 1/3/2024. Pg 16 (PDF Pg 21) & Appendix A (PDF Pg 100).
[81] Connolly, Chris, "2023 Washington Legislative Session Wrap Up," Northwest Energy Coalition (NWEC), May 2, 2023. [LINK]. Accessed 1/4/2024.
[82] Rewiring America, "High-Efficiency Electric Home Rebate Act (HEEHRA)." [LINK]. Accessed 1/3/2024.
[83] DOE S-CEP, "Inflation Reduction…" ibid [LINK]. Accessed 1/3/2024. Adaptation of Table 7 on Pg 51 (PDF Pg 56).

In contrast to HEEHRA, HOMES provides rebates for projects that achieve energy savings, verified either through modeled or measured energy gains. Projects can qualify for up to either $4,000 or $8,000 per low-income dwelling unit or home, or up to either $2,000 or $4,000 per dwelling unit or home not considered low-income.[84]

An important note for both HEEHRA and HOMES rebates is that neither can be combined with other federal funds for the same improvement, as articulated in U.S. Department of Energy (DOE) guidance:

> *Neither the Home Efficiency Rebates nor the Home Electrification and Appliance Rebates may be combined with other Federal grants or rebates for the same single upgrade or qualified electrification project that receives rebate funds from Section 50122, respectively… No other Federal grants, including another IRA home energy rebate, can be used for the same upgrade.*[85]

Energy Efficiency Tax Credits

Various IRA tax credits will also increase opportunities for building decarbonization. These are aptly summarized in Rewiring America's, *The Electric Explainer: The Inflation Reduction Act*, as follows:

> *The Energy Efficient Home Improvement credit, or 25C, allows households to deduct from their taxes up to 30% of the cost of upgrades to their homes, including installing heat pumps, insulation and, importantly, upgrading their breaker boxes to accommodate additional electric load. Upgrade costs include both equipment and installation/labor costs. These deductions are limited to $600 per measure, up to $1,200 per household per year—with one notable exception. Households can deduct 30% of the costs for buying and installing a heat pump water heater or heat pump for their space heating and cooling, up to $2,000…*
>
> *The Commercial Buildings Energy Efficient credit, or 179D, has been significantly expanded, offering $2.50 to $5.00 per square foot for businesses achieving 25 to 50% reductions in energy use over existing building performance standards.*[86]

Additionally, the New Energy Efficient Home tax credit or tax credit for Zero Energy Ready Homes in Internal Revenue Code Section 45L, provides up to $5,000 for homes developed to meet the DOE Zero Energy Ready Homes (ZERH) standard. Although this credit is focused on new single-family, multifamily and manufactured homes, it can also be claimed by existing homes that undergo a deep retrofit.[87]

Lastly, the IRA extended the Residential Clean Energy Property Credit in Internal Revenue Code Section 25D for residential solar, wind, geothermal biomass fuel, and added energy storage, with a 30% credit for projects started between 2022 and 2032; 26% for projects started in 2033; and 22% for projects

[84] DOE S-CEP, "Inflation Reduction…" ibid [LINK]. Pg 12 (PDF Pg 17). Also see NASEO, "Inflation Reduction Act…," ibid. [LINK], though note that the "LMI" column is not accurate as these rebate amounts are not available for moderate income homes. Accessed 1/3/2024.
[85] DOE S-CEP, "Inflation Reduction…" ibid. [LINK]. Accessed 1/3/2024. Pg 45 (PDF Pg 50).
[86] Rewiring America, "The Electric Explainer…" ibid. [LINK]. Accessed 1/3/2024. Pg 3.
[87] Rewiring America, "The Electric Explainer…" ibid. Pg 3. [LINK]; DOE, "Section 45L Tax Credits for Zero Energy Ready Homes." [LINK]. Accessed 1/3/2024.

started in 2034.[88] Nonprofit building owners (e.g., nonprofit housing, churches, etc.) can also now take advantage of this tax credit through a new Direct Pay provision.

The IRA also provides production and investment tax credits to accelerate U.S. manufacturing of clean energy products, though those are not detailed here as they will not directly intersect with existing building GHG emissions.

There are two important notes regarding tax credits and the HOMES and HEEHRA rebates detailed above. First, that while rebates cannot be combined with other federal funds for rebates on the same upgrade, the remaining cost of an upgrade can be claimed in tax credits (after subtracting the rebate value from the cost.[89] Secondly it should be noted that, unlike HOMES and HEEHRA rebates, these tax credits do not vary based on LMI status. In fact, some of these rebates may not be accessible for low-income homeowners. IRA tax credits require claimants to have tax liability (i.e., they must owe funds at the end of the year in order to claim the credit).[90] Those that receive refunds at the end of the year, or essentially those with no tax liability, are unable to benefit from these credits.

Green & Resilient Retrofit Program

The U.S. Department of Housing and Urban Development (HUD) Green and Resilient Retrofit Program (GRRP) stems from the IRA funding section titled, "Improving Energy Efficiency or Water Efficiency or Climate Resilience of Affordable Housing."[91] This section directs over $2 billion in grants and loans for retrofit projects that advance various objectives, among them building electrification, energy and water efficiency, zero-emission electricity generation, and climate resilience for eligible HUD-subsidized multifamily property owners.[92] There is also funding available to provide Energy and Water benchmarking services to HUD-subsidized properties to measure property usage and efficiency.[93] To date, approximately $175 million has been issued in grants and loans, with two more application rounds across various cohorts ending in May 2024.[94] Consulted staff are not aware of any applied for or awarded funds to multifamily buildings for the four counties covered in this plan.

Greenhouse Gas Reduction Fund

The IRA allocated $27 billion to be distributed in the GHG Reduction Fund, which EPA announced it would split into three components, namely the $14 billion National Clean Investment Fund, the $6 billion Clean Communities Investment Accelerator, and the $7 billion Solar for All competition.[95]

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[88] Bipartisan Policy Center, "Inflation Reduction Act Summary," 2022. [LINK]. Accessed 1/3/2024. Pg 11.
[89] DOE S-CEP, "Inflation Reduction…" ibid. [LINK]. Accessed 1/3/2024. Pg 46 (PDF Pg 51).
[90] Internal Revenue Service (IRS), "Frequently asked questions about energy efficient home improvements and residential clean energy property credits," FS-2022-40, December 2022. [LINK]. Accessed 1/3/2024. Pg 6.
[91] United States Department of Housing and Urban Development (HUD), "Green and Resilient Retrofit Program (GRRP)," last updated December 21, 2023. [LINK]. Accessed 1/4/2024.
[92] HUD, "Green and Resilient…" ibid. [LINK]. Accessed 1/4/2024.
[93] HUD, "Green and Resilient Retrofit Program (GRRP)/ The Benchmarking Initiative…"[LINK]. Accessed 1/4/2024.
[94] HUD, "Biden-Harris Administration Announces $174 Million to Support Energy Efficiency and Climate Resilience for Thousands of Low-Income Households as Part of Investing in America Agenda," December 21, 2023, HUD No. 23-284. [LINK]; US HUD, "GRRP Comprehensive Fact Sheet." [LINK]. Accessed 1/4/2024.
[95] United State Environmental Protection Agency (EPA), "About the Greenhouse Gas Reduction Fund," last updated on July 14, 2023. [LINK]. Accessed 1/4/2024.

Solar for All

The Solar for All competition will provide up to sixty grants, totaling $7 billion, to expand the number of low-income and disadvantaged communities primed for residential solar installations.[96] The EPA anticipates providing up to five grants of $250 million – $400 million, up to 20 grants of $100 million – $250 million, and up to 35 grants of $25 million – $100 million. Washington state applied for $250 million in funds to develop four new programs: WASH, ESSAP, BEAMS, and Tribally Envisioned Solar.[97]

- WASH: The Washington Affordable Solar Homes (WASH) program will work with multiple vendors to support income-qualified homeowners install rooftop solar at no cost. Up to 20% of program funds could support roof replacements and energy efficiency upgrades, and some owners will be able to add energy storage at no cost.[98]
- ESSAP: The Expanded Shared Solar Access Program (ESSAP) would allow income-qualified renters, residents, and tribal members to participate in community solar at no cost. Funding would be for projects 200 kilowatts (kW) to 1 megawatt in size with at least 1 subscriber per 10 kW. Up to 15% of the energy can be provided to a multifamily common area meter. To administer projects, utilities need to provide on-bill crediting for affordable multifamily tenants.[99]
- BEAMS: The Bridging Energy Affordability through Multifamily Solar (BEAMS) program would provide no-interest, forgivable loans for upgrades like roof repair, electrical upgrades, and energy efficiency at properties committing to installing solar for the tenant benefit. Properties could then use a no-interest revolving loan fund to install solar and energy storage onsite.[100]
- Tribally Envisioned Solar: This program is Commerce's commitment to partner with federally recognized tribes to support residential-serving solar projects and to jointly determine fund allocation and distribution.[101]

It is anticipated that the EPA will issue notices of award in July 2024 and that, if awarded, Commerce will develop its Solar for All programs for an additional year before formal launch in July 2025.[102] If Washington state receives this funding, it will not be directed to reducing onsite fossil fuel combustion in buildings, but will provide additional sources of renewable energy generation within the state.

National Clean Investment Fund

The National Clean Investment fund will provide two to three grants, totaling $14 billion, to national non-profit clean financing institutions able to work with private sector partners to provide accessible financing for tens of thousands of clean technology projects. The funding will enable families, small businesses, communities and others to access capital for installing clean technology projects, with at least 40% of capital flowing into low-income and disadvantaged communities.[103]

[96] EPA, "Solar for All," last updated November 15, 2023. [LINK] Accessed 1/4/2024.
[97] Commerce, "Washington's Application to Solar for All." [LINK]. Accessed 1/4/2024.
[98] Commerce, "Washington's Application to Solar for All." [LINK]. Accessed 1/4/2024.
[99] Commerce, "Washington's Application to Solar for All." [LINK]. Accessed 1/4/2024.
[100] Commerce, "Washington's Application to Solar for All." [LINK]. Accessed 1/4/2024.
[101] Commerce, "Washington's Application to Solar for All." [LINK]. Accessed 1/4/2024.
[102] Commerce, "Washington's Application to Solar for All." [LINK]. Accessed 1/4/2024.
[103] EPA, "National Clean Investment Fund," last updated July 14, 2023. [LINK]. Accessed 1/4/2024.

Applications for these funds were due October 12, 2023, with funding announcement anticipated March 2024 and funding deployment anticipated to begin in July 2024.[104]

Clean Communities Investment Accelerator

The Clean Communities Investment Accelerator will provide two to seven grants, totaling $6 billion, to hub non-profits that will deliver funding and technical assistance. These hub non-profits will enhance the capacity of local community lenders to finance clean technology projects in low-income and disadvantaged communities, with 100% of funds dedicated to these communities.[105]

Applications for these funds were also due October 12, 2023, with funding announcement anticipated March of 2024 and funding deployment anticipated to begin in July 2024.[106]

Other IRA Programs

It should be noted that other IRA programs have the potential to reduce building GHG emissions, primarily the $1 billion towards Zero Building Energy Code Adoption and $3 Billion in Environmental and Climate Justice Block Grants (ECJBG).[107] These programs are not reviewed in detail here because their impact on existing buildings in Washington state is not definitive.

- The Zero Building Energy Code Adoption funding will help reduce building emissions across the United States, however its primary impact will be on new building construction, and hence has less potential to affect existing building emissions. It is also worth noting that Washington state has been leading on energy code amendments, and in 2023 adopted energy code amendments that will make it very challenging and expensive to install fossil-fueled appliances in homes and buildings.[108] Combined with state law requiring clean energy grids by 2030 (see CETA subsection above), codes effectively prohibiting onsite fossil fuel combustion may essentially achieve Net Zero new buildings.
- The ECJBG funds are broken into three primary subgroups, all of which are focused on funding for or with community-based organizations (CBOs).[109] Environmental justice is a vital and often overlooked climate program element. However, while building emissions could technically be addressed depending on CBO focus area applications, it is not an obligated focus of this funding. It is notable that, within the Environmental Justice Thriving Communities Grantmaking Program, Philanthropy Northwest was awarded $50 million for the Northwest Network for Environmental Justice, which may address local buildings depending on future CBO applications and focus areas in the pacific northwest.[110]

[104] EPA Office of the GHG Reduction Fund, "EPA-R-HQ-NCIF-23-Full Announcement." [LINK]. Accessed 1/4/2024.
[105] EPA, "Clean Communities Investment Accelerator," last updated on November 15, 2023. [LINK]. Accessed 1/4/2024.
[106] EPA Office of the GHG Reduction Fund, "EPA-R-HQ-CCIA-23-Full Announcement." [LINK]. Accessed 1/4/2024.
[107] Rewiring America, "The Electric Explainer…" ibid. [LINK]. Accessed 1/3/2024. Pg 4, 5.
[108] Breda, Isabella, "WA adopts new rules to phase out fossil fuels in new construction," Seattle Times, November 29, 2023. [LINK]. Accessed 1/4/2024.
[109] Evergreen Action, "Fact Sheet: Environmental and Climate Justice Block Grant Program." [LINK]. Accessed 1/4/2024.
[110] EPA, "2023 Environmental Justice Thriving Communities Grantmaking Program Selectees." [LINK]. Accessed 1/4/2024.

LIHEAP and WAP

The federal Department of Health and Human Services (HHS) Low Income Home Energy Assistance Program (LIHEAP), and the DOE Weatherization Assistance Program (WAP), have been described as two sides of the same coin, both serving low-income households.[111] Given the Plan emphasis on redressing fossil fuel combustion, fuel switching in these programs is addressed at the end of this subsection.

LIHEAP

The LIHEAP program in Washington can direct funds to pay energy utilities on behalf of low-income households, can provide funding to repair or replace heating and cooling systems, and also directs funding to the state Weatherization program – an action that can help address existing building GHG emissions.[112] Current regulations allow states to spend up to 15% of their LIHEAP allocation on weatherization, though states can apply to use up to 25% of their allocation through the LIHEAP good cause waiver, which Commerce appears to pursue regularly.[113]

Washington state LIHEAP funds for FY 2024 are approximately $59.38 million.[114] A 15 – 25% weatherization allocation would mean $8.9 to $14.8 million for LIHEAP weatherization.

WAP

The WAP program increases energy efficiency in low-income households, helping reduce their energy costs.[115] Once DOE issues funding, states contract with organizations that use in-house crews and private contractors to perform weatherization services, often leveraging other federal, state and private programs to expand service provisions.[116] These funds are often bundled with LIHEAP allocations, and matchmaker funds contributed by utilities. For the counties addressed in this PLAN, Commerce lists the following weatherization service providers.[117]

- King King County Housing Authority (KCHA); Seattle Office of Housing (OH)
- Kitsap Kitsap Community Resources (KCR)
- Pierce Metropolitan Development Council (MDC); Pierce County Human Services (PCHS)
- Snohomish Snohomish County – Office of Energy and Sustainability (OES)

Washington state has programs that can add to, and build upon, WAP services. The most notable of these is the Weatherization Plus Health (Wx+H) program. Piloted in 2016 – 2017, the Wx+H program was integrated as a regular service in the Weatherization program in 2021. This program provides some services that overlap with WAP such as ventilation improvements, but offers several additional services,

[111] National Association for State Community Services Programs (NASCSP), "LIHEAP and WAP – Two Sides of the Same Coin." [LINK]. Accessed 1/4/2024.
[112] Commerce, "Low-Income Home Energy Assistance Program (LIHEAP)." [LINK]. Accessed 1/4/2024.
[113] NASCSP, "LIHEAP and WAP – Two Sides…"ibid. [LINK]; Commerce, "Weatherization Programs." [LINK]. Accessed 1/4/2024.
[114] U.S Department of Health and Human Services (HHS) Administration for Children and Families (ACF), "FY 2024 First Announced Award of $3.6 Billion of Regular LIHEAP Block Grant Funds Plus $100 Million of LIHEAP Infrastructure Investment and Jobs Act (IIJA) Funds," October 10, 2023. [LINK]. Accessed 1/4/2024.
[115] DOE, "About the Weatherization Assistance Program." [LINK]. Accessed 1/4/2024.
[116] DOE, "About the Weatherization Assistance Program." [LINK]. Accessed 1/4/2024.
[117] Commerce, "Weatherization Programs." [LINK]. Accessed 1/4/2024.

including but not limited to carbon monoxide detectors, carpet removal and floor replacement, and moisture and mold reduction.[118]

For the 2023 – 2024 FY, including LIHEAP and Wx+H allocations, approximately $35 million was appropriated for weatherization and home health improvements for low-income households.[119]

It should be noted that WAP funds are available for various types of residential units, including single-family, mobile homes, and multifamily buildings.[120] WAP also differentiates between:

- Large multifamily buildings, with 25 or more units or that are over three stories in height;
- Small or low-rise multifamily, with 5 – 24 units that are 3 stories or fewer in height; and
- 2 – 4 unit buildings, with fewer than 5 living units.[121]

To receive WAP funding either 66% of the units – or 50% for duplexes and four-unit buildings, and certain eligible types of large multifamily buildings – must be eligible low-income dwelling units or become eligible within 180 days of a rehabilitation program.[122]

Fuel-Switching in WAP and Conservation Funds

The viability of funding fuel switching with WAP and conservation funds has historically been poor, though recent changes in the WAP program may show promise for this funding application.

Funding fuel switching – or changing a home fuel source from one type of fuel to another – was historically challenging with WAP, and had to be approved on a case-by-case basis. This began to change in 2015 where program operators could prove that fuel switching was cost-effective for some conditions.[123] More recently, WAP guidance states that fuel switching is strongly encouraged where cost-effective, specifically citing conversion from bulk fuel delivery systems such as fuel oil and liquid propane.[124] Additionally, WAP guidance notes that the social cost of carbon can be considered in determining cost-effectiveness under "Non-Energy Impacts" outlined per WPN 22-10 guidance.[125] It is indeterminate whether this recent guidance could enable fuel-switching off of natural gas heat using WAP funds.

Regardless of potential changes to WAP funds for fuel switching, there is a general prohibition against funding fuel switching for local governments, municipal utilities and state subdivisions if such entities sell or distribute energy per the state constitution.[126] It is notable that these prohibitions do not apply to

[118] Commerce, "Weatherization Plus Health (Wx+H)." [LINK]. Accessed 1/4/2024.
[119] Connolly, Chris, "2023 Washington Legislative…," NWEC, ibid. [LINK]. In line with projected request per Commerce, "Weatherization Plus Health 2022 report" [LINK]. Pg 11 (PDF 13). Accessed 2/29/2024.
[120] Tonn, Bruce, et. al, "Weatherization Works II – Summary of Findings from the ARRA Period Evaluation of the U.S. Department of Energy's Weatherization Assistance Program," Oak Ridge National Laboratory, July 2015. [LINK]. Pg xiii (PDF pg 2). Accessed 1/8/2024.
[121] DOE, "Weatherization Program Notice 22-12," effective September 14, 2022. [LINK]. Accessed 1/8/2024. Pg 2.
[122] DOE, "Weatherization Program Notice 22-12," effective September 14, 2022. [LINK]. Accessed 1/8/2024. Pg 3.
[123] DOE, "WAP Memorandum 011 Clarification on Fuel Switching, May 6, 2015. [LINK]. Accessed 1/8/2024. Pg 1.
[124] DOE, "Weatherization Program Notice 23-06," effective March 3, 2023. [LINK]. Accessed 1/8/2024. Pg 5.
[125] DOE, "Weatherization Program Notice 23…" ibid. [LINK] and "Weatherization Program Notice 22-10 Revised," October 21, 2022. [LINK]. Accessed 1/8/2024. Pg 5.
[126] Washington State Constitution, Article 8, Section 10. [LINK]. Accessed 1/8/2024.

co-ops and investor-owned utilities.[127] For more on the topic of fuel switching, please see Section 2.1.d, Local Utilities, Local Programs & Local Financing.

Other Federal Programs

Some other programs could help to intermittently address existing building GHG emissions, and/or be directed towards activities that can reduce existing building GHG emissions. Such programs include EECBG funds, and FEMA BRIC funds.

EECBG

Although Energy Efficiency and Conservation Block Grant (EECBG) funds can fund a variety of GHG-reducing actions beyond just existing buildings, and EECBG funds are not annually reliable but instead intermittent, their recent issuance could affect existing building GHGs and thus are reviewed in this Plan. This subsection provides background on EECBG funding, context on previous funding patterns, and known details on current allocations as pertinent to the four counties addressed in this Plan.

EECBG funding was first authorized in late 2007, though it is typically associated with a subsequent allocation through the American Recovery and Reinvestment Act (ARRA) that issued $2.7 billion in formula grants and $400 million in discretionary grants in 2009.[128] The Infrastructure Investment and Jobs Act (IIJA) passed in 2021, also known as the Bipartisan Infrastructure Law (BIL), again authorized EECBG funding to be issued through formula awards and competitive grants through the U.S. DOE.[129] Approximately $550 million will be issued in EECBG funds this round and can again be applied to various uses, ranging from developing energy strategies, conducting residential and commercial energy audits, renewable energy installations, and public building retrofits.[130]

[127] American Council for an Energy-Efficient Economy (ACEEE), "State Policies and Rules to Enable Beneficial Electrification in Buildings through Fuel Switching," May 2020. [LINK]. Accessed 1/8/2024. Pg 14.
[128] Mayors Climate Protection Center (MCPC), "Successful City Initiatives with Energy Efficiency and Conservation Block Grant (EECBG) Funding," U.S. Conference of Mayors, February 2014. [LINK]. Pg 1 (PDF Pg 3). Accessed 1/9/2024.
[129] Aves, Kelly, "Using the Bipartisan Infrastructure Law to Invest in Energy Infrastructure, Reduce Greenhouse Gas Emissions," National League of Cities (NLC), November 7, 2023. [LINK]. Accessed 1/9/2024.
[130] DOE Community Energy Programs (CEP), "Energy Efficiency and Conservation Block Grant Program." [LINK]; "Blueprint 2A: Energy Efficiency: Energy Audits, Building Upgrades." [LINK]. Accessed 1/9/2024.

Initial federal Government Accountability Office reports are that recipients are using funds for energy efficiency retrofits, financial incentives, and building and facilities programs, though many entities have not yet completed their applications.[132] Formula funding recipients have until April 30, 2024, to submit plans to receive their allocation.[133]

Although EECBG funds can be used for various activities, expending funds on buildings – and notably public buildings – may be a popular decision, based on past expenditure patterns. Of 204 cities surveyed on their past 2009 EECBG allocations, the top five city EECBG expenditures included:

- 83% reported government building retrofits;
- 42% reported LED or efficient street lighting;
- 31% reported solar on public buildings;
- 26% reported public/business conservation education;
- 22% reported residential building retrofits.

Of the four counties addressed in this plan, approximately $4.9 million will be awarded through EECBG formula grant funding, though a majority of funds will be issued directly to incorporated areas outside of direct County control. As such, these one-time funds may provide some redress for existing building GHG emissions depending on independent government decisions. However, governments receiving EECBG funding are not obligated to expend these funds on decarbonizing existing buildings.

Table 2.4 EECBG Formula Awards for the Four Counties

Government	EECBG Formula Allocation[131]
King County	$474,460
City of Auburn	$141,710
City of Bellevue	$203,560
City of Burien	$112,300
City of Federal Way	$147,860
City of Issaquah	$76,450
City of Kent	$179,480
City of Kirkland	$144,580
City of Redmond	$143,150
City of Renton	$157,700
City of Sammamish	$121,420
City of Seattle	$681,520
City of Shoreline	$117,070
Bothell City	$76,740
King County subtotal	**$2,778,000**
Kitsap County	$245,220
City of Bremerton	$76,690
Kitsap County subtotal	**$321,910**
Pierce County	$497,770
City of Puyallup	$76,570
City of Tacoma	$246,170
Pierce County subtotal	**$820,510**
Snohomish County	$436,900
City of Edmonds	$76,430
City of Everett	$169,950
City of Lake Stevens	$76,130
City of Lynnwood	$76,450
City of Marysville	$124,740
Snohomish County subtotal	**$960,600**
ALL Plan EECBG Funds	**$4,881,020**

[131] DOE S-CEP, "Final Allocation of Funds." [LINK]. Accessed 1/9/2024. Pg 47, 48.
[132] ICLEI, "Energy Efficiency and Conservation Block Grant (EECBG)." [LINK]. Accessed 1/9/2024.
[133] Aves, Kelly, "Using the Bipartisan Infrastructure Law…," NLC, ibid. [LINK]. Accessed 1/9/2024.

FEMA BRIC

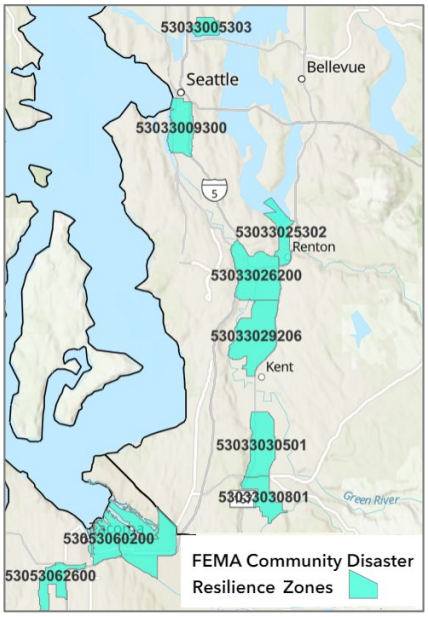
Although not specifically designed to address reductions in GHG emissions, the Federal Emergency Management Agency (FEMA) Building Resilient Infrastructure and Communities (BRIC) grant program has been noted as a possible avenue to improve resilience and reduce GHG emissions simultaneously. BRIC applications can be for multiple climate resilience items, including to address extreme heat events. As such, local governments could apply to weatherize and provide heat pumps for cooling in buildings.

FEMA BRIC funding is competitive, so it cannot be counted on as a regular or reliable funding pool to reduce GHG reductions. However, funding could be pursued for individual projects; application rounds occur annually with substantial associated funding – the 2023 competitive pool is for $1.0 billion.[134] In 2022, $1.9 billion was issued in BRIC funds to 194 applicants with an average project award of $9.8 million, though the $2 billion funding total was a temporary increase likely due to the COVID-19 pandemic.[135] The average award still appears consistent with the previous year – in 2021, 87 awards were issued, with an average award of $9.4 million.[136] Although most 2022 awards appear to be unrelated to climate resilience for buildings, a $9.8 million award for the Goldendale Climate Resilience Microgrid in Washington state is notable.[137]

Several other items are of note regarding BRIC funding, including the fact that communities with lower capacity can apply for technical assistance on BRIC submissions, CRDZ competitiveness, Washington state timelines, and project specific requirements.

- Lower Capacity: In general, lower-capacity communities are less likely to submit for (and hence less likely to receive) BRIC funds.[138] However, FEMA will provide direct technical assistance to a group of eligible BRIC applicants, assisting with project development and implementation; approximately 80 entities are anticipated to receive technical assistance in 2024.[139] Applicants must not have received a FEMA Pre-Disaster Mitigation (PDM) , BRIC, Flood Mitigation Assistance (FMA), or Hazard Mitigation Grant Program (HMGP) award within the past five years.[140]

Figure 2.1 Four County-Area FEMA CRDZs



See the FEMA CRDZ viewer.

[134] Federal Emergency Management Agency (FEMA), "Hazard Mitigation Grants – Building Resilient Infrastructure and Communities (BRIC)," Last updated January 8, 2024. [LINK]. Accessed 1/9/2024.
[135] FEMA, "BRIC Grant Program FY 2022 Subapplication and Selection Status," Last updated October 20, 2023. [LINK]; Weber, Anna, "Building Resilience, BRIC by BRIC: BRIC's Fourth Year," National Resources Defense Council (NRDC), October 18, 2023. [LINK]. Accessed 1/9/2024.
[136] FEMA, "BRIC Grant Program FY 2021 Subapplication and Selection Status," Last updated May 19, 2023. [LINK]; Accessed 1/9/2024.
[137]FEMA, "BRIC Grant Program FY 2022…" ibid. [LINK]. Accessed 1/9/2024. Application MS-2022-BR-035-0018.
[138] Weber, Anna, "Building Resilience…," NRDC, ibid. [LINK]. Accessed 1/9/2024.
[139] Weber, Anna, "Building Resilience…," NRDC, ibid. [LINK]. Accessed 1/9/2024.
[140] FEMA, "BRIC Direct Technical Assistance," Last updated November 16, 2023. [LINK]. Accessed 1/9/2024.

- CRDZs: For the first time in 2023, the BRIC Notice of Funding Opportunity (NOFO) included Community Disaster Resilience Zones (CRDZs), or census tracts that FEMA has identified as high risk from climate hazards.[141] To date, 483 CRDZs have been identified nationally, nine of which are in the four-county area split between King and Pierce counties (at right); no CRDZs have been identified in Kitsap or Snohomish counties. NRDC noted that projects which benefit CRDZs, "receive a preferential cost share (with FEMA covering 90% of costs instead of the standard 75%), and they receive a large number of prioritization points (40 out of a possible 100) in the national competition."[142] It should be emphasized that projects in non-CMDZ areas can still apply.
- WA Timelines: Although confusing, potential applicants should track BRIC timelines with the Washington State Military Department (MIL) Emergency Management Division (EMD), to which potential applicants must submit pre-applications.[143] While FEMA BRIC NOFOs are typically published in October, the Washington state MIL-EMD preapplication due date was July 2023.[144]
- Project Specific Requirements: BRIC applications must propose projects at the parcel level and include a Benefits-Cost Analysis (BCA).
    - State MIL-EMD staff have confirmed that, prior to submitting BRIC applications, the project must identify work for specific parcels – thus, a project could not apply for a general decarbonization program, but would have to submit applications for upgrades for specific buildings.[145] It is projected that FEMA BRIC projects would likely take at least 2 years to mature from concept inception to funding receipt, given the effort to develop a BRIC application; the year between a July MIL-EMD preapplication and the FEMA BRIC notice of award the summer of following year; and an additional four to six months for contract execution.[146] As such, the projects that would likely best benefit from potential BRIC applications would be either community or multifamily buildings, as a two year wait time would likely be untenable for enrolling single-family homeowners.
    - A BCA is the FEMA method of proving that projects are cost-effective, by calculating the dollar amount of total expected benefits of risk reduction compared to project costs.[147] Some have noted the BCA can be cumbersome.[148] It is indeterminate if a weatherization and heat pump application to address extreme heat would obtain a positive BCA outcome. However, it is notable that BCA assistance is available for projects in CMDZs that, if pursued, could develop a model BCA for other, similar projects in the region.[149]

[141] Weber, Anna, "Building Resilience…," NRDC, ibid. [LINK]. Accessed 1/9/2024.
[142] Weber, Anna, "Building Resilience…," NRDC, ibid. [LINK]. Accessed 1/9/2024.
[143] Washington State Military Department (MIL) Emergency Management Division (EMD), "Building Resilient Infrastructure and Communities (BRIC)," las updated October 20, 2023. [LINK]. Accessed 1/9/2024.
[144] MIL-EMD, "2023 Hazard Mitigation Assistance Grant Round: BRIC." [LINK]. Accessed 1/9/2024.
[145] Tim Cook, MIL-EMD State Hazard Mitigation Officer, email communication with author, September 8, 2022.
[146] FEMA, "About BRIC: Reducing Risk through Hazard Mitigation," [LINK]. Accessed 1/9/2024.
[147] FEMA, "Benefit-Cost Analysis," Last updated December 18, 2023. [LINK]. Accessed 1/9/2024.
[148] Miller, Benjamin M., et. al, "The Cost of Cost-Effectiveness: Expanding Equity in FEMA Hazard Mitigation Assistance Grants," Homeland Security Operational Analysis Center operated by the RAND Corporation, 2023. [LINK]. Accessed 1/9/2024.
[149] Department of Homeland Security – FEMA, "

3.0 Existing Buildings Gap Analysis

This section provides additional context for existing buildings in the four counties, and highlights the types of existing buildings where additional interventions are needed to reduce existing building GHGs. Given the analysis in the previous section, this section summarizes gaps for the built environment in the residential and commercial sectors, as well as gaps that affect multiple sectors.

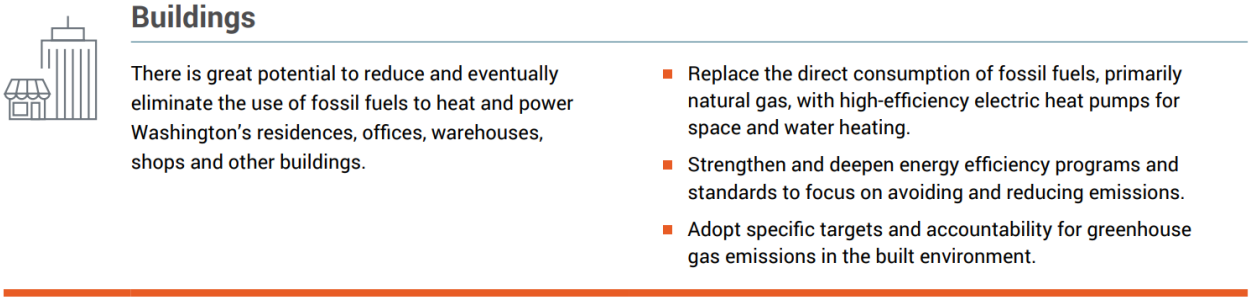
3.1 Background

This section reviews the Washington State 2021 Energy Strategy as well as the Operation 2030 White Paper, which together indicate the level of residential and commercial building decarbonization required to achieve GHG reduction goals.

In 2020, new GHG emission limits went into effect in Washington state, targeting that emissions fall to 45% below 1990 levels by 2030, and to 95% below 1990 levels by 2050.[150] Shortly thereafter, the Washington State 2021 Energy Strategy (SES) was released per legislative direction for the previous edition of the SES to be revised in alignment with CETA and these new GHG emission limits.[151]

The Washington State 2021 Energy Strategy reviews and provides direction for both transportation and the built environment sectors, including high-level recommendations and key actions. One of the SES's priority recommendations is to "Transition the Fossil Natural Gas Industry," affirming that, "the state's long-term greenhouse gas emissions limits cannot be achieved while continuing current uses of this fuel."[152] Additionally, the state lists Key Actions for buildings, supporting electric heat pump replacements for fossil fuel appliances, and supporting strong energy efficiency programs.

Figure 3.1 Excerpt from the Washington 2021 State Energy Strategy, Key Actions for Buildings – Pg. 19



Buildings

There is great potential to reduce and eventually eliminate the use of fossil fuels to heat and power Washington's residences, offices, warehouses, shops and other buildings.

- Replace the direct consumption of fossil fuels, primarily natural gas, with high-efficiency electric heat pumps for space and water heating.
- Strengthen and deepen energy efficiency programs and standards to focus on avoiding and reducing emissions.
- Adopt specific targets and accountability for greenhouse gas emissions in the built environment.

The SES modeled two cost scenarios to meet state GHG reduction targets, and the scenario that keeps natural gas in buildings is costlier in 2030 and beyond than the scenario that pursues building electrification.[153] This is because keeping natural gas in buildings requires developing larger quantities of clean fuels to compensate for remaining gas emissions, and these clean fuels are ultimately more expensive than electrification.[154]

[150] Ecology, "Washington's greenhouse gas inventory." [LINK]. Accessed 2/6/24.
[151] Commerce, "Washington 2021 State Energy Strategy," December, 2020. [LINK]. Accessed 2/6/24. Pg 11.
[152] Commerce, "Washington 2021 State Energy Strategy," December, 2020. [LINK]. Accessed 2/6/24. Pg 18.
[153] Commerce, "Washington 2021 State Energy Strategy," December, 2020. [LINK]. Accessed 2/6/24. Pg 46.
[154] Commerce, "Washington 2021 State Energy Strategy," December, 2020. [LINK]. Accessed 2/6/24. Pg 46.

Although the SES does not provide breakdowns of decarbonization needs by building sector, Commerce links to an independent analysis on its building electrification webpage. Operation 2030, a white paper on the SES developed by the Clean Energy Transition Institute and the 2050 Institute, summarized costs of the alternative scenarios:

> *Annual costs for the Gas in Buildings Scenario exceed the Electrification Scenario beginning in 2030 and by 2050 are approximately $3.4 billion per year more expensive than electrification. Assuming costs are roughly similar to those in 2050 for each year following, for each decade beyond 2050, retaining gas in buildings could cost nearly $35 billion per decade more than the Electrification Scenario… It would take another decade or two to transition these buildings to electricity, while paying significantly higher costs for clean gas during that period.*[155]

Operation 2030 also developed a proposal that divided overall building emission reduction targets between the Commercial and Residential building sectors from 2025 to 2050, per the rate of electrification needed to meet State GHG reduction goals. An extract of this proposal for existing buildings is provided in Table 3.1.

Table 3.1 Building GHG Reduction Needs by Sector, per Operation 2030 Report[156]

Targets	2025	2030	2035	2040	2045	2050
Total Building Sector Emissions Reduction	18%	60%	72%	82%	89%	96%
Residential Building Sector						
Emissions Reduction	20%	65%	77%	85%	91%	96%
Zero Net Carbon Retrofits – % units/Yr.	1.3%	3.1%	3.0%	2.8%	2.7%	2.3%
Zero Net Carbon Retrofits – Buildings/Yr.	42,000	110,000	110,000	110,000	110,000	99,000
Commercial Building Sector						
Emissions Reduction	14%	56%	68%	78%	87%	96%
Zero Net Carbon Retrofits – % sq. ft/Yr.	1.2%	1.8%	1.7%	1.7%	1.6%	1.6%
Zero Net Carbon Retrofits – Buildings/Yr.	1,400	2,400	2,300	2,500	2,500	2,500

Note: The Operation 2030 proposal also targeted 50% and 75% zero net carbon new construction by 2025 for Commercial and Residential construction, respectively, and increasingly thereafter. Changes in realized net zero new construction starts would affect the above targets.

3.2 Residential Buildings

This section estimates the residential decarbonization targets for each county based on its housing stock, and how much of those targets might be achieved by the anticipated federal and state home rebate funding between 2025 to 2029.

[155] Storm, Poppy et al., "Operation 2030: Scaling Building Decarbonization in Washington State," Clean Energy Transition Institute. 2050 Institute, January 2022. [LINK]. Accessed 2/6/24.
[156] Storm, Poppy et al., "Operation 2030…" Ibid. [LINK]. Accessed 2/6/24.

Residential Decarbonization Targets

Based on proposed goals in the Operation 2030 Report reviewed in Section 3.0, the goals of 42,000 and 110,000 annual net zero carbon residential retrofits per year in Washington state by 2025 and 2030, respectively, can be applied to the four counties covered in this plan in two ways:

- Each County's existing housing represents a proportion of the statewide existing housing stock. This ratio can be applied to the Operation 2030 retrofit targets for the state to get a sense of each County's optimal housing unit decarbonization targets.
- The Operation 2030 Report provides net zero carbon retrofit targets for the years of 2025 and 2030, but does not provide annual targets for the interim years. Interim year targets can be estimated based on an annual proportion of the difference between the two targets. In this case, between the 2025 goal of 42,000 annual retrofits, and the 2030 goal of 110,000 annual retrofits, there is a difference of 68,000 units. This difference divided by five years results in an increase to the annual retrofit target of 13,600 units per year.

These two applications for the four counties covered in this plan are represented in Table 3.2, to estimate housing unit decarbonization targets by county, both annually and for the 2025 – 2029 period.

Table 3.2 Estimated Residential Building Decarbonization Needs by County

County	**2023 Estimate of Housing Units**[157]	**Proportion of State's Total Housing**	**Estimated Residential Decarbonization Units Statewide and by County Proportion** YEAR *Targets*					**Total Units**
			2025	2026	2027	2028	2029	
			42,000	*55,600*	*69,200*	*82,800*	*96,400*	
King	1,020,823	30.5%	*12,830*	*16,985*	*21,140*	*25,294*	*29,449*	105,698
Kitsap	117,213	3.5%	*1,473*	*1,950*	*2,427*	*2,904*	*3,381*	12,136
Pierce	372,113	11.0%	*4,677*	*6,191*	*7,706*	*9,220*	*10,735*	38,529
Snohomish	336,690	10.0%	*4,232*	*5,602*	*6,972*	*8,343*	*9,713*	34,861
Statewide	3,341,640	55.0%	All Counties, 2025-2029, **Total Need**					**191,225**

The four counties covered in this plan contain 55% of the state's existing housing stock, and as such represent a majority of the net zero carbon residential retrofits needed in the state overall. As shown in Table 3.2, from 2025 to 2029, it is estimated that approximately 191,000 net zero carbon retrofits must occur in the four counties in order to keep pace with GHG reduction targets established by the state.

It should also be emphasized that all of these are assuming net zero carbon retrofits. As such, these housing units would require electrification of all appliances using onsite fossil fuel combustion, most primarily water and space heating, as well as weatherization and zero-emission electricity sources.

Also worth noting is the proportion of multifamily units in each County, and how that compares to the proportion of retrofits needed. The proportion of multifamily units per County and in the state as a whole is shown in Table 3.3.

[157] WA OFM, "April 1, 2023 Housing Units," April 1, 2023. [LINK]. Accessed 1/2/2024.

Table 3.3 Proportion of Multifamily Residential Units by County			
County	**2023 Estimate of Housing Units**[158]	**2023 Estimated of Two or More Housing Units**	**Proportion of Multifamily Housing Units** (2 or more units)
King	1,020,823	480,294	47%
Kitsap	117,213	23,192	13%
Pierce	372,113	97,948	54%
Snohomish	336,690	99,697	44%
4-County Subtotal		*700,681*	
State	3,341,640	1,004,671	

Table 3.3 shows there are 700,681 multifamily units in the four counties covered in this plan, representing approximately 70% of the multifamily units in the state.

Although net zero carbon retrofits do not have to occur in different types of housing stock to achieve decarbonization benefits, some types of decarbonization funds are limited to different types of housing stock. As such, it is helpful to understand the ratio of multifamily housing stock that will likely need to be retrofitted to achieve zero net carbon, if decarbonization is pursued proportionately to the existing balance of single-family and multifamily housing stock in each county. This target is shown in Table 3.4.

Table 3.4 Estimated Multifamily Residential Building Decarbonization Needs by County				
County	**2023 Estimate of Housing Units**[159]	**Estimated Residential Decarbonization Target, 2025 – 2029**	**Proportion of Multifamily Housing Units** (2 or more units)	**Estimated Multifamily Units Decarbonization Target, 2025 – 2029**
King	1,020,823	105,698	47%	49,731
Kitsap	117,213	12,136	13%	1,604
Pierce	372,113	38,529	54%	20,926
Snohomish	336,690	34,861	44%	15,352
Total Units		**191,225**	**-**	**87,614**

Residential Decarbonization Funding Statewide

This section assesses the probable decarbonization that will be achieved in the state through existing residential decarbonization funding. This includes federal IRA funding; WAP, LIHEAP AND Wx+ weatherization funding; as well as existing and projected state budget allocations. Other funding sources reviewed in Section 2.0 Existing Buildings Landscape Analysis did not include dedicated current or future existing residential building decarbonization funding.

IRA Funding

The primary source of residential decarbonization funding is projected to come from the federal Home Energy rebates reviewed in Section 2.2.a IRA. This section noted that Washington state would receive

[158] WA OFM, "April 1, 2023 Housing Units," April 1, 2023. [LINK]. Accessed 2/29/2024.
[159] WA OFM, "April 1, 2023 Housing Units," April 1, 2023. [LINK]. Accessed 1/2/2024.

$82.78 million HEEHRA rebates and $83.27 million in HOMES rebates, though with the option to use up to 20% of the allocation for administration.[160] After subtracting full administrative costs, there was also a requirement that a minimum percentage go to low-income households, and an additional 10% of funds go to low-income multifamily households. The remaining funds are considered the maximum "open efficiency rebate" allocation; it should be noted that while this is the maximum open rebate allowed, the state may choose to reserve additional funding to be allocated for low-income household rebates. The required Washington state funding breakdowns (minimums and maximum) are displayed in Table 3.5.

Within each type of IRA rebate, there are rules affecting how the projected funds are spent, in turn affecting the number of projected rebates that might be issued, which would reduce the number of zero carbon residential retrofits needed in each county. The number of IRA retrofits are estimated separately for the Low-Income Allocations and Max Open Electrification Allocations. However, for each of these categories, it is assumed that the state will use all of its allowed administrative ceiling; and that, for all categories, 20% claim a maximum rebate, and 80% claim a minimum rebate.

Projections of the number of rebates issued for the Low-Income Allocations assume the following:

Table 3.5 IRA Rebate Allocations and Required Category Expenditures[161]

IRA Rebate	Washington State Allocation	Admin. Ceiling (20%)	Low-Income Household Min. Allocation	Low-Income Multifamily Min. Allocation (10%)	*Combined Low-Income Allocation*	Max Open Electrification Rebate Allocation
HEEHRA	$82,782,050	$16,556,410	$27,028,390	$6,622,564	*$33,650,954*	$32,574,686
HOMES	$83,266,580	$16,653,316	$27,186,589	$6,661,326	*$33,847,915*	$32,765,349

- A maximum rebate of $14,000 for HEEHRA, and $8,000 for HOMES.[162]
- A minimum rebate of:
  - $11,250 for HEEHRA.
    - This combines the heat pump rebate of $8,000; a heat pump water heater (HPWH) rebate of $1,750, to more closely approximates a net zero carbon outcome; and a $1,500 electric panel upgrade, assuming an older housing stock.
  - $4,000 for HOMES.[163]

These assumptions are integrated in Table 3.6, showing a total of 10,490 anticipated rebates issued for low-income households statewide.

Table 3.6 Estimated Statewide IRA Rebates Issued, Low Income

IRA Rebate	Combined Low-Income Allocation	Maximum Rebate Est.	Rebates # Using Max *20% of low-income*	Minimum Rebate Est.	Rebates # Using Min *80% of low-income*	Total Low-Income Rebates Est.
HEEHRA	$33,650,954	$14,000	481	$11,250	2,393	**2,874**
HOMES	$33,847,915	$8,000	846	$4,000	6,770	**7,616**

[160] DOE S-CEP, "Inflation Reduction…" ibid [LINK]. Accessed 2/7/2024. PDF Pg 99, 102.
[161] DOE S-CEP, "Inflation Reduction…" ibid [LINK]. Accessed 2/7/2024. PDF Pg 99, 102.
[162] DOE S-CEP, "Inflation Reduction…" ibid [LINK]. Accessed 2/7/2024. Pg 11, 51 (PDF Pg 18, 56)
[163] DOE S-CEP, "Inflation Reduction…" ibid [LINK]. Accessed 2/7/2024. Pg 11, 51 (PDF Pg 18, 56)

Projections of the number of rebates issued for the Max Open Electrification Allocations assume the following:

- A maximum rebate of $14,000 for HEEHRA, and $4,000 for HOMES.[164]
- A minimum rebate of:
  - $8,795 for HEEHRA. HEEHRA covers half the cost of an installation, up to a certain cap, for moderate income homes. As such, this estimate includes:
    - $6,295 covering 50% of a ductless heat pump install cost of $12,695;
    - $1,750, the full rebate allowed for a HPWH, which typically cost $4,000; and
    - $750, covering 50% of an electric panel upgrade.[165]
  - $2,000 for HOMES rebates.[166]

These assumptions are integrated in Table 3.7, showing a total of 18,173 anticipated rebates issued for households statewide.

Table 3.7 Estimated Statewide IRA Rebates Issued, Open Rebate Allocation

IRA Rebate	Max Open Electrification Allocation	Maximum Rebate Est.	Rebates # Using Max *20% of Open*	Minimum Rebate Est.	Rebates # Using Min *80% of Open*	Total Rebates Est.
HEEHRA	$32,574,686	$14,000	465	$8,795	2,963	**3,428**
HOMES	$32,765,349	$4,000	1,638	$2,000	13,106	**14,744**

Although multifamily low-income rebates are already accounted for in Table 3.6, it is helpful to understand what rebates may occur specifically in multifamily housing, as it was previously noted that some decarbonization funds are limited to different types of housing stock. This delineation is provided in Table 3.8, which shows that a total of 2,064 rebates are anticipated for low-income multifamily units statewide (which are already included in the results of Table 3.6, as the source funds of these rebates are part of the combined low-income allocation).

Table 3.8 Estimated Statewide IRA Rebates Issued, Multifamily Low-Income

IRA Rebate	Low-Income Multifamily Min. Allocation	Maximum Rebate Est.	MF Rebates # Using Max *20% of MF low-income*	Minimum Rebate Est.	MF Rebates # Using Min *80% of MF low-income*	Total MF Low-Income Rebates Est.
HEEHRA	$6,622,564	$14,000	95	$11,250	471	**566**
HOMES	$6,661,326	$8,000	167	$4,000	1,332	**1,499**

Other Funding – all Residential

As noted in Section 2.1.e Climate Commitment Act, Washington state appropriated a one-time funding allocation of $80 million for electrification rebates and heat pumps for low- and moderate- income

[164] DOE S-CEP, "Inflation Reduction…" ibid [LINK]. Accessed 2/7/2024. Pg 11, 51 (PDF Pg 18, 56)
[165] Opinion Dynamics, "California Heat Pump Residential Market Characterization and Baseline Study," for the California Public Utilities Commission, May 17, 2022. [LINK]. Accessed 2/7/2024. Pg 8, 9. Ductless Heat Pump costs adjusted for inflation using a Jan. 2022 baseline, as data was presumably sourced from before 2022, to a December 2023 Cost using the U.S. Bureau of Statistics Consumer Price Index (CPI) Inflation Calculator. [LINK]
[166] DOE S-CEP, "Inflation Reduction…" ibid [LINK]. Accessed 2/7/2024. Pg 11, 51 (PDF Pg 18, 56)

households, as well as adult family homes and small commercial businesses, in FY 2023 – 2024. These are in addition to IRA rebates detailed in the previous subsection.

Similarly, as noted in Section 2.2.b LIHEAP and WAP, Washington state appropriated a $35M in FY 2023 – 2024 for weatherization and home health improvements for low-income households.[167] Assuming similar future appropriations for the subsequent 2.5 biennia could mean an estimated $87.5M from 2025-2030 for weatherization funding. However, approximately 57% of Washington households use electricity for space heating, such that weatherization of these households would not functionally reduce onsite fossil fuel combustion.[168] Assuming weatherization percentages proportionate to the Washington state fuel mix, applying the percentage of non-electrically heated households (43%) to $87.5M means than an additional $37,666,265 could contribute to zero net carbon retrofits of fossil fuel households in this period.

To estimate the number of rebates these additional funds would yield, the assessment in Table 3.9 conservatively assumes:

- For CCA funds, that all the allocated CCA rebate funding would go towards residential rebates, with none for commercial. The below analysis also assumes the same rebate funding amount for CCA funds as HEEHRA, as the HEEHRA rebates do not require advance processing of energy reduction estimates (unlike the HOMES rebates), and hence may reduce administrative burden. Similarly, the analysis assumes the same allocation pattern as the IRA rebates, assuming that Commerce would essentially follow the same funding formula, rules and combined outreach as the IRA funding for CCA rebates, providing easier administration of the CCA funds being distributed in tandem with IRA funds.
- For Weatherization funds, the actual per-household allocation would likely fall below the Maximum rebate estimate provided in Table 3.9, as it would only fund weatherization (not fuel-switching or electrification, per Section 2.2.b). However, these funds could functionally displace IRA and CCA rebates for weatherization, increasing the funding available for electrification by a proportionate ratio. As such, the same funding amounts are allocated for weatherization efforts, to yield a consistent rebate estimate when all funding sources are combined.

Table 3.9 Estimated Statewide CCA-funded Rebates Issued

Funding Source	Allocation	Maximum Rebate Est.	Rebates # Using Max *20% of Open*	Minimum Rebate Est.	Rebates # Using Min *80% of Open*	Total Rebates Est.
CCA Rebates	$80,000,000	$14,000	1,143	$8,795	7,277	**8,420**
Weatherization	$37,666,265	$14,000	538	$8,795	3,426	**3,964**

Based on the analysis in Table 3.9, these additional funding sources would provide the equivalent of an additional 12,384 residential rebates.

[167] Connolly, Chris, "2023 Washington Legislative…," NWEC, ibid. [LINK]. In line with projected request per Commerce, "Weatherization Plus Health 2022 report" [LINK]. Pg 11 (PDF 13). Accessed 2/29/2024.
[168] State space heating data source: U.S. Census Bureau, "Selected Housing Characteristics," American Community Survey Data 5-year Estimates. [LINK]. Accessed 2/29/24.

Other Funding – Multifamily Residential

As noted in Section 2.1.e Climate Commitment Act, Washington state legislators are considering a one-time appropriation of $50 million toward multifamily building funding for benchmarking, and retrofits for energy efficiency and electric appliances such as heat pumps.[169] Applying the same assumptions as used in Table 3.9, this would result in the following additional multifamily rebates:

Table 3.10 Estimated Statewide Budget, Additional Multifamily Rebates Issued					
Multifamily Budget Allocation	**Maximum Rebate Est.**	**Rebates # Using Max** *20% of Allocation*	**Minimum Rebate Est.**	**Rebates # Using Min** *80% of Allocation*	**Total Rebates Est.**
$50,000,000	$14,000	714	$8,795	4,548	**5,262**

Residential Decarbonization Gap

This section assesses the gap in needed residential decarbonization based on existing and projected funding sources.

Single-family Residential

The combination of 10,490 anticipated IRA rebates for low-income households, and 18,173 anticipated IRA rebates issued from Open Rebate Allocation Funds, equal a total of 28,663 anticipated rebates issued statewide, assuming HEEHRA funds were focused only on households requiring electrification (i.e., focused on replacing fossil fuel combustion appliances with heat pump appliance). To simplify comparisons, this assessment also presumes all IRA rebates would be expended in the same window of 2025-2029. Finally, when combined with the estimated 12,384 rebates from the Table 3.9 analysis, this yields a revised combined estimated of 41,047 rebates.

- As noted in Table 3.2, the four counties represent 55% of the existing housing stock. It is likely that a proportionate amount of state rebates would be utilized in the four counties, or 22,576 rebates.
- Section 3.1.a, Residential Decarbonization Targets, determined a total need of 191,225 net zero carbon retrofits in the existing housing stock.

Considering the above, the IRA rebates, CCA rebates and WAP funding are projected to only meet 11.8% of the total residential decarbonization need. For the 2025 –2029 assessment period, a gap of 168,649 needed zero net carbon residential retrofits would remain.

Multifamily Residential

- As noted in Table 3.4, it is projected that 87,614 multifamily zero net carbon retrofits are needed for the four counties covered under this plan for 2025 – 2029.
- As noted in Tables 3.8 and 3.10, it is projected that 2,064 IRA rebates and 5,262 rebates from the state budget allocation will be issued for multifamily low-income units statewide, or 7,326 total. As the four-county area covered in this plan represents 70% of the multifamily units in the

[169] Terence Sullivan, King County Climate & Energy Program Manager, email communication with author, February 28, 2024.

state per Table 3.3, this means a projected 5,110 of the multifamily rebates would be distributed in the four counties.

Considering the above, IRA rebates and the state multifamily building budget allocation are projected to only meet 5.8% of the total multifamily residential decarbonization need. For the 2025 –2029 assessment period, a gap of 82,505 needed zero net carbon multifamily unit retrofits would remain.

Additional Multifamily Considerations

When considering the multifamily gap, some other factors are of note; these are reviewed below.

- The state BPS will impact multifamily homes over 20,000 sf, though the state BPS drives energy efficiency improvements, not necessarily reductions in onsite fossil fuel combustion.
- Generally, multifamily electrification tends to experience increased challenges compared to single-family structures, as these retrofits are more technologically complex and require more electrical infrastructure. They also tend to be associated with an exacerbated "split incentive" barrier, where gas is typically billed to landlords whereas electricity is billed to tenants.
- Generally, multifamily housing owned by affordable housing providers and/or that are subsidized by HUD are more likely to receive WAP funding given the greater ease in proving the income status of residents. These building owners typically have access to other pools of funding and, given the mission of their organizations, are more prone to pursue improvements that benefit their residents. They may also receive more outreach for participating in decarbonization programs given these factors. As such, these building types are generally believed to have an increased tendency to apply for IRA and other building rebate funds.
- However, subsidized housing does not encompass the housing needs of low-income renters. It is estimated that roughly 75% – 80% of low-income households nationwide live in unsubsidized housing, also referred to as Naturally Occurring Affordable Housing (NOAH).[170]
    - NOAH buildings in this case would be ones where 50% percentage of residents are low-income occupants or households earning less than 80% AMI. NOAH residents are also at higher risk of rent increases, particularly those associated with capital upgrades and mandated upgrades.[171]
    - Occupants and Owners of these properties will typically have fewer resources, incentives and/or less external pressure to seek out and complete decarbonization upgrades.

3.3 Commercial and Community Buildings

This section estimates the commercial decarbonization targets for each county based on its civilian labor force, and how much of those targets might be achieved by the anticipated federal and state funding and policy between 2025 to 2029.

[170] Based on Harvard's Joint Center for Housing Studies; cited by the Preservation Compact in NOAH Preservation Strategies, [LINK]; see also, Corso, Abigail, et al., "Making Naturally Occurring Affordable Housing More Efficient: Outreach to Upgrade," [LINK]; and Kling, Steve et. al, "Preserving the Largest and Most At-Risk Supply of Affordable Housing," McKinsey, February 23, 2021. [LINK]. Accessed 2/29/24.

[171] American Council for an Energy-Efficient Economy (ACEEE), "Responding to Renter Challenges with Integrated Energy Efficiency and Anti-\Displacement Strategies, " November 2022. [LINK]. Accessed 2/29/24.

Commercial and Community Decarbonization Targets

Based on proposed goals in the Operation 2030 Report reviewed in Section 3.0, the State would need 1,400 buildings (or 1.2% of commercial sf/yr.) and 2,400 buildings (or 1.8% of commercial sf/yr.) undergoing net zero carbon residential retrofits per year in Washington state by 2025 and 2030, respectively, to achieve state GHG reduction goals.

Research could not determine a uniform source of commercial square footage or commercial building counts for the four counties covered in this plan. Although imperfect, the below method was used to approximate the commercial square footage retrofit needs of the four counties covered in this plan.

- Each County's existing civilian labor force represents a proportion of the statewide labor force. Although the Covid-19 Pandemic has recently affected in-office working patterns, historically the civilian labor force has worked at a separate worksite. One can estimate the relative proportion of each county's commercial buildings to Washington state's total commercial buildings by using the relative civilian labor in each county compared to the state. Although imperfect, it provides enough information to estimate rough targets for decarbonizing commercial buildings.
- The Operation 2030 Report provides net zero carbon retrofit targets for the years of 2025 and 2030, but does not provide annual targets for the interim years. Interim year targets can be estimated based on an annual proportion of the difference between the two targets. In this case, between the 2025 goal of 1,400 annual net zero carbon building retrofits, and the 2030 goal of 2,400 annual net zero carbon retrofits, there is a difference of 1,000 units. This difference divided by five years results in an increase to the annual retrofit target of 200 units per year.

These two applications for the four counties covered in this plan are represented in Table 3.11, to estimate commercial building decarbonization targets by county, both annually and for the 2025 – 2029 period.

Table 3.11 Estimated Commercial Building Decarbonization Needs by County

County	**Nov 2023 Civilian Labor Force**[172]	**Proportion of State's Total Civilian Labor Force**	**Estimated Commercial Building Decarbonization Need Statewide and by County Proportion** YEAR *Targets*					**Total Units**
			2025	2026	2027	2028	2029	
			1,400	*1,600*	*1,800*	*2,000*	*2,200*	
King	1,367,014	33.6%	*470*	*537*	*604*	*671*	*738*	3,021
Kitsap	131,429	3.2%	*45*	*52*	*58*	*65*	*71*	290
Pierce	467,271	11.5%	*161*	*184*	*207*	*229*	*252*	1,033
Snohomish	464,494	11.4%	*160*	*182*	*205*	*228*	*251*	1,026
Statewide	4,072,728	59.7%	All Counties, 2025-2029, **Total Need**					**5,370**

[172] Washington State Employment Security Department, "Labor force by county snapshot," December 26, 2023. [LINK]. Accessed 1/2/2024.

The four counties covered in this plan contain almost 60% of the state's existing workforce, and as such likely represent a majority of the net zero carbon commercial retrofits needed in the state overall. As shown in Table 3.2, from 2025 to 2029, it is estimated that approximately 5,370 net zero carbon commercial building retrofits must occur in the four counties in order to keep pace with GHG reduction targets established by the state.

Also worth noting is the typical size of commercial buildings, as some types decarbonization levers apply to different building sizes. Unfortunately, there is currently not a commercial building profile for the four counties covered in this plan. However, there is information for the western census region that can provide context for the probable local commercial building profile; Table 3.12 shows how buildings for the commercial net zero retrofit goal might fall into these different floorspace size categories.

Table 3.12 Estimated Commercial Building Decarbonization by Floorspace

Building Floorspace (sf)	**% of Commercial Buildings by Floorspace for Western Census region**[173]	**Estimated Portion of 2025-2029 Net Zero Building Retrofits by Floorspace per Year** (from 5,370 retrofit need)
1,001 to 5,000	45.3%	2,434
5,001 to 10,000	25.9%	1,393
10,001 to 25,000	16.5%	888
25,001 to 50,000	6.8%	365
50,001 to 100,000	3.2%	174
100,001 to 200,00	1.4%	76
Over 200,000	0.7%	38

Floorspace sizes for the western U.S. are roughly consistent with the national commercial building profile, as nationally 71% of commercial buildings are 10,000 sf or smaller.[174] Overall, the national median building size is 5,400 sf, while the mean average building size is 16,300 sf.[175]

Community Buildings

It is worth noting that there are both private and publicly owned buildings that may have similar building structures, usage patterns and appliance fuel sources. These can be commercial buildings, or may sometimes not be occupied by commercial uses, but have similar GHG emissions. For instance:

- A nonprofit or public service operation that provides community services may lease the same type of space as a commercial office user.
- A private gym may use the same type of space and have similar facilities and hours of operation to that of a nonprofit or small community center.
- Some service operations, such as family home daycares or small senior care homes can operate out of single family homes, but may be used as residences outside operating hours.

[173] Energy Information Administration (EIA), "2018 Commercial Buildings Energy Consumption Survey (CBECS) Table B3: Census region, number of buildings and floorspace," Revised December 21, 2022. [LINK]. Accessed 2/9/2024. Pg 1.
[174] EIA, "2018 CBECS Building Characteristics Highlights," Revised September 2022. [LINK]. Accessed 1/23/2024. Pg 9.
[175] EIA, "2018 CBECS Building Characteristics Highlights," Revised September 2022. [LINK]. Accessed 1/23/2024. Pg 9.

Too, some building types that are typically grouped in similar classifications can have widely disparate building sizes, usage and emission patterns. For instance, in the Energy Information Administration (EIA) Commercial Buildings Energy Consumption Survey (CBECS), the "public assembly" classification can include libraries, exhibition halls, ice rinks and funeral homes.[176]

Based on the disparate and overlapping nature of community buildings, these building are currently not associated with additional designated targets, but rather are considered to be grouped within the commercial building targets. However, the general likelihood of their decarbonization and potential gaps to redress for these buildings is still discussed in subsequent subsections.

Commercial and Community Building Decarbonization Funding and Policies Statewide

This section discusses the probable commercial and community building decarbonization that will be achieved in the state through existing decarbonization commercial policy and funding sources.

Overall, the impact of funding and policy levers on decarbonizing commercial and community buildings is less definitive than in the residential sector, due to the unknown impacts of the state BPS. Reviewed in Section 2.1.b, the State BPS is the primary driver that could incentivize commercial building owners to advance towards building retrofits. However, the state BPS has two notable features affecting how it will impact commercial building decarbonization in the 2025 – 2029 period:

- Building Size. Fundamentally, the state BPS affects buildings larger than 20,000 sf, with impacts occurring at different times depending on size, namely: ≥220,000 sf, 90,000 sf, and 50,000 sf buildings starting in 2026, 2027 and 2028 respectively, and initial reporting for 20,000 sf buildings anticipated to start in 2027.[177]
- Efficiency vs. Emissions. The state BPS requires buildings to align with *energy efficiency* targets, as opposed to complying with *GHG emission* targets such as within the Seattle BEPS policy. As such, buildings may achieve BPS compliance through improving electrical efficiency, which would not reduce GHG emissions after 2030 due to the impacts of CETA on utility-supplied electricity.

It should be noted that another factor that may positively affect decarbonization of residential buildings is the Commercial Buildings Energy Efficient credit reviewed in Section 2.2.a Federal Inflation Reduction Act. The credit is for $2.50/sf to $5.00/sf for businesses achieving 25 to 50% reductions in energy use over existing building performance standards. While potentially useful, it is notable that – similar to the BPS – it is for energy use reductions, and may be obtained through improving electrical efficiency, rather than specifically driving reductions in onsite fossil fuel combustion.

Commercial and Community Building Decarbonization Gap

This section assesses the gap in needed commercial and community building decarbonization based on existing and projected policy and funding sources.

[176] EIA, "2018 CBECS Building Type Definitions," based on 2018 CBECS. [LINK]. Accessed 2/8/2024.
[177] WA Commerce, "Clean Buildings Performance Standard," 2023. [LINK]; "Clean Buildings - Frequently Asked Questions," 2023; [LINK]; and Example Timeline – 220k square feet [LINK] Accessed 1/3/2024.

Although EIA Commercial space assessments do not perfectly align with the floorspace divisions of the State BPS, the State BPS will not incentivize approximately 88% of the needed commercial building retrofits identified in Section 3.2.a Commercial and Community Decarbonization Targets, as shown in Table 3.13.

Table 3.13 Estimated Commercial Building Decarbonization by Floorspace			
Building Floorspace (sf)	**Estimated Portion of 2025-2029 Net Zero Building Retrofits by Floorspace** (From total 5,370 retrofit need)	**Subtotal, Buildings**	**Subtotal, %**
1,001 to 5,000	2,434	*Most Not Subject to BPS*	
5,001 to 10,000	1,393		
10,001 to 25,000	888		
		4,716	88%
25,001 to 50,000	365	*Subject to BPS*	
50,001 to 100,000	174		
100,001 to 200,00	76		
Over 200,000	38		
		289	5%

There are two caveats to this conclusion:

- Although it is projected the BPS will affect less than 300 of the estimated needed commercial net zero building retrofits, the BPS-affected buildings may represent a sizable portion of the overall commercial square footage needed to undergo net zero retrofits. Nationally, while buildings larger than 100,000 accounted for less than 3% of commercial buildings, that sector comprises 34% of commercial floorspace. [178] However, again, it is uncertain if the BPS will result in reduced onsite fossil fuel combustion, and may just result in electric efficiency improvements.
- For fossil fuel usage in buildings, size matters. Smaller commercial buildings in the U.S. typically have higher natural gas energy intensities, at almost double the intensity of large buildings – though this small buildings data also typically includes food service buildings, which impacts this figure.[179] A 2022 National Renewable Energy Laboratory (NREL) report addressed the higher natural gas usage in food service buildings, and the higher decarbonization challenges.

  > *The food service segments have the largest thermal energy end-use intensity, largely because of the greater water heating and ventilation needs of restaurants. In this segment, 30% of thermal energy use goes to space heating, 33% to water systems, and 22% to fan energy for heating, cooling, and ventilation. This sector might be especially challenging to decarbonize... Service water temperature needs in dishwashing systems are often much higher than can be produced through heat pump water heating systems, so finding electric technologies that can minimize demand is an important challenge. Furthermore, cooking creates high ventilation needs, so this contributes strongly to both the heating and cooling component loads of the segment, but energy recovery for this ventilation is challenging, as exhaust air*

[178] EIA, "2018 CBECS Building Characteristics Highlights," Revised September 2022. [LINK]. Accessed 1/23/2024. Pg 9.

[179] EIA, "2018 CBECS Consumption and Expenditures Highlights," December 2022. [LINK]. Accessed 1/23/2024. Pg 16.

> *from cooking is often contaminated with smoke and grease, which can damage heat recovery equipment…This segment is composed of many small energy-intense restaurants, so retrofitting this sector will involve dealing with a much larger number of buildings than some of the previously mentioned segments.*[180]

Beyond food service, other small building types have higher natural gas usages as well. For instance, service buildings and religious worship buildings notably had higher natural gas intensities than electricity usage intensities, and these buildings are also typically smaller in size (an average of 7,000 sf and 12,000 sf, respectively).[181] For religious worship buildings, space heating accounted for the largest share of end-use consumption (45%), with furnaces being the most common heating equipment (41%).[182]

It should also be noted that the market may not support onsite gas decarbonization for commercial buildings as strongly as it does other efficiency measures, such as the higher return on investments that can be realized by LED lighting retrofits and weatherization. Unlike case studies in other parts of King County, the greater Seattle area does not easily achieve a positive net present value with commercial HVAC equipment swap-outs for buildings up to roughly 50,000 sf in size, but instead these tend to have a neutral economic impact, so there is less of an economic incentive for building owners to pursue fossil fuel equipment swap-outs.[183] As such, additional support such as technical assistance, financing options and incentives may be more important to supporting HVAC electrification retrofits overall.

There also remains a significant gap in the transition off gas water heating for commercial buildings. As noted in the Northwest Energy Efficiency Alliance's (NEEA's) Commercial Building Stock Assessment (CBSA) 4 Final Report for the Pacific Northwest,

> *Approximately two-thirds of natural gas water heating capacity is still in the form of domestic hot water tanks, while that value is 83% for electric water heating. The proportion of efficient tankless water heating has more than tripled from 2014 to 2019, but that still only represents 19% of total regional water heating capacity. On the electric side, heat pump water heaters represent such a small portion of regional electric water heating capacity that they are combined with in the "other" system type, at 5% of the total. There are significant opportunities for utilities to continue to expand the installed capacity of these more efficient technologies in the coming years.*[184]

Although the impacts of the state BPS are muddied, there is a gap in policy, incentives, support and programming to help decarbonize the 4,716 commercial and community buildings unaffected by the state BPS, and likely to help decarbonize the estimated 289 buildings affected by the BPS, in the 2025 – 2029 assessment period.

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[180] Reyna, Janet, et. al, "U.S. Building Stock Characterization Study: A National Typology for Decarbonizing U.S. Buildings," National Renewable Energy Laboratory (NREL), July 2022. [LINK]. Pg 64 (PDF 75). Accessed 2/22/24.
[181] EIA, "2018 CBECS Consumption and Expenditures Highlights," December 2022. [LINK]. Accessed 1/23/2024. Pg 14, 18.
[182] EIA, "2018 CBECS: Principal Building Activities, Religious Worship." [LINK]. Accessed 2/22/2024.
[183] Fathollahzadeh, Mohammad Hassan and Anish Tilak, "The Economics of Electrifying Buildings, Medium-Size Commercial Retrofits," RMI, September 2022. [LINK to download site]. Accessed 1/23/2024. Pg. 6
[184] Northwest Energy Efficiency Alliance (NEEA), May 21, 2020. [LINK]. Accessed 2/23/24. Pg 8 (PDF pg 15).

3.4 Multi-sector

This section reviews gaps that affect multiple building sectors including broad financing needs and embodied carbon.

Financing

This subsection review how financing issues affect multiple portions of the building sector, and the gap on financing support.

An article reviewing a new financing model offered by BlocPower startup aptly summarized how financing supports the decarbonization project cycle.

> *There is a beautiful dance between finance and technology that can scale clean energy technologies: Prices fall when deployments increase; deployments increase when prices fall. The challenge is getting this virtuous cycle going. Early technologies are expensive and can have bugs, which can scare away early adopters. Financial innovations can help by jumpstarting the mainstreaming of clean technology and removing the risk from customers.*[185]

While some local financing initiatives reviewed in Section 2.1.d Local Utilities, Local Programs and Local Financing, it should be noted that there is not currently a green bank in Washington state to help blend public and private capital to fund the upfront cost of clean energy improvements for commercial or residential building owners.[186] As such, the primary mechanism for funding potential zero net retrofit projects comes from local financing sources.

Multiple regions have pointed to the need to either develop new, innovative financing models to close the decarbonization gap, or the need to better promote and encourage adoption of new financing models that have already been developed, such as the following:

- Within the European Union, industry members have cited the need for, "effective and scalable financing schemes [in order to] reach the volume of investment required to upgrade European buildings," requiring a projected €100bn annually.[187]
- For the U.S., the IEA has estimated that that US$31 trillion will be needed for energy efficiency in buildings over the next four decades.[188] To achieve decarbonization, the Metropolitan Washington Council of Governments have noted that, "Engaging marginalized customers and ensuring their access to the benefits of decarbonization will require innovative funding models and cooperation among several stakeholders with a diverse array of technical expertise."[189]

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[185] Golden, Sarah, "Electrifying Everything Should State with the Masses," Green Biz, February 26, 2021. [LINK]. Accessed 2/28/24.

[186] Center for the New Energy Economy and the Nature Conservancy, "Washington – Green Infrastructure Bank," State Policy Opportunity Tracker, last updated July 2, 2021.

[187] SmartEn, "Scalable Innovative Financing for Smart Buildings," October 2018. [LINK]Accessed 2/28/2024. Pg 3 (PDF pg 4).

[188] Gouyldson, Andy, et. al, "Innovative financing models for low carbon transitions: Exploring the case for revolving funds for domestic energy efficiency programmes," Energy Policy Vol. 86, Pages 739-748, November 2015. [LINK]. Accessed 2/28/24.

[189] Metropolitan Washington Council of Governments, "Equitably Financing Building Decarbonization Measures," December 2022. [LINK]. Accessed 2/28/24.

Per Section 3.1.c, there is a gap of 168,649 residential retrofits that would remain after accounting for the impact of existing rebates. Although additional rebate funding would help to fill this gap, and some households and building owners may be able to finance zero net residential retrofits on their own, a notable portion of Washington state households lack free capital to finance such retrofits. Recent research determined that roughly 28% of Washington households do not have incomes cover basic needs, i.e., to meet the minimum cost of living in Washington.[190] Such households would likely not be able to assume additional debt and its consequent debt payments to conduct retrofits – even the low-interest loan options identified in Section 2.1.d Local Utilities, Local Programs and Local Financing. Similarly, as reviewed in Section 2.1.d, while forgivable loans might be an option for some multifamily units, these are not known to be common within the four counties covered in this plan. Lastly, C-PACER may be able to be used for high-cost retrofit projects, but would not be a viable mechanism for smaller project costs or single-family/smaller unit building retrofits. As such, applying this 28% of Washington households to the identified residential retrofit gap (168,649) indicates that at least 47,220 homes would not be able to use existing financing structures to achieve retrofits. This would represent a financing gap to achieving residential zero net carbon retrofits.

This need for innovative financing models and additional financing support is echoed in the commercial sector. Per Section 3.2.e, there is a gap of 4,716 commercial and community buildings that would need to decarbonize i in the 2025 –2029 assessment period. It has been posited, generally, that some of this gap in the Commercial sector could be met with innovative financing:

> *The biggest challenge in achieving long-term decarbonization goals is obtaining the necessary funding for energy upgrades. In fact, 39% of executives stated that access to capital has been a significant barrier in implementing decarbonization plans. And despite a myriad of financing mechanisms available, only 1 in 4 executives report their organizations use available financing structures for commercial scale decarbonization projects.*[191]

Applying the above conclusion that 75% of executives are unable to use available financing structures to the number of building commercial/community building retrofits needed (4,716), it indicates that roughly 3,535 buildings may likewise not be able to use existing financing structures to achieve retrofits. This would mean that, while the C-PACER instrument (reviewed in Section 2.1.d Local Utilities, Local Programs and Local Financing) might be useful for some buildings, it would not uniformly support all needed commercial retrofits. This would represent a financing gap to achieving zero net carbon commercial retrofits.

Embodied Carbon

This subsection reviews what embodied carbon is, that it affects multiple portions of the building sector, how it is addressed in the SES, state activity, and the gap on embodied carbon policy.

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[190] Nickelsburg, Monica, "28% of families in Washington state can't afford basic needs, UW study finds," KUOW, September 26, 2023. [LINK]. Also, Kucklick, Anna, Lisa Manzer and Alyssa Mast, "Overlooked & Undercounted Struggling to Make Ends Meet in Washington State," Center for Women's Welfare, UW School of Social Work, and Workforce Development Council of Settle-King County. September 2023. [LINK]. Pg 9. Accessed 2/28/24.

[191] Ameresco, "2030 is approaching: Survey reveals that innovative financing could fast track decarbonization plans," ESGDive, November 6, 2023. [LINK]. Accessed 2/28/24.

Embodied Carbon: What is It?

This subsection reviews what embodied carbon is, and associated building material GHG emissions.

Embodied carbon refers to the amount of GHGs emitted from creating and transporting materials, and typically specifically refers to the production of building materials.[192] Some include the emissions from the process of installing the building materials on a construction site, with production and installation emissions sometimes referred to as "upfront carbon."[193] Others sometimes also include the emissions that result from maintaining building materials, and emissions from its ultimate disposal at end-of-life.[194] For the purposes of this plan, building material embodied carbon "refers to greenhouse gas emissions arising from materials extraction, manufacturing, transportation, and construction."[195]

The building industry drives a large portion of emissions associated with the production of materials, with common building materials responsible for notable GHG emission releases worldwide. For instance, "globally, the buildings construction sector accounts for approximately 50% of the demand for cement and 30% of steel."[196] By itself, cement production is estimated to be responsible for between 7 to 8% of global GHG emissions, and steel production is estimated to be responsible for another 7% of global GHG emissions.[197] Overall, GHG emissions from building materials manufacturing accounts for 11% of global carbon emissions and 28% of GHG emissions associated with the building sector when combined with operational emissions.[198] These emissions are projected to increase over time, with steel production estimated to grow 25 – 40% by 2050, and cement demand projected to grow by 12 – 23% by 2050.[199]

Embodied Carbon: SES Approach

This subsection reviews SES treatment of embodied carbon.

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[192] University College London (UCL), "Embodied Carbon: Factsheet." [LINK]. Accessed 2/28/24.
[193] Siegel, Henry and Larry Strain, "Embodied Carbon: What You Can Do Right Now," March 5, 2020. [LINK]; and Adams, Matthew, Victoria Burrows, Stephen Richardson, "Bringing embodied carbon upfront ," World Green Building Council (WorldGBC), 2019. [LINK]. Pages 6, 18 (pdf pages 4, 10). Accessed 2/9/2024.
[194] Microsoft, "Reducing Embodied Carbon in Construction," 2021. [LINK]. Page 7. Also, Adams, Mathew, Victoria Burrows, Stephen Richardson, "Bringing…," ibid. [LINK]. Page 5 (pdf page 3). Accessed 2/28/24.
[195] Simonen, Kathrina, Tina Dilegge, Monica Huang, James Ditto, "Buy Clean Washington Study," Carbon Leadership Forum (CLF), February 19, 2019. Commissioned by WA State 65th Legislature. [LINK]. Page vi (pdf page 8). Accessed 2/28/24.
[196] United Nations Environment Program (UNEP), "2020 Global Status Report for Buildings and Construction," 2020. [LINK]. Page 23. Accessed 2/28/24.
[197] Rempher, Audrey and Victor Olgyay, "Colorado Passes Embodied Carbon Legislation," Rocky Mountain Institute (RMI), July 20, 2021. [LINK]; OpenAirCollective, "The New York (A2591/S542) and New Jersey (A5223) Low Embodied Carbon Concrete Leadership Act," last updated August 17, 2021. [LINK]; and Swalec, Caitlin and Christine Shearer, "Pedal to the Metal," Global Energy Monitor Report, June 2021. [LINK]. Page 3; and Peplow, Mark, "Can industry decarbonize steelmaking?," Chemical & Engineering News (c&en), Volume 99, Issue 22. [LINK]. Accessed 2/9/2024.
[198] Simonen, Kathrina, et al., "Buy Clean…," ibid. [LINK]. Page 2-1 (pdf page 23). Accessed 4/6/2022.
[199] Holappa, Lauri, "A General Vision for Reduction of Energy Consumption and CO2 Emissions from the Steel Industry," Metals 2020, 10, 1117; doi:10.3390/met10091117. [LINK]. Bataille, Chris, "Low and zero emissions in the steel and cement industries," Organization for Economic Co-operation and Development (OECD) Issue paper, 2019. [LINK]. Pg 5. Accessed 2/28/24.

The SES approaches embodied carbon mostly as it relates to industrial emissions from material production sites, as the production of building materials is conducted within the industrial sector. However, the 2023 Biennial Report on SES progress acknowledges that decarbonizing the building sector will also require minimizing embodied carbon. It reiterates that "policies that track and address embodied carbon in materials are one of the critical tools that can help us learn more about the GHGs required to produce the goods we use today, and can incentivize the procurement of goods with a lower carbon footprint."[200]

As such, embodied carbon policies represent an intersection of the buildings sector and the industrial sector, with the potential to reduce GHG emissions in both the building industry, as well as in manufacturing businesses producing building industry supplies. For instance, Washington's industrial sector accounts for 28% of the state's GHG emissions, with some of the highest identified energy-consuming industries including forest products, cement and glass.[201] Similarly, a 2021 Rocky Mountain Institute report found that the GHG emissions associated with several building materials for a construction site could be reduced by between 19 to 46% depending on the material source selected, most with a cost impact of less than one percent.[202] Specifically, the report found potential GHG reductions for the building materials outlined in Table 3.14.

Table 3.14 Embodied Carbon Reductions Possible from Sourcing[203]

Building Material	Possible GHG Percentage Reduction in Material Selection	Cost Premium impact
Concrete	14% to 33%	None to Low
Rebar	4% to 10%	None to Low
Insulation	16%	No Cost Premium
Finish Materials	5%	None to Low
Glazing (glass)	3%	10% Cost Premium

Although embodied carbon policies tend to focus first of concrete and steel production, salvaged wood products are also of growing interest among building products for its embodied carbon benefits. For instance, cross-laminated secondary timber has the potential to replace virgin steel and concrete, and could be an alternative material type with lower embodied carbon values.[204] Cradle-to-gate life cycle assessments show that reclaimed wood production consumes 11-13 times less energy than using virgin lumber.[205] The global warming potential of virgin wood products has also been shown to be Global

[200] Commerce, "2023 Biennial Energy Report," March 22, 2023. [LINK]. Accessed 2/12/2024. Pg 46,61 (PDF pg 48, 63).
[201] Commerce, "Washington 2021 State Energy Strategy," December, 2020. [LINK]. Accessed 2/12/24. Pg 85.
[202] Esau, Rebecca, Matt Jungclaus, Victor Olgyay, and Audrey Rempher, "Reducing Embodied Carbon in Buildings," Rocky Mountain Institute (RMI), July 2021. [LINK]. Accessed 2/12/2024
[203] Esau, Rebecca, et al., "Reducing Embodied Carbon…," Ibid. [LINK]. Accessed 9/13/021. Page 6.
[204] Strobaek, Neel and Davapriyo Das, "Is Recycle Timber the Answer to Our Carbon Woes," Interview of Dr. Colin Rose, Ramboll, July 3, 2022. [LINK]. Accessed 2/28/24.
[205] Bergman, Richard, et. al, "Using Reclaimed Lumber and Wood Flooring in Construction: Measuring Environmental Impact Using Life-Cycle Inventory Analysis," Proceedings of the International Convention of Society of Wood Science and Technology and UN Economic Commission for Europe – Timber Committee. October, 2010. [LINK]. Accessed 2/28/2024.

Warming Potential was about 3 and 5 times greater than salvaged wood products.[206] Finally, reducing wood waste directed to regional landfills both reduces GHG emissions associated with wood waste decomposition. Note that wood products are sometimes addressed in embodied carbon policies, though can sometimes be addressed through circular economy programming, which strives to re-purpose and retain materials and products in circulation for as long possible.[207] For more information on circular economy as it applies to wood, please see Appendix D.4 Circular Economy Salvaged Lumber.

To support embodied carbon reductions, the SES provides strategy groups with specific approaches. The two SES strategy groups that relate more strongly to embodied carbon are:

- Expand Policies to Consider Consumption-based Emissions, and
- Leverage the Economic Transition to Create New Inclusive, Living-Wage Jobs.

These strategy groups in turn identify several alternative means to support embodied carbon emission reductions, including:

- Evaluating consumption-based emissions, acknowledging the impact of embodied carbon, and that global demand will be increasing for low-embodied carbon materials.[208]
- Incentivizing the development of Environmental Product Declarations (EPDs) for products & materials consumed in state. The SES notes that,

  > *By establishing demand for and a willingness to purchase low-carbon products, private sector investments and innovation are encouraged… Without regulatory requirements, the disclosure of life-cycle emissions is left to voluntary private sector action. While some private companies are requiring EPDs for their construction projects, state and local governments procure and fund many of these products and materials. Public agencies could play a significant role in incentivizing better disclosure practices.*[209]

- Invest in Reducing Emissions from State Contracts and Operations materials consumed in state, including the recommended action of adopting "Buy Clean / Buy Fair" requirements for public projects, a type of embodied carbon policy that also requires labor information reporting.[210] The SES notes that,

  > *Requiring or incentivizing suppliers and contractors to meet certain labor standards, disclose the emissions performance of their products and follow low carbon practices can support a strong workforce and further the state's progress in decarbonizing. Requiring agencies to factor greenhouse gas emissions into purchasing decisions supports and drives clean industry—leveling the field for those who have invested in green approaches and motivating others to follow suit.* [211]

[206] Bergman, Richard, et. al, "Using Reclaimed Lumber…," ibid. [LINK]. Accessed 2/28/2024.
[207] EPA, "What is a Circular Economy," last updated December 14, 2023. [LINK]. Accessed 2/26/2024.
[208] Commerce, "Washington 2021 State Energy Strategy," December, 2020. [LINK]. Accessed 2/12/24. Pg 104.
[209] Commerce, "Washington 2021 State Energy Strategy," December, 2020. [LINK]. Accessed 2/12/24. Pg 105.
[210] Commerce, "Washington 2021 State Energy Strategy," December, 2020. [LINK]. Pg 109; also see Lewis, Meghan et. al, "Buy Clean and Buy Fair Washington Project Final Report," University of Washington Carbon Leadership Forum, and Commerce, November 1, 2022. [LINK]. Pg 1 (PDF pg 7) Accessed 2/12/24.
[211] Commerce, "Washington 2021 State Energy Strategy," December, 2020. [LINK]. Accessed 2/12/24. Pg 109.

Overall, as embodied carbon affects building products used in the building industry, embodied carbon is considered a multisector issue within the built environment.

Embodied Carbon: Gap

This subsection assesses the gap in embodied carbon policy based on existing state activity and the SES.

Drawing on the SES approach and the recent biennial report update, embodied carbon policies can interact with the building industry in two primary ways, namely they can:

- Result in lower emissions at point of construction for new and retrofit construction projects, and
- Incentivize industries to reduce the emissions of their buildings and facilities, in order to capitalize on growing markets for lower embodied-carbon products.

The latter impact may intersect with a gap in how industrial emissions are addressed in other state law. As previously reviewed in Section 2.1.e Climate Commitment Act, the CCA has specific treatment for covered industrial emitters or EITE facilities. The CCA conveys relatively low pressure on EITE facilities to reduce their GHG emissions, with free emission allowances through 2026 equal to their 2015-2019 emissions baseline, with these free allowances reduced by only:

- 3% from 2027 through 2030, and
- 6% from 2031 through 2040, and potentially onward.[212]

Although this approach is consistent with SES cautions with how EITEs are regulated, this also means these businesses have lower GHG emission reduction pressures from the CCA.[213]

Although the SES does not list specific, quantifiable GHG reduction goals for embodied carbon, it does provide specific policy recommendations. Yet, despite SES recommendations, there has not been significant state legislative action to date that advances the embodied carbon strategies identified in this section.[214] The lack of state policy regarding embodied carbon represents a policy gap at the County level, where one or several of the counties addressed in this plan could advance embodied carbon requirements for public and even private construction projects, reducing GHG emissions at the point of construction and incentivizing emissions reductions of industrial facilities.

For more information on embodied carbon programs, and additional context in Washington state, please see Appendix D.3 Embodied Carbon.

[212] WA Legislature, "Final Bill Report E2SSB 5126," Ibid. [LINK]. Accessed 1/8/2024.Page 5, 9.
[213] Commerce, "Washington 2021 State Energy Strategy," December, 2020. [LINK]. Accessed 2/12/24. Pg 93.
[214] In the 2024 state legislative session, House Bill 1282, and its companion bill Senate Bill 5322, are being tracked as to whether they affect embodied carbon requirements. As currently written, these bills would only affect state-funded capital projects.

4.0 Existing Building Decarbonization Priority Measures

This section builds on the gap analysis of the previous section to outline implementation-ready priority measures for the region. The priority GHG measures contained within this PCAP should be construed as broadly available to any entity in the MSA eligible for receiving funding under the EPA's Climate Pollution Reduction Grants (CPRG) program and other funding streams, as applicable.

This section also reviews implementation authority, implementation schedules and milestones, and GHG emission reduction estimates for the listed Priority Measures.

4.1 Priority Measures

This section summarizes priority measures to address decarbonization gaps identified in Section 3.

Single-family Residential and Small Business

The following Priority Measures are identified for single-family homes and some small businesses:

Appendix D. Measure 1: Heat pump rebate program for single-family homes

Description: Establish a rebate and/or installation program for heat pumps in single-family homes using higher GHG-emitting or fossil fuel heating sources such as oil-, propane-, gas-, or wood-heat. Prioritize rebates or installations in low-income households; in overburdened communities; in households with vulnerable populations such as seniors or children; and in hard-to-reach households, such as in first-language-not-English (FLNE) homes, and in rental homes with homeowner permission and that agree to some degree of rent protection for the tenants.

Appendix D. Measure 2: Water heating "tank swap" for single-family homes or small businesses

Description: Establish a water heating "tank swap" program, that provides rebates for heat pump water heaters to replace gas water heating in single-family homes or small businesses.

Appendix D. Measure 3: Whole-home decarbonization for single-family homes

Description: Establish a whole-home decarbonization program for single family homes that may include, but is not limited to, providing rebates for and/or installing heat pumps, heat pump water heaters, weatherization, air sealing, ventilation, air filtration. Limit the program to homes using higher GHG-emitting or fossil fuel sources such as oil, propane, gas, or wood fuels. Prioritize rebates or installations in low-income households; in overburdened communities; in households with vulnerable populations such as seniors or children; and in hard-to-reach households, such as in first-language-not-English (FLNE) homes, and in rental homes with homeowner permission and that agree to some degree of rent protection for the tenants. Also prioritize this program for single family homes that house community service businesses, such as in-home daycares and in-home senior care services.

Multifamily Residential

The following Priority Measures are identified for multi-family homes:

Appendix D. Measure 4: Water heating "tank swap" for multifamily buildings and units

Description: Establish a water heating "tank swap" program, that provides rebates for heat pump water heaters to replace gas water heating in multifamily units.

Appendix D. Measure 5: “Dryer swap" program for multifamily buildings and units

Description: Establish a "dryer swap" program, that provides rebates for electric heat pump clothes dryers to replace gas clothes dryers in multifamily units.

Appendix D. Measure 6: Whole-building decarbonization for multifamily buildings

Description: Establish a whole-building decarbonization program for multifamily buildings with onsite fossil fuel combustion that may include, but is not limited to, providing rebates for and/or installing heat pumps, heat pump water heaters, electric clothes dryers, weatherization, air sealing, ventilation and air filtration, and solar if there would otherwise be electric bill impacts on residents. Prioritize rebates or installations in low-income multifamily buildings, defined as buildings where at least at least 50% of households have incomes less than 80% AMI (<80%). Also prioritize rebates or installations in buildings located in overburdened communities, that house four or more units, and/or that are not considered subsidized affordable housing. Include mixed-use buildings for decarbonization measures only for residential building portions, and only when the buildings otherwise meet the criteria of this measure. Require that multifamily building owners agree to measures that ensure they do not indiscriminately increase rents, displace or evict tenants as a result of the improvements, and provide enforcement of tenant protections. While it is projected that most multifamily buildings with onsite fossil fuel combustion are those under 20,000 sf, or have between 10 – 20 units, do not limit this program to buildings that only meet these size restrictions.

Appendix D. Measure 7: Multifamily technical assistance

Description: Establish a program that provides outreach, building benchmarking, and/or technical assistance supporting decarbonization and energy efficiency to multifamily buildings, as well as support for installation of solar, energy storage and onsite electric vehicle charging where available. Limit the program to buildings where at least at least 50% of households have incomes less than 80% AMI (<80%), or that are subsidized affordable housing such as buildings receiving HUD subsidies, financing through the Low-Income Tax Credit Program, or other state or federal subsidized housing program support. Program support should include, but would not necessarily be limited to, support for replacing fossil fuel appliances as well as uptake of federal IRA rebates, C-PACER programs, and other financing options to achieve decarbonization and energy efficiency improvements.

Commercial and Community Buildings

For this measure, Commercial and Community Buildings are those that meet these criteria:

- The buildings can be either privately-owned, publicly-owned, or owned by a nonprofit entity.
- The buildings provide a community gathering space, or a community service. Examples include, but are not limited to day cares; senior centers; houses of worship; community centers; libraries; Community Based Organizations (CBOs) or nonprofit buildings that provide direct community services or host community meetings; fire stations with public or community meeting spaces; community kitchens; food banks; schools; designated cooling centers; and buildings housing district energy systems serving one or several of these building types.

The following Priority Measure is identified for commercial and community buildings:

Appendix D. Measure 8: Community decarbonization grants

Description: Establish a rebate, grant, and/or installation program to decarbonize building heating and/or mechanical systems, when such programs replace or reduce fossil fuel or GHG-intensive sources such as oil-, propane-, gas-, or wood fuels. Including support for air-sealing, ventilation, and high-efficiency air filtration in the program. Include support for decarbonizing district energy systems where necessary to achieve decarbonization or priority community buildings. Prioritize rebates, grants, and/or installations in buildings located in and/or serving overburdened communities; serving vulnerable populations such as seniors or children; or serving first-language-not-English (FLNE) community members. Make the program available for both privately-owned, nonprofit-owned and publicly-owned buildings, and prioritize buildings that provide a community gathering space. For all projects besides those in public ownership, prioritize including the option of technical assistance for assessments; engineering and design; support to connect building and system owners to relevant financial resources and external weatherization rebates and options as needed; as well as funding for direct capital improvements.

Multi-sector Decarbonization

The following Priority Measures are identified to address building decarbonization across multiple sectors:

Appendix D. Measure 9: Embodied carbon program

Establish an Embodied Carbon program to pursue integrating embodied carbon requirements in state building codes, to reduce embodied carbon associated with construction projects, and to achieve GHG reductions in industrial buildings that manufacture products in the construction building supplies chain. Absent state code adoption, adopt and support implementation of embodied carbon requirements for public projects, and integrate embodied carbon requirements in local buildings codes requiring limits for commercial and multifamily projects for large projects initially, phasing down to medium-sized projects. The program would initially support reporting, education and voluntary compliance for public projects with mandatory carbon limits for public projects, then phasing-in requirements for applicable private projects. The program would focus on cement, concrete and steel emission reductions, and possibly wood, as well as gypsum board and other finishes or products as deemed feasible through program research. The program could include, but would not necessarily be limited to, supporting education and outreach; code writing, research, and code implementation support for local building code amendments; research, feedback and implementation support for potential state building code amendments; supporting supplier development of Environmental Product Declarations (EPDs); testing of and researching of new lower-GHG emission materials; as well as programs to support or directly upgrade supplier facilities, manufacturing processes or fleets to reduce GHG emissions.

For more information, please see Appendix D.3 Embodied Carbon.

Appendix D. Measure 10: Circular economy salvaged lumber program

Establish a circular economy salvaged lumber program to support a central salvaged lumber warehouse that could include, but would not be limited to manufacturer incentives for using salvaged lumber warehouse products; a deconstruction training and certification program for salvaged lumber

harvesting; staff support for minimal processing and transportation to regional salvaged lumber suppliers and/or processors; and support for a community-centered salvaged lumber utilization program. Use of salvaged materials will offset virgin materials that have higher embodied carbon emissions; such materials can be used in both residential and commercial buildings.

For more information, please see Appendix D.4 Circular Economy Salvaged Lumber.

Appendix D. Measure 11: Innovative financing program

Establish an innovative financing program to increase uptake of existing financing tools, and to research and develop additional financing options to leverage added capital to accelerate building decarbonization in the private sector for residential and commercial buildings. This program could include, but would not be limited to: outreach and education on C-PACER financing; research and development of a local GHG offset program to fund fossil fuel appliance replacements; researching funding models to support food service decarbonization; and funding options that may improve low income homeowner decarbonization activity such as interest rate buy down programs, and consolidated private financing of lease-to-own electric appliance programs with on-bill repayment options.

4.2 Implementation Authority

This section summarizes the implementation authority of the priority measures identified in Section 4.1.

The counties covered in this plan have authority to implement Section 4.1 measures – which are aimed at reducing greenhouse gas emissions, conserving energy, and mitigating/adapting to the public health impacts of climate change – as a fundamental purpose of government.

The foundation of GHG reduction authority as a fundamental purpose of government relates partially to constitutional restrictions on gifting. Washington Constitution Article VIII, section 7, prohibits the gift of public funds except for the necessary support of the poor and infirm. The purpose of this provision is to prevent public funds from being used to benefit private interests where the public interest is not primarily served.[215] Expenditures that fall outside of article VIII, section 7's exception for necessary support of the poor and infirm are not considered a gift of public funds if such expenditures carry out a fundamental governmental purpose. In these cases, any benefit private parties receive is considered incidental to accomplishing the fundamental government purpose.[216]

Among the fundamental purposes of government recognized by the courts are the exercise of police power. County exercise of police power is provided in Article XI, Section 11 of the Washington Constitution, which reads, "Any county, city, town or township may make and enforce within its limits all such local police, sanitary and other regulations as are not in conflict with general laws."[217] The Washington Supreme Court has construed the police power broadly, holding that it extends not only to the preservation of the public health, safety, and morals but also to the preservation and promotion of the public welfare.[218]

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[215] *See Japan Line, Ltd. v. McCaffree*, 88 Wn.2d 93, 98, 558 P.2d 211 (1977); *State ex rel. Graham v. City of Olympia*, 80 Wn.2d 672, 675, 497 P.2d 924 (1972).
[216] *See CLEAN v. State*, 130 Wn.2d 782, 797, 928 P.2d 1054 (1996); and *City of Tacoma v. Taxpayers of City of Tacoma*, 108 Wn.2d 679, 702, 743 P.2d 793 (1987).
[217] Washington State Constitution, Art. XI, § 11. [LINK]. Accessed 2/20/24.
[218] *Hudson*, 94 Wn. App. at 995-96.

However, mitigating GHGs can be considered a fundamental purpose of government by itself. As far back as 2007, the Supreme Court in *Okeson v. City of Seattle* held that "combating global warming is a general government purpose, albeit a meritorious one," and that mitigating the effects of GHG emissions must therefore "be borne by general taxpayers rather than utility ratepayers."[219] More recently, the Supreme Court recognized the hazards posed by climate change and the need for mitigative action: "The issue is not whether man-made climate change is real—it is. Nor is the issue whether dramatic steps are needed to curb the worst effects of climate change—they are."[220] Similarly, the state Attorney General's Office has relied on legislative findings and climate change actions in concluding that addressing and mitigating climate change is within the general authority of local governments.[221]

Finally, the State Legislature has repeatedly declared that governmental action on climate change is necessary. The State Legislature has stated that, "[g]lobal climate change represents an existential threat to the livelihoods, health, and well-being of all Washingtonians"; that "significant and swift reductions in greenhouse gas emissions" are needed to address "immediate significant threats to our economy, health, safety, and national security" posed by climate change; and that "the state, including its counties, cities, and residents, must engage in activities that reduce greenhouse gas emissions and dependence upon foreign oil." [222]

In addition to the above, it should be noted that added authority is provided for one of the proposed measures, App. D Measure 9: Embodied Carbon program, which outlines the potential to adopt local amendments to the building code for commercial and multifamily projects. This authority is as follows:

- Revised Code of Washington (RCW) 19.27.060 states that counties may amend the building codes as they apply within their respective jurisdictions, so long as the amendments do not result in a code that is less than the minimum performance standards of the state code.[223]
- RCW 19.27.060 also states that, with few exceptions, local building code amendments may not affect single-family or multifamily residential.[224]
- However, in this case RCW 19.27.015 (which provides chapter definitions) defines "multifamily" as "common wall residential buildings that consist of four **or fewer** units…" (emphasis added).[225]

Given these RCW requirements, proposed local building code amendments to add embodied carbon requirements focus on amendments to commercial buildings, and multifamily buildings not within the RCW 19.27.015 definition. However, local jurisdictions could have the option to pursue embodied

[219] *Okeson v. City of Seattle*, 159 Wn.2d 436, 439, 445, 448-52, 150 P.3d 556 (2007).
[220] 195 Wn.2d 1, 5, 455 P.3d 1126 (2020) (emphasis added; citation omitted).
[221] 2008 Op. Att'y Gen. No. 6, 2008 WL 1847185, at *1-3 ("Washington State will have climate change programs and emission reduction targets which will, at the very least, impact local governments and perhaps require the participation of local governments. Local governments may make the policy choice to incorporate sustainability and climate change analysis into their programs.").
[222] Laws of 2008, ch. 289, § 1 (emphasis added); Laws of 2020, ch. 79 (amending the 2008 emission reduction legislation); and Laws of 2019, ch. 288 (codified at chapter 19.405 RCW, Washington Clean Energy Transformation Act of 2019).
[223] RCW 19.27.060. [LINK]. Accessed 2/20/2024.
[224] RCW 19.27.060. [LINK]. Accessed 2/20/2024.
[225] RCW 19.27.015. [LINK]. Accessed 2/20/2024.

carbon requirements in the residential code at the state level, as the state has the authority to amend residential building codes.

4.3 Implementation Schedules and Milestones

This section reviews the projected implementation schedules and milestones of the priority measures identified in Section 4.1.

Most priority measures would require hiring new staff to provide program oversight, and the execution of one or more contracts for services. These processes typically take 9 months when combined, as the new staff would typically be in charge of contract development. Sometimes this timing can be reduced to 7 months if existing staff have capacity to support the initial phase of advertising for contract services. The timing of these activities is reviewed below, and integrated in most measures as "Baseline Timing."

Hire Staff (3-4 months)

The following timeline and tasks are anticipated for this objective.

- Month 1: Develop position description, and obtain approval to post.
- Month 2: Advertise the position, and review candidate applications.
- Month 3: Conduct 1st and 2nd interviews of candidates, and extend position offer.
- Month 4: Provide time for leave notice to previous employer, and complete onboarding.

Milestone: Staff position hired.

Retain Contract Services (4-5 months)

The following timeline and tasks are anticipated for this objective.

- Month 1: Develop a Request for Qualifications (RFQ). Invite selection panel members.
- Month 2: Review of RFQ, obtain approval to publicly post, and complete posting.
- Month 3: Pre-proposal conference, receive & develop public answers. Receive submittals.
- Month 4: Score proposals, interview top scorers, selection panel final meeting.
- Month 5: Negotiate contract amendments; obtain procurement approval; execute contract.

Milestone: Contract services retained.

Rebate Programs

This subsection reviews the projected schedules and milestones of rebate program priority measures identified in Section 4.1. This scheduling subsection would apply to the following measure numbers and titles:

- App. D Measure 1: Heat pump rebate program for single-family homes
- App. D Measure 2: Water heating "tank swap" for single-family homes or small businesses
- App. D Measure 4: Water heating "tank swap" for multifamily buildings and units.
- App. D Measure 5: "Dryer swap" for multifamily buildings and units

This program timeline would combine the need to hire staff for program management and issuing one RFQ. For rebate-oriented priority measures, the one RFQ would likely be to establish a distributor rebate program. In this model, the local government retains an equipment distributor that issues rebates through their vetted contractor pool to customers, and then bills the local government for the

rebates issued. This model has been successfully used by local governments within King County, namely by the City of Seattle, and within a collaborative heat pump program between the cities of Bellevue, Issaquah, Kirkland, Mercer Island and Redmond.

In addition to activities conducted under Baseline Timing, the following is assumed for program outreach and activation:

Program Outreach (1-2 months)

The following timeline and tasks are anticipated for this objective.

- Month 1: Develop outreach collateral. Develop copy for webpage, newsletters, flyers and online rebate program postings. Meet with stakeholders on program design.

  Milestone: Outreach materials package complete.

- Month 2: Outreach implementation; outreach to stakeholders and presentations at community group meetings.

  Milestone: Outreach implementation launched.

Program Activation (1-3 months)

- Months 1-2: Continued outreach; In private sector, activity may be occurring to set up equipment installs, i.e., bidding, contract execution, and equipment ordering/delivery.
- Month 3: First installs anticipated.

  Milestone: First rebates issued.

Although Program Outreach will have milestones contributing to the program, this program activity can occur simultaneously to the process of retaining contract services, though program activation would need to occur after contract services have been retained (i.e., not concurrent).

As such, when adding the Baseline Timing (7 – 9 months) to program activation (1 – 3 months), it is anticipated that Rebate programs will take between 8-12 months to establish and see the first rebates issued.

Whole-Building Retrofit, Installation, and Technical Assistance Programs

This subsection reviews the projected schedules and milestones of whole-building retrofit and technical assistance priority measures identified in Section 4.1. This scheduling subsection would apply to the following measure numbers and titles:

- App. D Measure 3: Whole-home decarbonization for single-family homes
- App. D Measure 6: Whole-building decarbonization for multifamily buildings
- App. D Measure 7: Multifamily technical assistance

This program timeline combines the need to hire staff for program management and, for most priority measures, issuing multiple RFQs to retain consultant assistance with program management as well as hiring contractors to install electrification equipment and weatherization measures. Managing contractors to directly install improvements to properties has been widely used by housing authorities and local governments in the region. However, it is worth noting that the retained consultant(s) for

program management would likely inform scope design and selection criteria of the hired installation contractors; as such, the consultant RFQ would precede the installation RFQs, rather than running concurrent to it.

In contrast to measures 3 and 6, the technical assistance priority measure (7) would only require one RFQ if pursued as a stand-alone measure. However, some of the other timing impacts of this group pertain more closely to this measure than other schedule groups. As its schedule is unique, it is called out separately from measures 3 and 6.

In addition to activities conducted under Baseline Timing, the following is assumed for program outreach, participant recruitment and activation:

Additional Contracting (4-5 months)

As noted in the overview above, securing equipment and weatherization contractors would likely have to occur after consultant assistance for program management is retained, and would follow the standard contracting schedule already reviewed.

Milestone: Contract services retained for installation services.

Program Outreach; Application, Scoring and Participant Agreements; and Recruitment (2-3 months)

The following timeline and tasks are anticipated for this objective.

- Month 1: Develop outreach collateral. Develop copy for webpage, newsletters, flyers and online rebate program postings. Meet with stakeholders on program design. Possible design of workshop recruitment materials and application and scoring processes for candidates.

Milestone: Outreach materials package and application materials complete.

- Month 2: Outreach implementation; research on program participant candidates; outreach to stakeholders, possible candidates, and community group meeting presentations. Develop draft participant agreement forms.

Milestone: Outreach implementation launched, and participant agreement materials drafted.

- Month 3: Workshops and independent calls with possible program participant candidates. Secure and complete legal review of participant agreements forms.

Milestone: Participant recruitment launched, and participant agreement materials finalized.

Program Activation (4-5 months)

- Month 1: Receive candidate applications. Review and possible scoring of candidate applications. Selection of first round of building owner participants.
- Month 2: Site assessments and financial assessments of projects; utility rebate evaluations. Potential preliminary agreement with building owners; outreach to, and income verification of, residents.
- Months 3-4: Execute final agreements with building owners; issuing work orders with installers; installer equipment and material orders submitted with suppliers.
- Month 5: First whole-building retrofits completed.

Milestone: First buildings retrofits completed.

Although the Program Outreach (etc.) phase will have milestones contributing to the program, two months of this program activity can likely occur simultaneously to the process of retaining installer contract services. It is preferable that installer contracts be finalized prior to workshops or outreach with potential building applicants, so that installers could attend outreach workshops and be available to answer questions from building owners on potentially unique building attributes. Program activation would need to occur after contract services have been retained (i.e., not concurrent).

As such, when adding the Baseline Timing (7 – 9 months), Additional Contracting (another 4-5 months); 1 month of Outreach (etc.), and Program Activation (4 – 5 months), it is anticipated that whole-building retrofit programs will take between 16-20 months to establish and see the first retrofits completed. Note that, if there is an option to establish contracting at the same time or combined in consultant assistance, this would reduce the whole-building retrofit schedule to 12-16 months.

As noted previously, the technical assistance priority measure (7) would only require one RFQ if pursued as a stand-alone measure, and not require additional contracting. It would also:

- Still require 3 months of the Outreach (etc.) phase, though likely without the milestones of requiring applications or participant agreements;
- Still require 2 months of the Program Activation phase, assuming one month to complete site assessments and financial assessments of projects and utility rebate evaluations, and another month – and added task and milestone – of generating review materials, issuing reports and possible meetings to review outcomes with building owners.

Milestone: First technical assistance reports issued.

As such, when adding the Baseline Timing (7 – 9 months), 3 months of Outreach (etc.), and 2 months of Program Activation, it is anticipated that technical assistance for multifamily buildings measure would take between 12-15 months to establish and see the first technical assistance reports issued.

Staff-Reliant Program Development

This subsection reviews the projected schedules and milestones of staff-reliant program priority measures identified in Section 4.1. This scheduling subsection would apply to the following measure numbers and titles:

- App. D Measure 8: Community decarbonization grants
- App. D Measure 9: Embodied Carbon program
- App. D Measure 10: Circular economy salvaged lumber program
- App. D Measure 11: Innovative financing program

This program timeline would require the 3-4 months of the baseline timing to hire staff for program management, but most measures are not anticipated to require contract assistance; the exception is embodied carbon measure (9). In contrast to measures 10 and 11, the community grants measure (8) would require added time for grant applications, and the embodied carbon priority measure (9) would require added time for adopting local building code amendments. As their schedules are unique, measures 8 and 9 are called out separately from measures 10 and 11.

In addition to activities conducted under Baseline Timing (for staff hiring only), the following is assumed for program development, outreach and activation:

Program Development (4-6 months)

- Months 1-3: Research new policy or program options.
- Months 4-5: Meet with stakeholders on draft policy or program concepts.
- Month 6: Revise policy or program design per stakeholder feedback.

Milestone: New policy or program design completed.

Program Outreach (1-2 months)

The following timeline and tasks are anticipated for this objective.

- Month 1: Develop outreach collateral. Develop copy for webpage, newsletters, flyers and online rebate program postings.

Milestone: Outreach materials package complete.

- Month 2: Outreach implementation; outreach to larger stakeholder group and presentations at community group meetings.

Milestone: Outreach implementation launched.

Program Activation (1-3 months)

- Months 1-2: Continued outreach; meetings with interested community partners, such as with manufacturers that wish to use incentives for using salvaged lumber warehouse products (measure 10), or retrofit projects interested in using C-PACER (measure 11).
- Month 3: First policy program products used.

Milestone: First policy impacts realized, or program products used.

Each item in this schedule is anticipated to need to fall sequentially, and could not occur concurrently. As such, when adding the hiring staff of the Baseline Timing (3 – 4 months), Program Development (another 4 – 6 months); Outreach (1 – 2 months), and Program Activation (1 – 3 months), it is anticipated that measures 10 and 11 will take between 9 – 15 months to establish and see the first products implemented.

As noted previously, the community grants measure (8) would require added time for grant applications, resulting in the following schedule modifications:

- It is anticipated that Program Development would take 4 months (rather than 4-6 months), as staff could draw on the experience of other community grant programs to design grant parameters and scoring.
- It is anticipated that Program Activation would take 4-5 months (rather than 1-3 months), providing additional time to score applications, execute agreements with community building owners, and possible longer time for equipment delivery depending on system complexity.

As such, when adding the hiring staff of the Baseline Timing (3 – 4 months), Program Development (4 months); Outreach (1 – 2 months), and Program Activation (4 – 5 months), it is anticipated that measure 8 will take between 12 – 15 months to establish and see the first installations from Community grants.

Milestone: First community grants issued; first community grant installations achieved.

Additionally, although components of embodied carbon measure (9) would see 9-15 months for product implementation (an EPD assistance program or internal embodied carbon policy), one component – adopting local building code amendments – would result in the following schedule modifications:

- It is anticipated the full Baseline Timing of 7 – 9 months would be required (rather than 3 – 4 months), as contract assistance would likely be needed for research assistance and training.
- It is anticipated that Program Development would take 6 months (rather than 4-6 months), as embodied carbon amendments will take more time with stakeholders to achieve code design.
- It is anticipated that Program Activation would be replaced by a Code Adoption process, which typically take 6 months to achieve. This requires policy proposal review by County leadership, as well as a notice to Commerce, newspaper notice of planned adoption, public ordinance posting, State Environmental Policy Act (SEPA) review, and staff support at County Council meetings.

As such, when adding the Baseline Timing (7 – 9 months), Program Development (6 months); Outreach (1 – 2 months), and Code Adoption (6 months), it is anticipated that measure 9 will take between 20 – 23 to achieve local building amendments that incorporate embodied carbon requirements.

> Milestone: Commerce and newspaper notices of planned adoption; draft public ordinance posted; SEPA review; final embodied carbon building code amendment adopted.

Any project applications associated with these measures would also need to include semi-annual and final reports in proposed project timelines.

4.4 Priority Measure GHG Reduction Estimates

This section provides GHG reduction estimates in Table 4.1 for the priority measures identified in Section 4.1, as well as the assumptions supporting the priority measure GHG estimates.

Table 4.1 GHG Reduction Estimates of Priority Measures

App. D Measure #	Measure *Measure titles only; for full measure, see Section 4.1.*	Cumulative GHG Emission Reductions **(MTCO2e)**	
		2025-2030	2025-2050
1	Heat pump rebate program for single-family homes	644	5,596
2	Water heating "tank swap" for single-family homes& sm. business	684	6,282
3	Whole-home decarbonization for single-family homes	1,757	16,202
4	Water heating "tank swap" for multifamily buildings and units	684	6,282
5	"Dryer swap" for multifamily buildings and units	1,125	11,155
6	Whole-building decarbonization for multifamily buildings	2,308	21,894
7	Multifamily technical assistance	1,035	9,989
8	Community decarbonization grants	7,225	36,123
9	Embodied Carbon program	79,100	133,350
10	Circular economy salvaged lumber program	22,400	78,400
12	Innovative financing program	1,599	14,815

Table 4.11 Assumptions

This section provides GHG reduction estimates for the priority measures identified in Section 4.1. Note that there may be minor variations in calculations due to rounding. Additionally, most of these estimates do not currently account for conversion to low-GHG energy grids available in a majority of the four counties covered in this plan, or statewide GHG-neutral electrical grids starting in 2030 due to CETA.

Single-family Residential and Small Business Measures – GHG Assumptions

This sub-section reviews GHG assumptions for single-family residential and small business Priority Measures.

App. D Measure 1: Heat pump rebate program for single-family homes

Estimates for whole-home decarbonization used the NREL ResStock Energy Efficiency and Electrification Dashboard.[226] Data entries selected Washington state with Climate Zone 4c. Per the dashboard data information tab, the climate zones are based on ASHRAE 2004, which places all four counties covered in this plan in Marine zone 4c.[227] Per the NREL Dashboard, in Climate zone 4c for single-family detached homes in Washington state with natural gas heating fuel:

- The Dwelling Unit Savings - Total tab option of "Minimum efficiency heat pump with electric back up" is the conservative emissions reduction option, and shows the following data:
    - Emissions savings average: 2,476 kgCO2e/yr., or 2.476 MTCO2e/yr.
    - *Energy savings average from electricity: 97 kWh/yr.*
    - *Energy savings from natural gas:2,019 therms/yr.*

For a 5-year program, assuming 100 heat pump installations, this assumes:

- Year 1: 0 installations and 0 GHGs reduced, as the program will be established in this period.
- Year 2: 30 installs. As heat pump installations will occur throughout the year, assume 50% of GHG emission reductions achieved (30/2 = 15 new contributing GHG reductions; 15*2.476 MTCO2e = 37 MTCO2e in year 2)
- Year 3: 50 installs. Assume 50% of GHG emission reductions achieved for year 3, plus full emission reductions from Year 2 installs (50/2 = 25 new contributing GHG reductions; 25*2.476 MTCO2e = 62 MTCO2e) + (30 from year 2 *2.476 MTCO2e = 74 MTCO2e) = 136 MTCO2e total in year 3
- Year 4: 20 installs. Assume 50% of GHG emission reductions achieved for year 4, plus full emission reductions from Year 2 and Year 3 retrofits (20/2 = 10 new contributing GHG reductions; 10*2.476 MTCO2e = 25 MTCO2e) + (80 from years 2 & 3 *2.476 MTCO2e = 198 MTCO2e) = 223 MTCO2e total in year 4
- Year 5: 0 new installations. Assume full emission reductions from Year 2, 3 and 4 retrofits (100 installs *4.815 MTCO2e) = 247 MTCO2e total in year 5
- For 2031-2050, assuming an annual reduction of value 247 MTCO2e for 100 heat pump installations multiplied by 20 years would result in a 2031-2050 value of 4,952 MTCO2e.

[226] NREL, "State Level Residential Building Stock and Energy Efficiency Analysis," ResStock Energy Efficiency and Electrification Dashboard. [LINK]; also see ResStock Public dataset [LINK]. Accessed 2/22/24.
[227] Heinking, Susan and Corey Sussman, "the Science of Building Codes and Climate Zones," Pepper Construction Blog, August 15, 2019. [LINK]. Also, DOE, "Building America Top Innovations Hall of Fame Profile: Building Science-Based Climate Maps," January 2013. [LINK]. Accessed 2/22/24.

For 2025 – 2030, combining year 1 (0 MTCO2e), year 2 (37 MTCO2e), year 3 (136 MTCO2e), year 4 (223 MTCO2e), and year 5 (247 MTCO2e), it is estimated that roughly 644 MTCO2e could be reduced.

For 2025 – 2050, adding the 2025 – 2030 estimate of 644 MTCO2e to the 2031 – 2050 estimate of 4,952 MTCO2e, it is estimated that roughly 5,596 MTCO2e could be reduced.

App. D Measure 2: Water heating "tank swap" for single-family homes and small businesses

Estimates for whole-home decarbonization used the NREL ResStock Energy Efficiency and Electrification Dashboard.[228] Data entries selected Washington state with Climate Zone 4c. Per the dashboard data information tab, the climate zones are based on ASHRAE 2004, which places all four counties covered in this plan in Marine zone 4c.[229] Per the NREL Dashboard, in Climate zone 4c for single-family detached homes in Washington state with natural gas heating fuel:

- The Dwelling Unit Savings - Total tab option of "Heat pump water heater" shows the following data:
    - Emissions savings average: 311 kgCO2e/yr., or 0.311 MTCO2e/yr.
    - *Energy savings average from electricity: 44 kWh/yr.*
    - *Energy savings from natural gas: 231 therms/yr.*

For a 5-year program, assuming of 900 HPWH installations, this assumes:

- Year 1: 0 installs and 0 GHGs reduced, as the program will be established in this period.
- Year 2: 250 installs. As these will be installed throughout the year, assume 50% of GHG emission reductions achieved (250/2 = 125 new contributing GHG reductions; 125*0.311 MTCO2e = 39 MTCO2e in year 2)
- Year 3: 350 installs. Assume 50% of GHG emission reductions achieved for year 3, plus full emission reductions from Year 2 installations (350/2 = 175 new contributing GHG reductions; 175*0.311 MTCO2e = 54 MTCO2e) + (250 from year 2 *0.311 MTCO2e = 78 MTCO2e) = 132 MTCO2e total in year 3
- Year 4: 300 installs. Assume 50% of GHG emission reductions achieved for year 4, plus full emission reductions from Year 2 and Year 3 installations (300/2 = 150 new contributing GHG reductions; 150*0.311 MTCO2e = 46 MTCO2e) + (600 from years 2 & 3 *0.311MTCO2e = 187 MTCO2e) = 233 MTCO2e total in year 4
- Year 5: 0 new installs. Assume full emission reductions from Year 2, 3 and 4 installations (900 installs *0.311 MTCO2e) = 280 MTCO2e total in year 5
- For 2031-2050, assuming an annual reduction of value 280 MTCO2e for 900 HPWH installs multiplied by 20 years would result in a 2031-2050 value of 5,598 MTCO2e.

For 2025 – 2030, combining year 1 (0 MTCO2e), year 2 (39 MTCO2e), year 3 (132MTCO2e), year 4 (233 MTCO2e), and year 5 (280 MTCO2e), it is estimated that roughly 684 MTCO2e could be reduced.

[228] NREL, "State Level Residential Building Stock and Energy Efficiency Analysis," ResStock Energy Efficiency and Electrification Dashboard. [LINK]; also see ResStock Public dataset [LINK]. Accessed 2/22/24.
[229] Heinking, Susan and Corey Sussman, "the Science of Building Codes and Climate Zones," Pepper Construction Blog, August 15, 2019. [LINK]. Also, DOE, "Building America Top Innovations Hall of Fame Profile: Building Science-Based Climate Maps," January 2013. [LINK]. Accessed 2/22/24.

For 2025 – 2050, adding the 2025 – 2030 estimate of 684 MTCO2e to the 2031 – 2050 estimate of 5,598 MTCO2e, it is estimated that roughly 6,282 MTCO2e could be reduced.

App. D Measure 3: Whole-home decarbonization for single-family homes

Estimates for whole-home decarbonization used the NREL ResStock Energy Efficiency and Electrification Dashboard.[230] Data entries selected Washington state with Climate Zone 4c. Per the dashboard data information tab, the climate zones are based on ASHRAE 2004, which places all four counties covered in this plan in Marine zone 4c.[231] Per the NREL Dashboard, in Climate zone 4c for single-family detached homes in Washington state with natural gas heating fuel:

- The Dwelling Unit Savings - Total tab option of "Enhanced enclosure upgrade with heat pump water heater and high efficiency heat pump with electric backup" is the closest match to measure 4, providing for high-efficiency enclosure improvements and electrification of primary fossil fuel appliances (water and space heating). The following data is reported for this measure:
    - Emissions savings average: 4,815 kgCO2e/yr., or 4.815 MTCO2e/yr.
    - *Energy savings average from electricity: -2,137 kWh/yr.*
    - *Energy savings from natural gas: 757 therms/yr.*

For a 5-year program, assuming 150 whole-home decarbonization projects, this assumes:

- Year 1: 0 homes and 0 GHGs reduced, as the program will be established in this period.
- Year 2: 20 homes. As home retrofits will occur throughout the year, assume 50% of GHG emission reductions achieved (20/2 = 10 new contributing GHG reductions; 10*4.815 MTCO2e = 48 MTCO2e in year 2)
- Year 3: 100 homes. Assume 50% of GHG emission reductions achieved for year 3, plus full emission reductions from Year 2 retrofits (100/2 = 50 new contributing GHG reductions; 50*4.815 MTCO2e = 241 MTCO2e) + (20 from year 2 *4.815 MTCO2e = 96 MTCO2e) = 337 MTCO2e total in year 3
- Year 4: 30 homes. Assume 50% of GHG emission reductions achieved for year 4, plus full emission reductions from Year 2 and Year 3 retrofits (30/2 = 15 new contributing GHG reductions; 15*4.815 MTCO2e = 72 MTCO2e) + (120 from years 2 & 3 *4.815 MTCO2e = 578 MTCO2e) = 650 MTCO2e total in year 4
- Year 5: 0 new home retrofits. Assume full emission reductions from Year 2, 3 and 4 retrofits (150 retrofits *4.815 MTCO2e) = 722 MTCO2e total in year 5
- For 2031-2050, assuming an annual reduction of value 722 MTCO2e for 160 home retrofits multiplied by 20 years would result in a 2031-2050 value of 14,445 MTCO2e.

For 2025 – 2030, combining year 1 (0 MTCO2e), year 2 (48 MTCO2e), year 3 (337 MTCO2e), year 4 (650 MTCO2e), and year 5 (722 MTCO2e), it is estimated that roughly 1,757 MTCO2e could be reduced.

[230] NREL, "State Level Residential Building Stock and Energy Efficiency Analysis," ResStock Energy Efficiency and Electrification Dashboard. [LINK]; also see ResStock Public dataset [LINK]. Accessed 2/22/24.
[231] Heinking, Susan and Corey Sussman, "the Science of Building Codes and Climate Zones," Pepper Construction Blog, August 15, 2019. [LINK]. Also, DOE, "Building America Top Innovations Hall of Fame Profile: Building Science-Based Climate Maps," January 2013. [LINK]. Accessed 2/22/24.

For 2025 – 2050, adding the 2025 – 2030 estimate of 176 MTCO2e to the 2031 – 2050 estimate of 14,445 MTCO2e, it is estimated that roughly 16,202 MTCO2e could be reduced.

Multifamily Residential Measures – GHG Assumptions

This sub-section reviews GHG assumptions for multifamily residential Priority Measures.

App. D Measure 4: Water heating "tank swap" for multifamily buildings and units.

This measure assumes the same program development and implementation schedule, and hence the same GHG reduction estimates, as provided for Measure 2

App. D Measure 5: "Dryer swap" for multifamily buildings and units

Assuming that a new electric dryer will use 20,654 kWh, replacing a gas dryer usage of 705 therms annually, this would result in an equivalent GHG impact off 1.671 kg MTCO2e reduced annually. For a 5-year program, assuming 300 heat pump clothes dryer installations, this assumes:

- Year 1: 0 installs and 0 GHGs reduced, as the program will be established in this period.
- Year 2: 50 installs. As these will be installed throughout the year, assume 50% of GHG emission reductions achieved (50/2 = 25 new contributing GHG reductions; 25*1.671 MTCO2e = 42 MTCO2e in year 2)
- Year 3: 125 installs. Assume 50% of GHG emission reductions achieved for year 3, plus full emission reductions from Year 2 installations (125/2 = 62.5 new contributing GHG reductions; 62.5*1.671 MTCO2e = 104.5 MTCO2e) + (50 from year 2 *1.671 MTCO2e = 83.5 MTCO2e) = 188 MTCO2e total in year 3
- Year 4: 125 installs. Assume 50% of GHG emission reductions achieved for year 4, plus full emission reductions from Year 2 and Year 3 installations (125/2 = 62.5 new contributing GHG reductions; 62.5*1.671 MTCO2e = 104.5 MTCO2e) + (175 from years 2 & 3 *1.671 MTCO2e = 292.5 MTCO2e) = 397 MTCO2e total in year 4
- Year 5: 0 new installs. Assume full emission reductions from Year 2, 3 and 4 installations; (300 installs *1.671 MTCO2e) = 501 MTCO2e total in year 5
- For 2031-2050, assuming an annual reduction of value 501 MTCO2e for 300 heat pump dryer installs multiplied by 20 years would result in a 2031-2050 value of 10,025 MTCO2e.

For 2025 – 2030, combining year 1 (0 MTCO2e), year 2 (42 MTCO2e), year 3 (188 MTCO2e), year 4 (397 MTCO2e), and year 5 (501 MTCO2e), it is estimated that roughly 1,125 MTCO2e could be reduced.

For 2025 – 2050, adding the 2025 – 2030 estimate of 1,125 MTCO2e to the 2031 – 2050 estimate of 10,025 MTCO2e, it is estimated that roughly 11,155 MTCO2e could be reduced.

App. D Measure 6: Whole-building decarbonization for multifamily buildings

Estimates for whole-home decarbonization use data from the NREL ResStock Energy Efficiency and Electrification Dashboard.[232] Data entries selected Washington state with Climate Zone 4c. Per the dashboard data information tab, the climate zones are based on ASHRAE 2004, which places all four

[232] National Renewable Energy Laboratory (NREL), "State Level Residential Building Stock and Energy Efficiency Analysis," ResStock Energy Efficiency and Electrification Dashboard. [LINK]; also see ResStock Public dataset [LINK]. Accessed 2/22/24.

counties covered in this plan in Marine zone 4c.[233] Per the NREL Dashboard, in Climate zone 4c for multifamily with 5+ units in Washington state with natural gas heating fuel:

- The Dwelling Unit Savings - Total tab option of "Enhanced enclosure upgrade with heat pump water heater and high efficiency heat pump with electric backup" is the closest match to measure 4, providing for high-efficiency enclosure improvements and electrification of primary fossil fuel appliances (water and space heating). The following data is reported for this measure **per dwelling unit :**
    - Emissions savings average: 1,399 kgCO2e/yr., or 1.399 MTCO2e/yr.
    - *Energy savings average from electricity: -1,211 kWh/yr.*
    - *Energy savings from natural gas: 288 therms/yr.*

For a 5-year program, assuming the average multifamily building has 10 units, each building would represent 13.99 MTCO2e/yr. reduction. For 70 whole-building decarbonization projects, this assumes:

- Year 1: 0 buildings and 0 GHGs reduced, as the program will be established in this period.
- Year 2: 15 building retrofits. As retrofits will occur throughout the year, assume 50% of GHG emission reductions achieved (15/2 = 7.5 new contributing GHG reductions; 7.5*13.99 MTCO2e = 105 MTCO2e in year 2)
- Year 3: 30 buildings. Assume 50% of GHG emission reductions achieved for year 3, plus full emission reductions from Year 2 retrofits (30/2 = 15 new contributing GHG reductions; 15*13.99 MTCO2e = 210 MTCO2e) + (15 from year 2 *13.99 MTCO2e = 210 MTCO2e) = 420 MTCO2e total in year 3
- Year 4: 25 buildings. Assume 50% of GHG emission reductions achieved for year 4, plus full emission reductions from Year 2 and Year 3 retrofits (25/2 = 12.5 new contributing GHG reductions; 12.5*13.99 MTCO2e = 175 MTCO2e) + (30 from years 2 & 3 *13.99 MTCO2e = 629 MTCO2e) = 804 MTCO2e total in year 4
- Year 5: 0 new installs. Assume full emission reductions from Year 2, 3 and 4 retrofits (70 building retrofits*13.99 MTCO2e) = 979 MTCO2e total in year 5
- For 2031-2050, assuming an annual reduction of value 979 MTCO2e for 70 whole-building retrofits multiplied by 20 years would result in a 2031-2050 value of 19,586 MTCO2e.

For 2025 – 2030, combining year 1 (0 MTCO2e), year 2 (105 MTCO2e), year 3 (420 MTCO2e), year 4 (804 MTCO2e), and year 5 (979 MTCO2e), it is estimated that roughly 2,308 MTCO2e could be reduced.

For 2025 – 2050, adding the 2025 – 2030 estimate of 2,308 MTCO2e to the 2031 – 2050 estimate of 19,586 MTCO2e, it is estimated that roughly 21,894 MTCO2e could be reduced.

App. D Measure 7: Multifamily technical assistance

This measure assumes that multifamily technical assistance will be helping buildings similar to those evaluated under App. D Measure 6: Whole-building decarbonization for multifamily buildings – namely, helping multifamily buildings of 10 units each decarbonize, with each building representing 13.99 MTCO2e/yr. reduction.

[233] Heinking, Susan and Corey Sussman, "the Science of Building Codes and Climate Zones," Pepper Construction Blog, August 15, 2019. [LINK]. Also, DOE, "Building America Top Innovations Hall of Fame Profile: Building Science-Based Climate Maps," January 2013. [LINK]. Accessed 2/22/24.

- It is currently estimated that roughly 50 buildings would pursue decarbonization with this technical assistance. For GHG reduction estimates, this figure is reduced by roughly one-third (36%) to 32, under the assumption that some buildings would pursue decarbonization independently, but these buildings owners may use this technical assistance to guide decision-making.

For a 5-year program

- Year 1: 0 buildings and 0 GHGs reduced, as the program will be established in this period.
- Year 2: 6 building retrofits. As retrofits will occur throughout the year, assume 50% of GHG emission reductions achieved (6/2 = 3 new contributing GHG reductions; 3*13.99 MTCO2e = 42 MTCO2e in year 2)
- Year 3: 14 buildings. Assume 50% of GHG emission reductions achieved for year 3, plus full emission reductions from Year 2 retrofits (14/2 = 7 new contributing GHG reductions; 7*13.99 MTCO2e = 97 MTCO2e) + (6 from year 2 *13.99 MTCO2e = 84 MTCO2e) = 181 MTCO2e total in year 3
- Year 4: 12 buildings. Assume 50% of GHG emission reductions achieved for year 4, plus full emission reductions from Year 2 and Year 3 retrofits (12/2 = 6 new contributing GHG reductions; 6*13.99 MTCO2e = 84 MTCO2e) + (20 from years 2 & 3 *13.99 MTCO2e = 280 MTCO2e) = 364 MTCO2e total in year 4
- Year 5: 0 new installs. Assume full emission reductions from Year 2, 3 and 4 retrofits (32 building retrofits*13.99 MTCO2e) = 448 MTCO2e total in year 5
- For 2031-2050, assuming an annual reduction of value 1,035 MTCO2e for 32 whole-building retrofits multiplied by 20 years would result in a 2031-2050 value of 8,954 MTCO2e.

For 2025 – 2030, combining year 1 (0 MTCO2e), year 2 (42 MTCO2e), year 3 (181 MTCO2e), year 4 (364 MTCO2e), and year 5 (448 MTCO2e), it is estimated that roughly 1,035 MTCO2e could be reduced.

For 2025 – 2050, adding the 2025 – 2030 estimate of 1,035 MTCO2e to the 2031 – 2050 estimate of 8,954 MTCO2e, it is estimated that roughly 9,989 MTCO2e could be reduced.

- Commercial and Community Building Measures – GHG Assumptions

This sub-section reviews GHG assumptions for commercial and community building measures.

App. D Measure 8: Community decarbonization grants

Estimates for community decarbonization are pulled primarily from building-specific decarbonization projections developed by the Seattle Office of Sustainability & Environment. Building specific analyses include three notable buildings projected to require decarbonization retrofits, namely:

- Langston Hughes Performing Arts Center (20,992 sf), requiring full HVAC replacement, a dedicated outdoor air system and variable refrigerant flow system. [234] GHG reduction estimates:
  - 0.01710 MTCO2e/sf for 2025-2030, and
  - 0.08550 MTCO2e/sf for 2025-2050.

[234] Christine Bunch, City of Seattle Climate & Energy Strategic Advisor, email communication with author, January 2, 2024. Square footage data from King County Department of Assessments, Parcel 982670-0795. [LINK]. Accessed 2/22/24.

- Seattle Center - Seattle Rep Theatre, Bagley Wright (34,934 sf), which requires replacing 7 rooftop air handlers and two built up indoor air handlers (hot and chilled water coils) with 9 packaged rooftop heat pumps.[235] GHG reduction estimates:
    - 0.03006 MTCO2e/sf for 2025-2030, and
    - 0.15028 MTCO2e/sf for 2025-2050.
- Van Asselt Community Center (19,269 sf), which requires replacing packaged rooftop units (PRTUs) gas units with PRTU heat pumps.[236] GHG reduction estimates:
    - 0.01233 MTCO2e/sf for 2025-2030, and
    - 0.06163 MTCO2e/sf for 2025-2050.
- When these per square footage values are averaged, they yield GHG reduction estimates of
    - 0.01983 MTCO2e/sf for 2025-2030, and
    - 0.09914 MTCO2e/sf for 2025-2050.

Community decarbonization grants assume 14 grants in publicly-owned buildings.

- For publicly owned buildings, it is assumed the average project will roughly equal the size of a library. Three libraries were averaged in size for this analysis, namely:
    - Seattle Public Library (SPL), Beacon Hill Branch, which is 10,800 sf.[237]
    - SPL, Columbia Branch, which is 12,420 sf.[238]
    - SPL, West Seattle Branch, which is 7,856 sf.[239]
- Assuming an average publicly owned building size of 10,359 sf, multiplied by the average square footage GHG reduction estimates, results in average project GHG estimates of:
        - 244 MTCO2e for 2025-2030, and
        - 1,221 MTCO2e for 2025-2050.
- Assuming 14 projects in publicly owned buildings results in project GHG estimates of:
        - 3,419 MTCO2e for 2025-2030, and
        - 17,097 MTCO2e for 2025-2050.

However, unlike many other measures contemplated, it is assumed roughly 40% of these estimates would be attributable to a decarbonization program, and the remaining financing would be sourced from elsewhere, such as local government capital budgets. As such, the 14 projects in publicly owned buildings would only claim 40% of the GHG estimates, or:

- 1,367 MTCO2e for 2025-2030, and
- 6,838 MTCO2e for 2025-2050.

[235] Christine Bunch, City of Seattle Climate & Energy Strategic Advisor, email communication with author, January 2, 2024. Square footage data from King County Department of Assessments, Parcel 198820-0250. [LINK]. Accessed 2/22/24.
[236] Christine Bunch, City of Seattle Climate & Energy Strategic Advisor, email communication with author, January 2, 2024. Square footage data from King County Department of Assessments, Parcel 785700-2030. [LINK]. Accessed 2/22/24.
[237] Square footage data from King County Department of Assessments, Parcel 308600-3265. [LINK]. Accessed 2/22/24.
[238] Square footage data from King County Department of Assessments, Parcel 170340-0005. [LINK]. Accessed 2/22/24.
[239] Square footage data from King County Department of Assessments, Parcel 608710-0165. [LINK]. Accessed 2/22/24.

Community decarbonization grants assume 46 grants in other community buildings.

- For community buildings, it is assumed the average project will roughly equal the median size of a commercial building in the U.S., or 5,400 sf.[240] In reviewing building sub-types, this assumption is generally confirmed by the average size of some common community building sub-types. While median building sizes are not typically reported in building type reports, research found:
    - More than one-half (53%) of office buildings, commonly used by nonprofits and community services, are between 1,000 to 5,000 sf.[241]
    - More than one-half (61%) of religious worship buildings were 10,000 sf or smaller, and 38% were between 1,000 to 5,000 sf.[242]
    - Two-thirds (68%) of public assembly buildings were less than 10,000 sf.[243]
- Assuming an average community building size of 5,400 sf, multiplied by the average square footage GHG reduction estimates, results in average project GHG estimates of:
    - 127 MTCO2e for 2025-2030, and
    - 637 MTCO2e for 2025-2050.
- Assuming 46 projects in community buildings results in project GHG estimates of:
    - 5,856 MTCO2e for 2025-2030, and
    - 29,284 MTCO2e for 2025-2050.

For a 5-year program, combining 14 projects in larger publicly owned buildings and 46 projects in buildings providing community space, results in total community grant GHG reduction estimates of:

- 7,225 MTCO2e for 2025-2030 in total, and
- 36,123 MTCO2e for 2025-2050 in total.

- Multi-sector Decarbonization Measures – GHG Assumptions

This sub-section reviews GHG assumptions for multi-sector decarbonization Priority Measures.

App. D Measure 9: Embodied Carbon program

Assumes the following per type of measure activity, applied to implementation in one (King) county:

- King County Capital projects: In 2021, King County conducted a purchasing emission inventory for its 2019 operations and capital projects, using the EPA's U.S. environmentally-extended input-output (USEEIO) model to develop emissions calculations. This report found that overall embodied carbon for King County capital projects equated to 58,380 MTCO2e annually. For capital projects, it is assumed that no reduction would happen in the first year as the staff person is hired, and then every year the embodied carbon emissions would reduce by 10% for King County capital projects:
    - Year 1, No change; 10% embodied carbon reductions annually thereafter (i.e., Year 2, 10%; Year 3, 20%; Year 4, 30% reduction, Year 4, 40%). Maintain 40% reduction through 2050. Would result in roughly 58,350 MTCO2e reduced 2025 – 2030 and 467,050 MTCO2e reduced from 2031 – 2050.

[240] EIA, "2018 CBECS Building Characteristics Highlights," Revised September 2022. [LINK]. Accessed 1/23/2024. Pg 9.
[241] EIA, "2018 CBECS: Principal Building Activities, Office." [LINK]. Accessed 2/22/24.
[242] EIA, "2018 CBECS: Principal Building Activities, Religious Worship." [LINK]. Accessed 2/23/24.
[243] EIA, "2018 CBECS: Principal Building Activities, Public Assembly." [LINK]. Accessed 2/23/2024.

  - However, after 2030 a majority of embodied carbon policy implementation will rely on local jurisdiction funding and support to maintain the program. As such, it is estimated that only 5% of embodied carbon emissions in this period will be attributable to the legacy of the initial program, or 23,350 MTCO2e.
  - As such, the 58,350 MTCO2e reduced 2025 – 2030 and 23,350 MTCO2e reduced from 2031 – 2050 would result in a culminative 81,700 MTCO2e reduced from 2025 – 2050.
- Commercial projects:
  - Assume a 2027 start date for emission reductions, given the projected embodied carbon code modification schedule reviewed in Section 4.3 Staff-Reliant Program Development.
  - Assume 1.17% commercial sf growth per year based on 2002 to 2018 norm in King County Assessor's data, such that there would be 28 million (M) sf of growth from 2027 to 2030, and 207M sf of growth from 2030 to 2050, in all of King County and its cities.
  - Assume implementation in unincorporated King County and City of Seattle starting in 2027 due to stronger political appetite to establish embodied code requirements in these jurisdictions. Assume integration in state codes and hence applicability to all commercial projects occurring in King County and its cities starting in 2031.
  - As there is no current disaggregation of commercial sf in King County by jurisdiction, this analysis estimates the proportion of commercial sf growth for unincorporated King County and the City of Seattle based on 2018 employment numbers in these jurisdictions. In 2018, these areas employed 638,521 persons, or 46.7% of the 1,368,241 person-workforce in King County.[244] Applied to the 28M sf total commercial growth projection equates to 13M sf growth from 2027 to 2030 in unincorporated King County and City of Seattle.
  - Embodied carbon calculator GHG reduction estimates require affected square footage estimates. Determining the affected sf requires a projection of building growth by type, as only certain types of buildings would be affected. Building type assumptions are adapted from Portland data, but scaled back due to more extensive rural area in unincorporated King County. As such, this estimate assumed that growth would occur in the following tiers: 60% low-rise buildings (1-5 floors), 30% mid-rise buildings (6-10 floors), 10% high-rise (more than 10 floors).
  - Small commercial and multifamily 3 floors or less would likely not be affected by local embodied carbon codes. Exempting small projects, including residential 3 floors or less and half of commercial space (i.e., half of the low rise buildings), yields an assumption that only 70% of growth would be affected, or 9M sf of growth from 2027 to 2030, and 145M sf of growth from 2030 to 2050.
  - Assumes the building code is amended to require a 20% reduction in embodied carbon for concrete effective in 2026, and phasing in a 40% reduction effective in 2030. This data was entered into the C40/Carbon Leadership Forum (CLF) Embodied Carbon Policy Calculator.[245]
  - The results are that roughly 20,750 MTCO2e reduced 2025 – 2030 and 617,750 MTCO2e reduced from 2031 – 2050.

[244] King County and its cities, "2021 Urban Growth Capacity (UGC) Report," June 2021. Adopted December 14, 2021. Ratified April 6, 2022. [LINK]. Pg 42 (PDF 49).
[245] Benke, B., Lewis, M., Carlisle, S., Huang, M., and Simonen, K. "Developing an Embodied Carbon Policy Reduction Calculator," Carbon Leadership Forum, University of Washington, (2022). [LINK]. Accessed 2/21/24.

- However, after 2030 a majority of embodied carbon policy support will rely on local jurisdiction funding and support to maintain the program. As such, it is estimated that only 5% of embodied carbon emissions in this period will be attributable to the legacy of the initial program, or 61,775 MTCO2e.
- As such, the 20,750 MTCO2e reduced 2025 – 2030 and 30,890 MTCO2e reduced from 2031 – 2050 would result in a culminative 51,650 MTCO2e reduced from 2025 – 2050.

For 2025 – 2030, combining capital project (58,350 MTCO2e) and commercial project (20,750 MTCO2e) GHG reductions, it is estimated that 79,100 MTCO2e could be reduced.

For 2025 – 2050, combining capital project (81,700 MTCO2e) and commercial project (51,650 MTCO2e) GHG reductions, it is estimated that 133,350 MTCO2e could be reduced.

App. D Measure 10: Circular economy salvaged lumber program

Calculations are based on 101,000 tons/year of clean wood that King County Solid Waste Division has flow control over; when Seattle and single commodity wood processor tonnage is included, the total available clean wood is over 300,000 tons per year. The current mix of recycled, landfilled and combusted wood was run through the WAste Reduction Model (WARM) tool and compared to percentages of the wood stream being "source reduced."[246] The 2025-2030 estimates estimate 1% – 3% increased salvaged lumber utilization (reuse) and assumes that the project will have at least a legacy 1% re-use impact from 2030-2050. This calculation does not include reduced transportation emissions from utilizing salvaged lumber over virgin lumber; does not address carbon sequestration in built structures using mass timber panels; and does not incorporate growth factors or other lumber waste streams.

By year, this assumes:

- Year 1: 0% salvaged lumber reuse, as the program will be established in this period.
- Year 2: 1% salvaged lumber reuse, resulting in 2,800 MTCO2e reduced.
- Year 3: 2% salvaged lumber reuse, resulting in 5,600 MTCO2e reduced.
- Year 4: 2% salvaged lumber reuse, resulting in 5,600 MTCO2e reduced.
- Year 5: 3% salvaged lumber reuse, resulting in 8,400 MTCO2e reduced.
- Year 6 – onward (to 2050) : 1% salvaged lumber reuse/year, with a reduction of value 2,800 MTCO2e/yr.

For 2025 – 2030 (years 1 through year 5) it is estimated that roughly 22,400 MTCO2e could be reduced.

For 2025 – 2050 (all years) it is estimated that roughly 78,400 MTCO2e could be reduced.

App. D Measure 11: Innovative financing program

This measure assumes that the innovative financing program will be helping buildings similar to those evaluated under App. D Measure 6: Whole-building decarbonization for multifamily buildings, and under App. D Measure 8: Community decarbonization grants.

- For multifamily buildings, it is assumed the program would be helping multifamily buildings of 10 units each decarbonize, with each building representing a 13.99 MTCO2e/yr. reduction.

[246] EPA, "Versions of the Waste Reduction Model," December 2023. [LINK]. Accessed 2/21/24.

- It is currently estimated that roughly 30 multifamily buildings would pursue decarbonization in this program. For GHG reduction estimates, this figure is reduced by roughly one-third to 20, under the assumption that some buildings would pursue decarbonization independently.
- For community and commercial buildings, it is assumed that buildings would be 5,400 sf on average, multiplied by the average GHG reduction estimates by sf, resulting in average project GHG reduction estimates per building of:
    - 127 MTCO2e, or 12.7 MTCO2e/year and
- It is currently estimated that roughly 30 community and commercial buildings would pursue decarbonization in this program.

For a 5-year program

- Year 1: 0 buildings and 0 GHGs reduced, as the program will be established in this period.
- Year 2: 4 multifamily building and 6 community building retrofits. As retrofits will occur throughout the year, assume 50% of GHG emission reductions achieved.
    - Multifamily: (4/2 = 2 new contributing GHG reductions; 2*13.99 MTCO2e = 28 MTCO2e in year 2)
    - Community: (6/2 = 3 new contributing GHG reductions; 3*12.7 MTCO2e = 38 MTCO2e in year 2)
- Year 3: 10 multifamily building and 16 community building retrofits. Assume 50% of GHG emission reductions achieved for year 3, plus full emission reductions from Year 2 retrofits .
    - Multifamily: (10/2 = 5 new contributing GHG reductions; 5*13.99 MTCO2e = 70 MTCO2e) + (4 from year 2 *13.99 MTCO2e = 56 MTCO2e) = 126 MTCO2e total in year 3
    - Community: (16/2 = 8 new contributing GHG reductions; 8*12.7 MTCO2e= 102 MTCO2e) + (6 from year 2 *12.7 MTCO2e = 76 MTCO2e) = 178 MTCO2e total in year 3
- Year 4: 6 multifamily building and 8 community building retrofits. Assume 50% of GHG emission reductions achieved for year 4, plus full emission reductions from Year 2 and Year 3 retrofits.
    - Multifamily: (6/2 = 3 new contributing GHG reductions; 3*13.99 MTCO2e = 42 MTCO2e) + (14 from years 2 & 3 *13.99 MTCO2e = 196 MTCO2e) = 238 MTCO2e total in year 4
    - Community: (8/2 = 4 new contributing GHG reductions; 4*12.7 MTCO2e = 51 MTCO2e) + (from years 2 & 3 *12.7 MTCO2e = 279 MTCO2e) = 330 MTCO2e total in year 4
- Year 5: 0 new installs. Assume full emission reductions from Year 2, 3 and 4 retrofits.
    - Multifamily: (20 building retrofits*13.99 MTCO2e) = 280 MTCO2e total in year 5
    - Community: (30 building retrofits*12.7 MTCO2e) = 381 MTCO2e total in year 5
- For 2031-2050, the following would apply
    - Multifamily: assuming an annual reduction of value 280 MTCO2e for 20 whole-building retrofits multiplied by 20 years results in a 2031-2050 value of 5,596 MTCO2e.
    - Commercial: assuming an annual reduction of value 381 MTCO2e for 30 community building retrofits multiplied by 20 years results in a 2031-2050 value of 7,620 MTCO2e.

For 2025 – 2030, combining year 1 (0 MTCO2e), year 2 (28 MTCO2e and 38 MTCO2e), year 3 (126 MTCO2e and 178 MTCO2e), year 4 (238 MTCO2e and 330 MTCO2e), and year 5 (280 MTCO2e and 381 MTCO2e), it is estimated that roughly 1,599 MTCO2e could be reduced.

For 2025 – 2050, adding the 2025 – 2030 estimate of 1,599 MTCO2e to the 2031 – 2050 estimates of 5,596 MTCO2e and 7,620 MTCO2e, it is estimated that roughly 14,815 MTCO2e could be reduced.

Appendix D.1. PSREA Emissions Sources

Appendix D.1 reviews the data sources and assumptions used in the PSREA emissions analysis reviewed in Section 1.2.

Electricity and natural gas emissions were determined by the kWh and therms consumed within King County for the inventory years multiplied by the utility- and year-specific emissions factors.

Using Puget Sound Energy's annual reported CO2, CH4, N2O, and SF6 emissions, total kWh generated and purchased, and total natural gas supply, gas-specific emissions factors were calculated for each inventory year and applied to the total energy consumption.[247] For Kitsap County, Cascade Natural Gas (CNG) does not have emissions factor data, so the EPA's national estimate was used for this inventory.[248]

Specific additional electricity emissions data sources are listed below.

- King County: Seattle City Light (SCL) 2019 emissions factor was reported by The Climate Registry and used for both 2019 and 2020.[249] An SCL staff member provided a more specific emissions factor for 2019, broken down by CO2, CH4, and N2O.
- Pierce County: Tacoma Power's emissions factor is reported annually by California Air Resources Board.[250] Peninsula Light Company and Lakeview Light & Power do not have data on their emissions factors, so the Washington State Electric Utility Fuel Mix Disclosure Report was used to calculated estimated utility-specific emissions factors.[251]
- Snohomish County: Snohomish County PUD publishes its greenhouse gas emissions and associated emissions factor annually.[252]

Energy consumption data was procured directly from CNG, Lakeview Light & Power, Peninsula Light Company, PSE, SCL, Snohomish County PUD, and Tacoma Power for 2019 for residential, commercial, and industrial sectors, including transport customers within those sectors.

Emissions from electricity and natural gas transmission and distribution were also accounted for in these inventories. Emissions from electricity loss were calculated by multiplying the energy consumed by the grid loss factor from eGRID (USEPA, 2021), which follows the U.S. Community Protocol outlined by ICLEI (ICLEI, 2013). Emissions from natural gas leakage were calculated using the emissions factor provided by ClearPath, ICLEI's greenhouse gas inventory software platform (ICLEI, 2021).

Residential heating fuel and propane emissions were calculated using EIA state and national residential propane and heating oil sales data. County portions of total fuel sales were determined using the U.S. Census American Community Survey (ACS) home heating fuel data for each County.

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[247] Puget Sound Energy (PSE), "Measuring greenhouse gases (GHG)." [LINK]. Accessed 1/2/2024.
[248] United States Environmental Protection Agency (EPA), "Emissions Factors for Greenhouse Gas Inventories," 2021. [LINK] Note: New emission factors have since been released here. Accessed 1/2/2024.
[249] The Climate Registry. CRIS Public Reports retrieved from the Climate Registry [LINK]
[250] California Air Resources Board (CARB), "Mandatory GHG Reporting – Asset Controlling Supplier," LAST UPDATED November 6, 2023. [LINK]. Accessed 1/3/2024.
[251] WA Commerce, "Washington State Electric Utility Fuel Mix Disclosure Report for Calendar Year 2020," December 1, 2021. [LINK]. Accessed 1/3/2024.
[252] Snohomish County PUD, "2019 Greenhouse Gas Emissions using the Fuel Mix Disclosure Report," Updated 3/2/2021. [LINK]. Accessed 1/2/2024.

Commercial and industrial fuel oil emissions were calculated using EIA industrial and commercial fuel oil sales data downscaled by the portion of industrial and commercial employees in each County. Employment data was collected from the Employment Security Department of Washington State, which provides the data on the number of employees across industries. Commercial and industrial propane sales data was not available and was thus omitted from the inventory.

Industrial process emissions were collected from the EPA Facility Level Information on Greenhouse gases Tool (FLIGHT), which collects GHG emissions reported by large facilities per County. FLIGHT data on industrial emissions from the combustion of natural gas were removed to avoid double counting with industrial natural gas emissions calculated from utility-reported energy data.

Limitations
Industrial and commercial propane sales data was not available from the EIA so these emissions were not calculated for the PSREA inventory. EIA residential propane data was only available at the regional level, so the analysis required downscaling total sales from the entire western region (Alaska, Arizona, California, Hawaii, Nevada, Oregon, and Washington).

Appendix D.2 Washington State Energy Codes

Appendix D.2 provides background on Washington state energy codes.

The GHG emissions of new buildings are affected by the building codes in force at the time of permit issuance. Building code development and the resulting GHG emissions associated with new buildings are guided by several state code provisions, three of which are reviewed below:

- RCW 19.27A.160 requires the State Building Code Council (SBCC) to adopt Washington State Energy Codes (WSEC) from 2013 through 2031 that incrementally move towards a 70% reduction in annual net energy consumption against a 2006 baseline.[253]
- RCW 19.27A.150 directs Commerce to develop a plan to enhance energy efficiency and reduce GHG emissions from homes, buildings, districts and neighborhoods. The plan must be consistent with the RCW 19.27A.160 targets outlined above and be used to help direct the future code efficiency increases of RCW 19.27A.020 as outlined below.[254]
- RCW 19.27A.020 directs the SBCC, when guiding amendments to the state energy code, to "construct increasingly energy efficient homes and buildings that help achieve the broader goal of building zero fossil-fuel greenhouse gas emission homes and buildings by the year 2031…"[255]

The 2018 WSEC achieved 39.5% and 30.4% energy reductions for residential and commercial buildings respectively compared to 2006.[256] The 2021 WSEC achieved 57.6% and 47.0% energy reductions for

[253] RCW 19.27A.160, [2009 c 423 § 5.] [LINK]. Accessed 7/21/21.
[254] RCW 19.27A.150. [LINK]. Accessed 3/23/2022.
[255] RCW 19.27A.020. [LINK]. Accessed 3/23/2022.
[256] Glenn, Diane, "2018 Washington State Energy Code Progress Toward 2030," State Building Code Council (SBCC), November 25, 2020. [LINK]. Accessed 7/21/21. Pg 2.

residential and commercial buildings respectively compared to 2006, though updated analysis on the subsequent 2021 code amendments has not yet been posted.[257]

Building codes have the strongest impact on new buildings, but can affect existing buildings through some types of renovation projects.

The final item of note regarding building codes in this context is that local governments do not have the power to amend building codes for single-family homes, and some multifamily residential buildings up to three stories tall.[258] Local residential code amendments can be pursued with the SBCC, but these are approved only for specific conditions that are unique to the jurisdiction – such as unique climactic, geologic or environmental conditions.[259] Amending the commercial energy code only affects multifamily buildings four stories tall and taller, and commercial buildings.[260] This means that building code amendments by a local jurisdiction are not a viable pathway to affect fossil fuel use for single-family homes and some multifamily buildings, whether new or existing.[261]

Appendix D.3 Embodied Carbon

Appendix D.3 reviews what embodied carbon is; its associated emissions in the built environment; how it is being regulated, and by whom; and how it could intersect with Washington state regulations.

Embodied Carbon: Material Production and GHG Reduction Potential

This subsection reviews the methods that material producers may employ for manufacturing different material types, such as steel rebar or Portland cement, and the associated GHG emissions. For instance, material producers may:

- Employ different technologies at their production facilities with varying GHG intensities.
    - Roughly 60% of global steelmakers use coal-fueled, blast furnace-basic oxygen furnaces (BF-BOFs), the most carbon-intensive method of steel production, rather than electric arc furnaces (EAFs) that rely on electricity.[262]
    - A primary cement ingredient, clinker, is produced from heating limestone in a kiln to 1400°C (2552°F) – a process which typically relies on fossil fuel heating.[263]

[257] Doan, Tony, "2021 Washington State Energy Code Progress Toward 2030," SBCC, 2023. [LINK]. Accessed 2/05/24. Pg 2
[258] See RCW 19.27.060(1)(a) [LINK], and RCW 19.27.015(4) [LINK]. Accessed 3/23/2022.
[259] SBCC, "Forms," Local Residential Amendments. [LINK]. Accessed 5/24/2022.
[260] International Code Council, "2018 Washington State Energy Code – Commercial Provisions," July 2020. [LINK]. Section C101.2 Scope applies the code to commercial buildings; Section C202 defines commercial as buildings not defined as residential. Residential includes R-2 and R-3 buildings three stories or less in height. Accessed 9/13/21.
[261] Technically, a jurisdiction could amend the residential energy code such that it amended requirements for multifamily buildings three stories tall. This would be challenging as the residential energy code addresses single-family buildings, and the state prohibits amending the building codes for single-family buildings. As such, amendments would have to be pursued with care so as to not violate other state statues.
[262] Swalec, Caitlin and Christine Shearer, "Pedal…," ibid. [LINK]. Accessed 4/6/2022. Page 3, 13.
[263] Rubenstein, Madeline, "Emissions from the Cement Industry," Columbia Climate School: State of the Planet News, May 9, 2012. [LINK]. Accessed 4/6/2022.

  - Currently, about 40% of emissions for cement production come from combusting fossil fuels to heat limestone kilns.[264] Substituting alternative fuels such as waste and biomass could reduce cement emissions roughly 10% by 2050.[265] Only 3% of thermal energy used for cement production was sourced from bioenergy or biomass in 2020.[266]
  - Additionally, roughly 50% of GHG emissions occur from the breakdown of limestone itself, of calcination, where the limestone (calcium carbonate) is separated into calcium oxide and CO2.[267] Various carbon capture, usage, and storage (CCUS) options are currently being piloted to capture some of these emissions, including chemical and physical adsorption methods.[268]
- Use different electricity sources to power their production facilities.[269] For instance, roughly 5 – 10% of emissions associated with cement production come from, "electricity to power plant machinery and from transportation."[270]
- Have different GHG emission burdens depending on shipping distance and methods. For instance, roughly 10% of the emissions that result from the use of structural steel typically occurs from its transportation from the production facility to the construction site.[271]

The above references to cement are distinct from concrete, even though these terms are often used interchangeably.[272] Cement is the binder used to glue aggregates of fine or coarse rocks together into the finished product of concrete.[273] Concrete has additional opportunities to achieve GHG reductions separate from the production of its cement ingredient. Today, adding carbon to concrete before if cures can result in stronger concrete and reduce emissions up to 5%; future technologies could sequester up to 30% of emissions.[274] Curing concrete is considered one form of mineralizing carbon in concrete; the state of Hawaii, and the cities of Honolulu and Austin have considered or have experimented with carbon-mineralized concrete in government projects.[275]

[264] Rubenstein, Madeline, "Emissions from the Cement…," ibid. [LINK]. Accessed 8/31/2021.
[265] Czigler, Thomas, Sebastian Reiter, Patrick Schulze and Ken Somers, "Laying the Foundation for Zero-Carbon Cement," McKinsey & Company, May 14, 2020. [LINK]. Accessed 4/6/2022.
[266] Vass, Tiffany, Peter Levi, Alexandre Gouy, Hana Mandova, "Cement" International Energy Agency (IEA) Tracking Report, November 2021. [LINK]. Accessed 4/6/2022.
[267] Rubenstein, Madeline, "Emissions from the Cement…," ibid. [LINK]. Accessed 4/6/2022.
[268] Vass, Tiffany, et al., "Cement," ibid. [LINK]. Accessed 4/6/2022.
[269] Simonen, Kathrina, et al., "Buy Clean…," ibid. [LINK]. Page 3-18 (pdf page 72). Accessed 4/5/2021.
[270] Rubenstein, Madeline, "Emissions from the Cement…," ibid. [LINK]. Accessed 8/31/2021.
[271] Lewis, Meghan, Jordan Palmeri, Kate Simonen, "Implementing Buy Green," CLF, February 2022. [LINK]. Accessed 4/6/2022. Page 12.
[272] Rubenstein, Madeline, "Emissions from the Cement…," ibid. [LINK]. Accessed 4/6/2022.
[273] Czigler, Thomas, et al., "Laying the Foundation…," ibid. [LINK]. Accessed 4/6/2022.
[274] Czigler, Thomas, et al., "Laying the Foundation…," ibid. [LINK]. Accessed 4/6/2022.
[275] CleanTech Group, "Between a Rock and Hard Place: Commercializing CO2 Through Mineralization," June 13, 2018. [LINK]; Plautz, Jason, "Hawaii to combat climate change with carbon-injected concrete," SmartCities Dive, July 8, 2019. [LINK]; City of Honolulu, "Resolution 18-283," November 11, 2018. [LINK]; City of Austin, "Environmental Commission Motion 20190619 007c," June 19, 2019. [LINK]. Accessed 2/9/2024

Embodied Carbon: How is it Regulated?

This subsection reviews how regulation can help drive reductions in embodied carbon and reviews some government efforts to secure embodied carbon reductions in development.

Most embodied carbon regulations are considered examples of 'Buy Clean' policies, a nickname for the regulation type, "derived from the Buy Clean California Act passed in 2017."[276] A recent report from the Carbon Leadership Forum (CLF) provides a useful summary of typical Buy Clean initiatives.

> *'Buy Clean' is a type of procurement policy that establishes construction material purchasing requirements for government agencies. Buy-clean policies focus on reducing cradle-to-gate embodied carbon, or the greenhouse gas emissions arising from the raw material extraction, transportation, and manufacturing of construction materials. Embodied carbon is measured using life cycle assessment (LCA) with a metric called global warming potential (GWP). Buy-clean policies vary in their scope (e.g., which material types are included), structure, and mechanisms for implementation. They typically include two primary components*
>
> • ***Disclosure:*** *Requirement to disclose the carbon footprint of covered products using an environmental product declaration (EPD). An EPD is a third-party-verified document that reports the environmental impacts of a product, including GWP, based on a product LCA.*
>
> • ***Limits:*** *Requirements that a product's carbon footprint be below a maximum allowable GWP value (e.g., limit) established by a government agency or third party. Limits vary depending on the policy design and may be set at industry-average or a different threshold specified by the policy language.*[277]

As noted above, most Buy Clean policies apply to purchasing requirements for government agencies, or embodied carbon limits in government-funded capital construction projects. One notable exception is the Marin County Low Carbon Concrete program, which amended the building code to establish concrete emission limits for both private and public development projects. The Marin County code provides 10 GWP thresholds by concrete strength, limiting cement content and embodied carbon, with compliance allowed at either the concrete mix or project level scale.[278]

Buy Clean Programs tend to focus on requesting, then requiring, product disclosures with EPDs, and reducing carbon emissions with GWP limits, with an initial focus on cement or concrete.

> *Material-specific GWP maximums often target the materials with the highest embodied carbon (concrete, steel, and aluminum.) Policy components include disclosure (EPD reporting), incentives (bid bonus), and standards (GWP maximum limits per material.) The production of cement, iron, and steel are responsible for the largest percentage of building material emissions. Low-carbon concrete policies have the greatest potential to significantly reduce*

[276] Lewis, Meghan, et al., "Implementing Buy Green," ibid. [LINK]. Accessed 4/6/2022. Page 4.
[277] Lewis, Meghan, et al., "Implementing Buy Green," ibid. [LINK]. Accessed 4/6/2022. Page 4.
[278] Lewis, Meghan, "Looking Ahead to Embodied Carbon Policy Action in 2021," CLF, November 5, 2020. [LINK]. Also see, Marin County Code Chapter 19.07, "Low Carbon Concrete Requirements," [LINK] Accessed 4/6/2022.

> *carbon emissions resulting from the purchasing of new building materials, according to the Carbon Neutral Cities Alliance.*[279]

Buy Clean policies have been implemented in states such as California and Colorado for multiple product types, as well as New York and Oregon programs specifically for concrete.[280] There are also local government programs, in addition to Marin County (reviewed above), with independent requirements:

- Los Angeles: Requires EPDs for steel, flat glass, and mineral wool insulation by 1/1/21 for public projects, and to align procurement decisions using California's adopted GWP limits by 7/1/21.[281]
- Port Authority of New York and New Jersey: Requires EPD submittals for concrete, asphalt, steel, aluminum, and wood, with a goal of a 30 percent GHG Reduction by 2025 and a 50 percent GHG reduction by 2030; GWP limits to be established in the near future.
- Portland Low Carbon Concrete Program: Requires concrete EPDs in construction specifications as of 1/1/20, with GWP limits for city projects by 3/1/22.
- Sound Transit: Requires concrete EPDs for some Sound Transit projects for 75 percent of poured in place concrete by volume.[282]

Given the multiple embodied carbon regulations that currently exist, there are variations in what is regulated; if programs require only disclosure or set GWP limits; and the timeline for enactment. However, regulation implementation timelines typically have a period of optional, then mandatory disclosure through requested, then required, EPDs prior to establishing emissions limits.[283]

There are multiple open-source tools available for contractors to find low embodied carbon building materials or life-cycle analysis options, including the Athena Impact Estimator, the Bath Inventory of Carbon and Energy, Tally, One Click LCA and the Embodied Carbon in Construction Calculator (EC3).[284]

Embodied Carbon: In Washington State and the Region

This subsection reviews how embodied carbon could intersect within Washington state regulations at the state level or local level.

As mentioned previously, the SES approach to achieving state GHG emission reduction targets integrates industrial sector decarbonization, which in turn has strategies supporting embodied carbon policies to secure those GHG reductions. SES modeling assumes baseline industrial GHG reductions, assuming the sector will achieve 1% annual energy efficiency improvements in the deep decarbonization scenario and, by 2050, "could convert to electricity for 50% of process heating, 100% of machine drives and 75% of

[279] Bowles, Webly, "Jurisdictions prepare for a Wave of Embodied Carbon Policies," New Buildings Institute (NBI), Getting to Zero, June 17, 2021. [LINK]. Accessed 8/30/21.
[280] Lewis, Meghan, et al., "Implementing Buy Green," ibid. [LINK]. Accessed 4/6/2022. Page 4.
[281] Dyl, Shelby, "Los Angeles Continues Its Push to Find Carbon-Neutral Ground," JD Supra, February 24, 2020. [LINK]. Accessed 8/31/2021. Note: The CA procurement deadline has been extended, which may affect Los Angeles' implementation timeline.
[282] Lewis, Meghan, et al., "Implementing Buy Green," ibid. [LINK]. Accessed 4/6/2022. Page 7.
[283] Image sourced from Lewis, Meghan, et al., "Implementing Buy Green," ibid. [LINK]. Accessed 4/6/2022. Page 8.
[284] See the following tools: Athena Impact Estimator [LINK], the bath Inventory of Carbon and Energy [LINK], Tally [LINK], One Click LCA [LINK], and the Embodied Carbon in Construction Calculator [LINK]. Also see Cortese, Amy, "The Embodied Carbon Conundrum: Solving for All Emission Sources from the Built Environment," NBI, Building Innovation, February 26, 2020. [LINK]. Accessed 8/31/2021.

building heating and cooling."[285] This modeling shows this being achieved primarily through a reduction in pipeline (natural) gas combustion.

Additionally, and also mentioned previously, there are a group of EITE industries treated differently under the CCA. These facilities receive free allowances through 2026 against their 2015-2019 emissions baseline, and then the free allowances are reduced by a relatively minor amount, namely:

- 3% from 2027 through 2030, and
- 6%from 2031 through 2040, and potentially onward.[286]

EITE facilities cover a wide range of industries, including manufacturing of aluminum, steel, cement, and wood products – including manufacturing of these materials for building products.

Assessment of Canadian regulations similar to the CCA indicates that this legislative feature helps avoid excessive cost impacts to those facilities and avoid industry migration out of state.

> *"Full carbon pollution pricing can pose competitiveness risks to facilities in EITE sectors if they are competing with facilities producing similar products in countries without equivalent carbon pricing in place, both in domestic and export markets. Carbon leakage occurs when production and investment shift to jurisdictions with similar or relatively higher emissions intensity of production due to less stringent carbon pricing. This weakens emissions reductions at the global level, together with a loss of economic activity in the jurisdiction with more stringent carbon pricing."*[287]

Under existing CCA regulations, EITE industries will be required to secure minor emission reductions. While the emission reductions requirements are low enough to suppress industry migration impacts, there may also be low enough that there is insufficient incentive to upgrade facilities to reduce carbon emissions. Embodied carbon regulations – whether for publicly or privately funded construction – may increase incentives to reduce emissions for one or multiple product lines, so as to increase competitiveness in markets subject to embodied carbon regulations (i.e., to remain competitive with other lower-carbon product alternatives).

There may be other benefits associated with embodied carbon regulations in addition to GHG reductions, namely support for local jobs and local product sourcing.

- *"With concrete often being a locally made product and cities purchasing more concrete than any other entity, jurisdictions that specify low-carbon concrete can capture multiple benefits: significant GHG reductions while also retaining jobs and supporting the local economy."*[288]
- *"King County conducted a consumption-based inventory of sources and quantities of GHG emissions occurring over a one-year period (2015)… and isolated construction as an emissions category in its models (separating it from a homes and buildings category). In*

[285] Commerce, "Washington 2021 State Energy Strategy," December, 2020. [LINK]. Accessed 2/12/24. Pg 85.
[286] WA Legislature, "Final Bill Report E2SSB 5126," Ibid. [LINK]. Accessed 6/15/2021. Pages 5, 9.
[287] Environment and Climate Change Canada (ECCC), "Review of the OBPS Regulations: Consultation Paper," 2021. [LINK]. Page 11. Also see, Tempest, Kevin, Katelyn Roedner-Sutter, and Kjellen Belcher, "Policy Brief, Washington State's Climate Commitment Act," EDF, Low Carbon Prosperity Institute, September 2021. [LINK]. Page 8. Accessed 4/6/2022.
[288] Bowles, Webly, "Jurisdictions prepare…" ibid. [LINK]. Accessed 8/30/21.

> *2015, nearly 90% of construction emissions occurred during the production phase of materials. While overall emissions attributed to construction decreased by four percent since 2008, the inventory found that government demand for construction increased. Further, it highlighted that government demand on foreign production increased by 94% during this time, estimating that emissions associated with foreign production are twice the amount of emissions associated with domestic production."*[289]

- *"Many of these imported products and materials could be made here in the U.S. by American workers instead of in countries with lower environmental and health standards and higher emitting facilities."*[290]

A final important factor to consider regarding embodied emissions is that the emissions associated with creating building materials are being emitted in the present day. Operational emissions, or the emissions associated with shipping and commuting to new buildings, or to provide electricity to new buildings, will all be emitted in the future for new development. However, the industrial processes to produce steel or develop cement, are all being released from current industries. Embodied emissions are one pathway to address emissions occurring today, rather than emissions that will occur in the future.

Embodied carbon policies are a pathway to monitor and reduce emissions associated with new development building materials, and possibly incentivize emission reductions by some material producers. However, support is required to prepare producers for embodied carbon requirements for new development projects in Washington State, especially in supporting adoption of EPDs for the volume of material requests associated with private development. For instance, this support would be important if a local embodied carbon regulation started with the pathway of regulating cement:

> *Facility-specific EPDs for more than 5,000 concrete mixes exist for approximately 17 companies in the US; three of these companies are in Washington… Less than 10% of ready-mixed concrete producers in Washington State are equipped to deliver facility- or mix-specific EPDs at this time. All of these companies are in large urban markets. Although setting embodied carbon performance targets for concrete might be possible in areas where the EPD market is established, data on production opportunities and manufacturer capabilities across the state are not currently available to assess the feasibility of performance targets.*[291]

The impacts of embodied carbon requirements depend on how extensively they are pursued both across a geographic area and across product categories or whole-building requirements. Policies also be pursued within a single county, or with varying measures pursued across multiples counties. For instance, embodied carbon could be pursued for one, or a mix of, different types of construction and retrofit projects, including County-issued public projects, as well as for residential and commercial construction projects. Similarly, varying approaches could: implement global warming potential limits for concrete, steel, wood, gypsum board or other finishes; support local Building Code updates within a county for commercial buildings to include embodied carbon reductions; or advocate at the state level for changes in the residential building code to include embodied carbon reduction targets. These are just some of the policy approaches that could be pursued to achieve embodied carbon reductions.

[289] Simonen, Kathrina, et al., "Buy Clean…," ibid. [LINK]. Page 2-14 (pdf page 36). Accessed 4/6/2022.
[290] BlueGreen Alliance, "Buy Clean." [LINK]. Accessed 4/6/2022.
[291] Simonen, Kathrina, et al., "Buy Clean…," ibid. [LINK]. Page 3-11 (pdf page 65). Accessed 8/31/2021.

Appendix D.4 Circular Economy Salvaged Lumber

Appendix D.4 reviews what circular economy salvaged lumber is; local goals, benefits and program options of a circular economy salvaged program; as well as past performance and program partners.

Circular Economy Salvaged Lumber: What is it?

Per the EPA, a circular economy is one that,

> *Keeps materials and products in circulation for as long possible… [It] refers to an economy that uses a systems-focused approach and involves industrial processes and economic activities that are restorative or regenerative by design, enables resources used in such processes and activities to maintain their highest value for as long as possible, and aims for the elimination of waste through the superior design of materials, products, and systems (including business models).*[292]

Applying this concept to salvaged lumber means that programs could support all portions of product lifecycles, from salvaging lumber at building deconstruction and demolition, to its integrated use as a subsequent building product. Although circular economy applications have benefits for multiple product types, applying this work to lumber products also helps lock in the carbon of wood products. Additionally, wood programs can be designed to support, and concentrate benefits in, frontline communities.

Circular Economy Salvaged Lumber: Goals, Benefits and Program Options

The overall goal of a circular economy salvaged lumber program would be to direct salvaged lumber to better uses than its typical waste stream, which is typically landfilling or burning as hog fuel.

- When applied to King County as a case study, this could mean directing part or all of the 61,500 tons of unpainted and untreated wood currently flowing through King County transfer stations to Cedar Hills (landfilling), and the over 40,000 tons of flow-controlled unpainted and untreated wood currently flowing through to private C&D processing facilities (hog fuel).

The ultimate goal of circular economies for unpainted and untreated wood would be that this material is incorporated back into new building products, locking carbon into the building products, with the potential for wood-based products to be reused multiple times.

There are multiple benefits for circular economy salvaged lumber. A local circular wood management program can begin to bring in external products, or unpainted and untreated salvaged lumber from across the Puget Sound, in turn providing building materials for projects around the Pacific Northwest. Doing so has the potential to shift the regional value of salvaged wood from ~$20/ton (current price of hog fuel) toward $1,000/ton (current price for wood fiber insulation). This action could yield significant ripple effects in the regional economy, local job market, and be designed to benefit frontline and disadvantaged communities.

This program could also yield significant climate benefits. Building products made from locally sourced salvaged lumber have lower embodied carbon than virgin wood products, reducing the climate change

[292] EPA, "What is a Circular Economy," last updated December 14, 2023. [LINK]. Accessed 2/26/2024.

impact of wood products. Overall, if the circular economy for salvaged wood achieves full reuse, with all 350,000 tons of regional unpainted and untreated wood being processed into new building products, GHGs would be reduced by an estimated minimum of 1.01 million MTCO2e.

There are many different ways to support and spur on the circular economy for salvaged wood, including:

- Supporting the collection, minimal processing, and shipping of salvaged lumber.
- Construction and deconstruction/demolition (C&D) grants supporting wood market development.
- Incentivizing expanded salvaged lumber product manufacturing, such as finger-jointed lamstock, cross-laminated timber (CLT) and dowel-laminated timber (DLT), wood fiber insulation, and engineered wall systems.
- Testing and certification of salvaged lumber products
- Establishing a community-centered salvaged lumber utilization program.
- Providing training and certification in salvaged lumber harvesting (deconstruction).

Circular Economy Salvaged Lumber: Past Performance and Regional Partners

Various activities have been undertaken to support circular economy salvaged lumber previously; again, the focus of these activities have been in King County Solid Waste, including the following:

- 2015 King County Code revised to ban clean wood from disposal.
- 2020 King County Strategic Climate Action Plan (SCAP) includes wood and lower embodied emission materials in Consumption and Materials Focus Area priority actions.
- 2022-23 SWD Re+ Circular Economy awards over $420,000 in grants for related efforts
- 2023 Washington State residential building code updated with sections on lumber reuse, deconstruction, and C&D codes.
- 2023 King County Solid Waste Division (SWD) hosted the Salvaged Lumber Summit with over 170 participants from multiple states and countries.
- 2023 SWD develops the Circular Wood Work Plan to firmly establish a circular wood management system over a 5 year timespan.
- 2023 Seattle Public Utilities receives a $4M EPA grant to build a salvaged lumber warehouse
- 2023 SWD develops Deconstruction Training with 3 community partners for $56,000
- 2024 Anticipating proposed C&D fee increase (amount to be determined)

The following entities have been actively involved with initial efforts in developing components of a local circular wood management system: Second Chance Outreach (Hope for Homies), Freedom Project, Community Passageways, WELD Seattle, Build Reuse, Zero Waste Washington, Seattle Public Utilities, Second Use, Ballard Reuse, Earthwise, Dedicated Deconstruction, Bennion Construction, Re-Use Consulting, Batt+Lear, Sankofa, and Sustainable Northwest Wood.

The following entities have expressed interest in being part of a circular wood management system: Vaagen Timber, Muckleshoot Tribe, Seattle Colleges Wood Technology Center, TallWood Design Institute, Sound Foundations NW, BLOCK Homes, Puget Sound Sustainable Construction Leaders.

There is also ongoing coordination with similar programs across the country through Build Reuse, including San Antonio, Minnesota. An example this coordination work can be seen in the YouTube recording of the Feb 2023 King County Salvaged Lumber Summit.

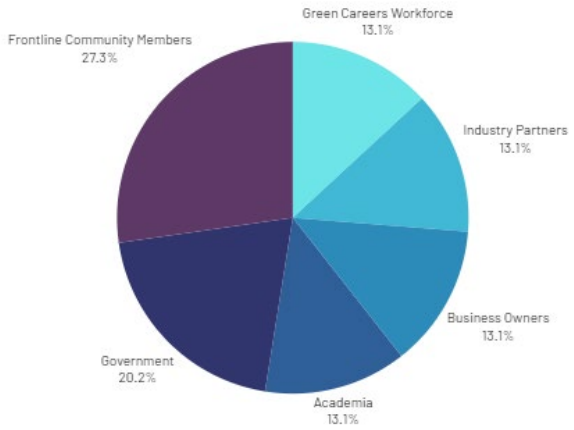
Appendix D.5 Workforce Development

Appendix D.5 reviews how the Priority Measures under consideration might be implemented with concrete strategies and commitments that ensure job quality, strong labor standards, and support a diverse, highly skilled workforce. This section reviews the workforce collaboration platform, examples of workforce development activities, and how these activities might be pursued for individual measures.

Workforce Collaboration Platform: C3

To support works measures pursued from this plan, King, Kitsap, Pierce, and Snohomish counties are collaborating via the Coalition for Climate Careers (C3). The C3 initiative originated from the King County Green Jobs Strategy, but has since expanded to the four-county region.

FIGURE APPENDIX D.5.1: C3 EXECUTIVE STEERING COMMITTEE COMPOSITION



The Coalition is led by an Executive Steering Committee with a shared leadership model granting equal decision-making power to the community and institutions. C3 ensures frontline community implementation by providing public and private workforce partnership funding, policy guidance, promoting green career opportunities, and fostering cross-community collaboration. Membership includes diverse representation from labor and industry, government officials, educational institutions, business owners, non-profits, community-based organizations, and registered apprenticeship and pre-apprenticeship program professionals.

C3 serves as a strategic platform for collaboration among public and private entities, alongside frontline communities, with the shared vision of establishing a thriving and inclusive local green workforce. This platform prioritizes working in frontline communities affected by climate change, proactively engaging workers and community leaders in designing and implementing workforce development.

Workforce Development Program Examples

Workforce development activities that ensure job quality, strong labor standards, and support a diverse, highly skilled workforce include the following types of programs:

- Pre-apprenticeship and Apprenticeship Programs
- Community College Partnerships
- Joint Labor-Management Training Programs
- Paid Internships

Such programs help advance decarbonization efforts. Below are examples of each program type, demonstrating active programs that can be executed across the four-county region in support of the measures outlined in this plan**.**

Pre-apprenticeship and Apprenticeship Programs

In response to the projected growth in local clean energy jobs, King County launched the innovative JumpStart Initiative, targeting workforce development for the 18 – 24 year-old demographic that are identified as high-opportunity youth from disadvantaged backgrounds. This program is collaborating with existing pre-apprenticeship training providers to equip participants with industry-recognized credentials through a combination of skills training and paid work-based learning. Training occurs directly with a network of established contractors and employers specializing in installing heat pumps and solar panels in residential single-family homes.

An example pre-apprenticeship training provider within the JumpStart network is YouthBuild, which will help connect JumpStart participants to diverse apprenticeship options following training. The four counties may strategically leverage the C3 platform to effectively promote JumpStart and pre-apprenticeship programs with a similar focus throughout the four-county region for priority measures identified in this plan.

Community College Partnerships

C3 partners have a history of working with community colleges offering industry-recognized building and construction credentials, including a collaboration with the Seattle Colleges network. The Seattle Colleges Pre-Apprenticeship Construction Training Program (PACT), a JumpStart network partner, offers industry-recognized certifications such as the Occupational Safety and Health Administration (OSHA) -10 and OSHA-30 certificates in addition to college credit for participants that complete the training program. Partners in the four-county network could pursue expanded college program collaborations to connect training programs affiliated with decarbonization in support of priority measures identified in this plan.

Joint Labor Management Training Programs

The Puget Sound Joint Electrical Apprenticeship Training Committee (PSEJATC) is a registered apprenticeship program within the JumpStart network. As JumpStart continues to expand its reach, the C3 platform will highlight registered apprenticeship programs to accelerate the development of a clean energy workforce across the four-county region. The four-county region could seek collaboration with the PSEJATC on joint labor-management training in support of priority measures identified in this plan.

Paid Internships

The NextGen Climate Program provides paid climate leadership internships, connecting undergraduate and graduate students from underrepresented backgrounds to research opportunities across GHG emissions and decarbonization sectors. The C3 network offers an opportunity to model the NextGen Climate program across all four counties to establish multiple paid research opportunities, empowering the next generation of climate leaders.

- ## Recommended Workforce Development Activities for Priority Measures

Based on the existing C3 workforce development platform, and review of active programs C3 network, the following types of activities are recommended to support the types of priority measures identified in this plan:

Single-family Residential Measures and Multifamily Measures

- Pre-apprenticeship and Apprenticeship Programs
- Community College Partnerships

With more than 2.1 million workers and growing, the energy efficiency (EE) sector represents the largest source of employment in the clean energy economy, adding nearly 58,000 jobs in 2021 (US Energy and Employment Report 2022). In King County alone, HVAC installer/insulation/plumbing businesses are expected to grow by 4%, and electrical wiring contractor businesses are expected to grow by 3.2%. Many of these positions emphasize clean energy and are considered green jobs.

C3 programs for these types of measures offer one-on-one case management to address individual participant needs, with wraparound support services assisting with securing childcare, transportation assistance, and financial needs while participants engage in paid work-based learning. Following training, participants are connected to apprenticeships or direct hire opportunities. This approach ensures participants secure high-quality jobs within the growing clean energy sector, supporting a steady pipeline of skilled workers equipped to meet the rising workforce demand of residential decarbonization.

Commercial and Community Building Measures

- Pre-apprenticeship and Apprenticeship Programs
- Community College Partnerships
- Joint Labor-Management Training Programs

In addition to the above apprenticeship and pre-apprenticeship program approaches, additional workforce development approach and be pursued in commercial and community measure programs. Through C3 quarterly meetings, recipients of community decarbonization grants, including community-based organizations and private property owners, will benefit from comprehensive guidance and resources through C3 partners. These tools will equip recipients the means to connect with local pre-apprenticeship and apprenticeship programs into their decarbonization projects. This framework will provide a structured approach for integrating workforce development activities throughout the various phases of the project lifecycle, encompassing design, siting, and installation of building heating and/or mechanical system upgrades. These tools will include guidance on equitably engaging with Minority- and Woman-owned Business Enterprise (MWBE) firms identified at the state level or through local registration within the four counties.

In addition, King County and C3 will actively promote JumpStart contractors to recipients of community decarbonization grants aimed at energy efficiency and infrastructure improvements and weatherization upgrades. Through this mutually beneficial connection, grant recipients will be able to access a pool of qualified and skilled contractors offering valuable expertise in installation of decarbonization technology

while simultaneously expanding opportunities for JumpStart contractors to engage in regional commercial decarbonization efforts.

Multi-sector Decarbonization Measures

- Pre-apprenticeship and Apprenticeship Programs
- Paid internships

Under multi-sector decarbonization measures, all measures may benefit from paid internships, and circular economy salvaged lumber program may present additional opportunities for pre-apprenticeship and apprenticeship programs.

The development and expansion of innovative financing programs (such as C-PACER), presents strategic opportunities to engage young adults in the clean energy transition. This could involve training and development internships specifically focused on supporting business and community engagement or interest rate buy down programs. Building upon the University of Washington's successful case competition for undergraduate students to develop C-PACER promotion campaigns targeting building owners, there may be emerging opportunities to include the next generation of climate leaders in helping to design and research decarbonization methods through the NextGen Climate program.

NextGen interns have also previously explored GHG reduction strategies in King County's RE+ circular economy initiative, so there is precedent for additional internship support for circular lumbar. A circular economy and salvaged lumber program presents additional potential avenues for expanding deconstruction training and certification for workers and contractors. This could involve strategically expanding existing training and outreach efforts to reach underrepresented populations, such as justice-involved youth and formerly incarcerated individuals, possibly applying apprenticeship and pre-apprenticeship programs for this measure.

Appendix D.6 Equity Impacts of Priority Measures

Appendix D.6 reviews the potential equity impacts of priority measures contemplated in this plan. Reviews provide a narrative introduction with specific potential quantifiable impacts.

Single-family Residential and Small Business Measures

Appendix D. Measure 1: Heat pump rebate program for single-family homes
This program, when prioritizing low-income households with vulnerable populations where GHG-emitting heating sources are higher than average, would provide affordable and accessible alternative heating equipment that reduces fossil fuel reliance and its impacts on climate change and air pollution. This program would provide communities that are at higher-than-average risk for experiencing cumulative climate-related impacts, and are often already bearing disproportionate negative health outcomes associated with environmental exposure, with the following benefits:

- Equitable options for appliances that can use renewable energy,
- Improved home energy efficiency,
- Improved indoor air quality,
- Reduced air pollution,

- Long-term climate impacts protection, through the added benefits of cooling and air filtration during smokier summers (wildfire smoke),[293]
- Reduced energy and utility burden on cost-burdened communities,[294]
- Increased climate resilience for low-income and vulnerable populations during climate emergencies,[295] and
- When paired with workforce development in frontline communities, this program may also increase available jobs, while providing improved job access and skills development specifically among vulnerable populations.

Appendix D. Measure 2: Water heating "tank swap" for single-family homes or small businesses
A water heating "tank swap" program would provide affordable and accessible alternative heating equipment that reduces fossil fuel reliance and its impacts on climate change and air pollution. This program would provide communities that are at higher-than-average risk for experiencing cumulative climate related impacts, and are often already bearing disproportionate negative health outcomes associated with environmental exposure, with the following benefits:

- Equitable options for appliances that can use renewable energy,
- Improved home energy efficiency, and
- Long-term climate impacts protection through the added benefits of reduced GHG emissions.[296]

Appendix D. Measure 3: Whole-home decarbonization for single-family homes
Major climate-related hazards including extreme heat and cold events, and wildfire smoke events are expected to grow in intensity and frequency.[297] Whole home decarbonization programs prioritizing low-income households have the potential to provide a host of benefits to low-income, vulnerable, and overburdened communities. These benefits are the same as those listed under Appendix D. Measure 1, with the following amendments and additions:

- Mitigating displacement risks associated with rising climate-related housing costs where some degree of rent protection is integrated for rental households. [298]

Multifamily Residential Measures

Appendix D. Measure 4: Water heating "tank swap" for multifamily buildings and units
Half of multifamily renters nationally spend more than 30% of their incomes on utilities and rent, may use more electricity than non-renters, and have fewer Energy Star appliances along with other energy

[293] Casola, Joe, et. al, "An Unfair Share: Exploring the Disproportionate Risks from Climate Change Facing Washington State Communities," University of Washington (UW) Climate impacts Group, UW Department of Environmental and Occupational Health Sciences, Front and Centered, 2018. [LINK]. Accessed 2/28/2024.
[294] Puget Sound Sage, "Powering the Transition: Community Priorities for a Renewable and Equitable Future," June 2020. [LINK]. Accessed 2/28/2024.
[295] FEMA, "A Whole Community Approach…," ibid. [LINK]. Accessed 2/28/2024.
[296] Casola, Joe, et. al, "An Unfair Share…," ibid. [LINK]. Accessed 2/28/2024.
[297] Westerling, Anthony LeRoy. "Wildfires in West Have Gotten Bigger, More Frequent and Longer since the 1980s." The Conversation, 15 May 2023. [LINK]. Accessed 2/28/2024.
[298] Palmeira, Monica, "Bluelining: Climate Financial Discrimination on the Horizon," The Greenlining Institute, 2023. [LINK]. Accessed 2/28/2024.

efficiency features.[299] A water heating "tank swap" program that provide rebates for heat pump water heaters to replace gas water heating in multifamily units provides the following benefits for renters when focused on implementation for low-income and vulnerable populations:

- Equitable options for appliances using renewable energy,
- Improved home energy efficiency, and
- Long-term climate impacts protection through the added benefits of reduced GHG emissions

Appendix D. Measure 5: "Dryer swap" program for multifamily buildings and units.
A "dryer swap" program for multifamily buildings and units would provide the same benefits as those listed under Appendix D. Measure 4.

Appendix D. Measure 6: Whole-building decarbonization for multifamily buildings
Major climate-related hazards including extreme heat and cold events, and wildfire smoke events are expected to grow in intensity and frequency.[300] Additionally, half of multifamily renters nationally spend more than 30% of their incomes on utilities and rent, may use more electricity than non-renters, and have fewer Energy Star appliances along with other energy efficiency features.[301] Decarbonization programs prioritizing low-income multifamily buildings have the potential to provide a host of benefits to low-income, vulnerable, and overburdened communities. These benefits are the same as those listed under Appendix D. Measure 3.

Appendix D. Measure 7: Multifamily technical assistance
A technical assistance program supporting decarbonization and energy efficiency for multifamily buildings, including uptake of federal IRA rebates, would provide the same benefits as those listed under Appendix D. Measure 3.

Commercial and Community Building Measures

Appendix D. Measure 8: Community decarbonization grants
Low-income, vulnerable, and overburdened communities experience significant and disparate risk to the impacts of climate change due to overlapping socioeconomic indicators that include precarious housing and building infrastructure conditions that increase exposure to extreme heat and cold, flooding, wildfire smoke, and earthquakes.[302] Decarbonization grants prioritizing these communities would provide opportunities for additional cooling centers and places of refuge from climate emergencies and health hazards. Such grants could provide essentially the same benefits as those listed under Appendix D. Measure 1, with the following amendments and additions:

- Improved community energy efficiency,

[299] Caliner, Michael, "Reducing Energy Costs in Rental Housing: The Need and the Potential," Joint Center for Housing Studies of Harvard University (JCHS), America's Rental Housing. Research Brief 13-2, December 2013. [LINK]. Accessed 2/28/2024.
[300] Westerling, Anthony LeRoy. "Wildfires in West Have Gotten Bigger...," ibid. [LINK]. Accessed 2/28/2024.
[301] Caliner, Michael, "Reducing Energy Costs in Rental Housing…," ibid. [LINK]. Accessed 2/28/2024.
[302] U.S. Government Publishing Office, "Experiences of Vulnerable Populations During Disaster," 116th Congress, second session, July 28, 2020; Printed 2021. [LINK]. Accessed 2/28/2024

- Mitigating health disparities associated with the cumulative impact of environmental hazards, social conditions, and climate change on low-income and overburdened communities.[303]

Multi-sector Decarbonization Measures

Appendix D. Measure 9: Embodied carbon program
Estimates that low embodied carbon material substitutions can result in GHG emissions reductions of 30-50% at cost parity with currently available materials.[304] Additionally,

> *Building materials also have a direct local impact on community health because material supply chains rely on manufacturing facilities and power plants, both of which are associated with negative health impacts for adjacent communities through the release of heavy metals, toxic chemicals, and particulate matter into the water, air, and food sources of nearby communities, causing short-term and long-term health problems.*[305]

This program can provide vulnerable communities with the following benefits:

- Reduced air pollution
- Creates good jobs for frontline workers in the growing zero-carbon economy, and
- Support the creation of new small businesses.[306]

Appendix D. Measure 10: Circular economy salvaged lumber program
As circular economy salvaged lumber would have similar lifecycle impacts on a specific product as that of a broader embodied carbon initiative, this program could provide the same benefits as those listed under Appendix D. Measure 9.

Appendix D. Measure 11: Innovative financing program
Innovative financing could pursue a range of program options that could provide specific benefits to frontline communities. For instance:

- On-bill financing programs can offer a means of paying for efficiency improvements in rental housing stock to alleviate the split-incentive problem.[307] On-bill financing and repayment programs can be tied to the utility meter and not the occupant, allowing repayment of the improvement even if the occupant changes.
- These types of financing mechanisms can be qualified by the cost-effectiveness of the proposed improvement and not the credit worthiness of the applicant, potentially opening these financing mechanisms up to a much wider applicant pool.[308]

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[303] Min, Esther, et. al, "The Washington State Environmental Health Disparities Map: Development of a Community-Responsive Cumulative Impacts Assessment Tool," Int. J. Environ. Res. Public Health, 16(22), 4470. 2019. [LINK]. Accessed 2/28/2024.
[304] Magwood, Chris and Tracy Huynh, "The Hidden Climate Impact of Residential Construction," RMI, 2023. [LINK]. Accessed 2/28/2024.
[305] Lewis, Meghan, et. al, "Part 1: Introduction to Embodied Carbon," American Institute of Architects and CLF, 2022. [LINK]. Accessed 2/28/2024. Page 6.
[306] Portland Planning and Sustainability, "Embodied Carbon I the Built Environment." [LINK]
[307] The Climate Center, AECOM, and Building Decarbonization Coalition (BDC), "Funding and Financing a Climate-Safe Future: Low- and Moderate-Income Residential Building Decarbonization," 2023. [LINK]. Accessed 2/28/2024.
[308] Mast, Bruce, Holmes Hummel, and Jeanne Clinton, "Towards an Accessible Financing Solution," BDC, 2020. [LINK]. Accessed 2/28/2024.

Overall, Innovative financing programs for renewable energy and energy efficiency improvements in residential and commercial buildings have the potential to accelerate the deployment of improvements that would be supported under Appendix D. Measures 1 – 8.

Appendix E: MSA LIDAC Census Tracts

The following table of LIDAC census tracts in the four county Puget Sound region was obtained from the CEJST, accessed on 1/30/2024: https://screeningtool.geoplatform.gov/en/downloads#8/47.468/-122.106

Census Tract	County	Census Tract	County	Census Tract	County
53033005302	King County	53033029206	King County	53053071704	Pierce County
53033009000	King County	53033029407	King County	53053071705	Pierce County
53033009100	King County	53033029503	King County	53053071706	Pierce County
53033009200	King County	53033029504	King County	53053071803	Pierce County
53033010001	King County	53033029700	King County	53053071805	Pierce County
53033010002	King County	53033030004	King County	53053071806	Pierce County
53033010401	King County	53033030005	King County	53053071807	Pierce County
53033010402	King County	53033030006	King County	53053071808	Pierce County
53033010702	King County	53033030313	King County	53053071901	Pierce County
53033011001	King County	53033030314	King County	53053072000	Pierce County
53033011002	King County	53033030501	King County	53053072106	Pierce County
53033011101	King County	53033030801	King County	53053072905	Pierce County
53033011200	King County	53033030802	King County	53053072907	Pierce County
53033011402	King County	53035080102	Kitsap County	53053940002	Pierce County
53033011700	King County	53035080200	Kitsap County	53053940003	Pierce County
53033023202	King County	53035081000	Kitsap County	53053940005	Pierce County
53033025302	King County	53035081400	Kitsap County	53053940006	Pierce County
53033026100	King County	53053060200	Pierce County	53053940007	Pierce County
53033026400	King County	53053061002	Pierce County	53053940008	Pierce County
53033026500	King County	53053061300	Pierce County	53053940011	Pierce County
53033026801	King County	53053061400	Pierce County	53061040200	Snohomish County
53033026802	King County	53053061601	Pierce County	53061040700	Snohomish County
53033027100	King County	53053061900	Pierce County	53061041202	Snohomish County

53033027200	King County	53053062000	Pierce County	53061041806	Snohomish County
53033027300	King County	53053062600	Pierce County	53061041809	Snohomish County
53033028000	King County	53053062801	Pierce County	53061041812	Snohomish County
53033028100	King County	53053063000	Pierce County	53061041901	Snohomish County
53033028200	King County	53053063300	Pierce County	53061041903	Snohomish County
53033028402	King County	53053063400	Pierce County	53061041904	Snohomish County
53033028802	King County	53053063501	Pierce County	53061041905	Snohomish County
53033028902	King County	53053071206	Pierce County	53061051400	Snohomish County
53033029003	King County	53053071504	Pierce County	53061051803	Snohomish County
53033029004	King County	53053071601	Pierce County	53061052903	Snohomish County
53033029203	King County	53053071703	Pierce County	53061052905	Snohomish County

Appendix F: Summary of Informal PCAP Comments Received

The Agency made the draft PCAP available for informal public review and comments from 01/23/2024 through 02/07/2023 in line with EPA requirements. Appendix F contains a summary of comments received. The Agency will revisit these comments during CCAP development.

Date Received	Company/Organization	General Topic	**Comment Summary**
1/24/2024	Rural Resources Community Action	Built Environment	Consider including duct sealing technology as a built environment measure.
1/24/2024	Private Citizen	Table of Emissions	Consider corrections to King County aviation GHG emissions and methodology.
1/25/2024	City of Tacoma	Transportation	Consider additional transportation measures relating to VMT reductions, active transportation networks, EV charging infrastructure for passenger vehicles and micro mobility options.
1/26/2024	Everett Community College	Built Environment	Consider additional built environment measures that provide grants and low interest loans for solar installation in public buildings and identify new capital investment streams to address additional power upgrades associated with building electrification.
1/31/2024	Western Washington University	Built Environment	Consider including energy efficiency strategies and promotion of rooftop solar as built environment measures.
1/31/2024	Penske Truck Leasing Co.	Transportation	Consider a whole-system approaches to transportation decarbonization and consider including additional transportation measures related to infrastructure development, MHD ZEV access, demonstration projects, circular economy, secondary markets, and off-road MHD ZEV.
1/31/2024	Perpetual	Consumption & Waste	Consider including a reuse & reduction in waste of foodware as a solid waste measure.
1/31/2024	Port of Seattle	Transportation and Built Environment	Consider additional transportation measures related to sustainable transportation and walkable/livable neighborhoods, VMT reduction, maritime fuels, zero-emission vessels, ZEV offroad equipment, non-transit fleets, and maritime electrification. Consider defining acronyms in the built environment

Date Received	Company/Organization	General Topic	**Comment Summary**
			discussion and expanding the embodied carbon policy measure to include residential and commercial buildings. Make data and maps associated with LIDAC communities available to Phase 2 applicants.
1/31/2024	Republic Services, Inc.	Transportation	Consider additional transportation measures related to the electrification of privately held refuse hauler fleets for waste collection is urban/suburban areas.
2/1/2024	Washington State Housing Finance Commission	Built Environment	Consider revisions and additions to Options 4 and 5 of the built environment priority measures.
2/2/2024	Northwest Seaport Alliance	Transportation	Consider revisions to clarify statements in Section 1 (Introduction) and Section 4 (Priority GHG Reduction Measures).
2/7/2024	RMI	Built Environment	Consider various edits to priority measures for the built environment including comprehensive rebate programs for low-income households and overburdened communities.

Appendix G: Equity Strategies and Resources in the Region

Resource	Description + Goals	Who was Consulted?	Key Topics	Key Themes
Policies to Advance Health Equity	The Tacoma-Pierce County Health Department (TPCHD) collaborated with the CoLab for Community and Behavioral Health Policy and the Northwest Center of Public Health Practice at the University of Washington to identify ten pro-equity policy areas that provide strategic, high-level policy direction for addressing COVID-19 recovery efforts in Pierce County. The collaborating teams integrated information from multiple sources, prioritizing the direct experiences and recommendations of community members. This report summarizes this process and the evidence-base of the final policy areas for promoting health equity and recovery.	• Asia Pacific Cultural Center • Compact of Free Association (COFA) Alliance National Network of Washington • Odilia Campos-Estrada, Community Health Worker (CHW) • Catherine's Place • Centro Latino • College Success Foundation • Leonila Correa, (CHW)-Faith, Health and Action Latinx Health Ministers • Grupo San Miguel de San Frances de St Cabrini in Lakewood • Harvest Pierce County/Pierce Conservation District • Latinx en Accion • Latinx Unidos of the South Sound • Key Peninsula Partnership for a Healthy Community • The Multicultural Child and Family Hope Center • Power of Two • Springbrook Connections • The Tacoma Women of Color Collective • United Way of Pierce County	• Economic stability • Housing Affordability and Accessibility • Healthy Community Planning and Built Environment • Food Affordability and Accessibility • Social Connectedness	Community health and emergency preparedness

Resource	Description + Goals	Who was Consulted?	Key Topics	Key Themes
Health Equity Maps (ex. Pierce County)	Maps that measure health and equity across multiple indicators. These tools are used by planners, developers, governmental staff, decision makers, etc. to redistribute neighborhood investment and correct spatial inequity.	Jurisdictional GIS teams	Overall equity, Livability, Accessibility, Education, Environmental Health	Community leadership and community-driven policy making, community capacity development
TPCHD Communities of Focus	Evidence-based program at TPCHD to work directly with people in zip codes that offer less access to opportunities to improve health than others. Each CoF has a workplan to affect policy, systems, and environmental change. TPCHD staff provide meeting support, technical assistance, and lead participatory policy-making and budgeting processes.	Various coalitions of agency partners, NPOs, and community members.	Civic participation, Food, racial justice, healthy community planning, poverty, trauma, access to medical services, air pollution, education, housing, safety, greenspace, inadequate prenatal care and low birth rates, opioid deaths, respiratory and cardiovascular disease, shorter life spans.	Community leadership and community-driven policy making, community capacity development
TPCHD Family Resource Centers + Family Support Partnership	A network of providers collaborating to provide families tailored resources to promote healthy relationships and environments for children.	Network of service providers throughout Pierce County	Parenting classes and support groups, food and housing access, free diapers and wipes, service	Community health and emergency preparedness

Resource	Description + Goals	Who was Consulted?	Key Topics	Key Themes
	Services are offered at the neighborhood level through nine Family Resource Centers throughout Pierce County.		referrals, education, workforce development, environmental health, community connections.	
HEAL Act Environmental Justice Assessments	Required for any state agency covered by the HEAL Act to inform and support the agency's consideration of overburdened communities and vulnerable populations when making decisions and to assist the agency with the equitable distribution of environmental benefits, the reduction of environmental harms, and the identification and reduction of environmental and health disparities.	Depends on policy or investment.	Model tool for EJ impact assessment of decisions or grant funding.	Community leadership and community-driven policy making, community capacity development
TPCHD Pierce County COVID-19 Health Equity Assessment	TPCHD partnered with Tacoma-Pierce County Equity Action Network, the University of Washington (UW) CoLab for Community and Behavioral Health Policy, and Northwest Center for Public Health Practice	• Asia Pacific Cultural Center • Compact of Free Association (COFA) Alliance National Network of Washington • Odilia Campos-Estrada, Community Health Worker (CHW) • Catherine's Place • Centro Latino	Structural racism, adverse social, economic, and environmental conditions, pandemic, emergency response, elevated disease risk, income disparities,	Community health and emergency preparedness

Resource	Description + Goals	Who was Consulted?	Key Topics	Key Themes
	to inform COVID-19 response and recovery efforts.	• College Success Foundation • Leonila Correa, (CHW)-Faith, Health and Action Latinx Health Ministers • Grupo San Miguel de San Frances de St Cabrini in Lakewood • Harvest Pierce County/Pierce Conservation District • Latinx en Accion • Latinx Unidos of the South Sound • Key Peninsula Partnership for a Healthy Community • The Multicultural Child and Family Hope Center • Power of Two • Springbrook Connections • The Tacoma Women of Color Collective • United Way of Pierce County	access to healthcare, child and youth, food, healthy community planning, economic stability, housing, social connectedness.	
TPCHD COVID-19 After-Action Report and Improvement Plan	File available on request. Captures highlights, successes, and areas for improvement for pandemic emergency response between January 2020-March 2022. Includes recommendations to strengthen programs, emergency preparedness, and response efforts.	CoF, Family Resource Centers, EMS, healthcare, Equity Action Network, pharmacies, businesses	Partnerships, Equity, Public Information and Communications, Data management analysis and reporting, Language Access, Neighborhood level response, mental health	Community health and emergency preparedness

Resource	Description + Goals	Who was Consulted?	Key Topics	Key Themes
TPCHD Gift Guidance	File available upon request. TPCHD collected best practices on reimbursing community members for their time and developed an organizational procedure that allows up to $100 per gift card and sample scenarios for responding to inequities.	N/A	Paying community members for their time, language access, trauma informed,	Community capacity development
Inclusive Community Building	File available on request. Community informed guidance for municipal agencies.	National and local organizers	Relationship building, trust, collective action, wellness and prosperity, bridging community and government, developing more equitable policies.	Community leadership and community-driven policy making
(SRFC) Sustainable and Resilient Frontline Communities (2020 King County SCAP)	King County's first community-driven climate justice framework. One of three sections in the County's Strategic Climate Action Plan which includes GHG emissions reduction and Climate Preparedness.	King County Staff and Frontline communities in King County, including the Climate Equity Community Task Force. A cohort of frontline communities assembled to guide and inform the SCAP and its ensuing actions and strategies. See here.	Eight focus areas: 1) Community leadership, 2) Community capacity building, 3) Equitable green jobs pathways, 4) Emergency preparedness and community health, 4) Food systems and food security, 6) Housing	All

Resource	Description + Goals	Who was Consulted?	Key Topics	Key Themes
			security and anti-displacement, 7) Energy justice and utilities, 8) Transportation access and equity	
City of Seattle Equity and the Environment Agenda 2016	City of Seattle's first community-driven environmental equity agenda, setting direction for its newly established environmental equity program	Over 1,000 frontline community members/orgs, in Seattle, WA, and City of Seattle staff, specifically the Environmental Justice Committee supported its development. See more information here.	1) Healthy environments for all, 2) Jobs, local economies & youth pathways, 3) Equity in city environmental programs, 4) Environmental narrative and community leadership, 5) Opportunities for government, environmental organizations, community and philanthropic leadership	All

Resource	Description + Goals	Who was Consulted?	Key Topics	Key Themes
Snohomish County Climate Vulnerability Index Tool	The Climate Vulnerability Tool is a web mapping application that provides access to data quantifying climate vulnerability for Snohomish County. The tool synthesizes key climate, environmental, and community data, and organizes this data into three indexes. This tool allows review/analysis and planning including adaptive capacity, sensitivity, and exposure potential for population vulnerability.	Internal and external partners and collaborators including the public, with special emphasis on overburdened populations.	Adaptive Capacity Gap: Determines how adaptable a population is with regards to climate change. The higher the adaptive capacity gap score, the less able the population will be able to adapt. The majority of adaptive capacity gap data is sourced from U.S. Census. Sensitivity: Age and health conditions that affect how susceptible the population may be to climate-related hazards. The majority of sensitivity data comes from the Centers for Disease Control and Prevention (CDC). Exposure: Range of potential climate	Community health and emergency preparedness

Resource	Description + Goals	Who was Consulted?	Key Topics	Key Themes
			impacts. Uses high-emissions data to represent worst-case climate change scenarios. The majority of exposure data was developed by the UW Climate Impacts Group (CIG) and represents the "high emissions" RCP 8.5 for mid-century (2020-2049).	

Resource	Description + Goals	Who was Consulted?	Key Topics	Key Themes
Snohomish County Office of Social Justice	Executive Somers established the Office of Social Justice based on a recognition of the need for change within Snohomish County.	Snohomish County Executives, Council, public, private and other collaborators.	The creation of the Office of Social Justice emphasized the Executive's commitment to leading an effort of transforming institutional racism by identifying our current internal and external systems for change.	Community leadership and community-driven policy making
Pierce County Equitable Community Engagement Framework	This framework is both a summary and guide of best practices for equitable community engagement for the Sustainable Resources (SR) division of Pierce County's Planning and Public Works department.	The framework was informed by other guides (listed in the document) as well as community feedback received at outreach events in 2022 and 2023.	Equitable community engagement, getting to know and building trust/relationships with frontline communities, building government capacity to work with and prioritize frontline communities, government accountability,	Community leadership and community-driven policy making
Building the Groundwork for Meaningful Climate Empowerment	Involve those most impacted by climate change in climate action planning and implementation processes.	Pacific Islander Health Board of WA, PULL group, Youth Leading Change, PSESD Latinx Family Advocacy Group, DeMark Apartments Group, Safe		Transportation access and equity, community capacity development

Resource	Description + Goals	Who was Consulted?	Key Topics	Key Themes
		Streets, Red Barn Youth Center, Bethel Family Services		
Pierce County Equity in Decision Making: Equity Note and Equity Index	To increase access to opportunity in the Pierce County community by identifying barriers and their long-term implications on equity in residents' prosperity, health, and safety. The Equity Note supports intentional processes for this, helping us work towards a more equitable and livable Pierce County for all.	Internal and external partners and collaborators including the public.		Community leadership and community-driven policy making
Pierce County Climate Vulnerability Assessment	This assessment will help County staff and the general public better understand (1) How climate and weather patterns are expected to change in Pierce County, (2) What communities and County facilities are vulnerable to changing conditions, (3) What policies and investments can protect vulnerable community members	Vulnerable populations identified in the CVA, the general public, climate advocates, cities and towns, tribal representatives		Community health and emergency preparedness