Economic Impact Assessment for the Proposed Supplemental Federal "Good Neighbor Plan" Requirements for the 2015 8-hour Ozone National Ambient Air Quality Standard

U.S. Environmental Protection Agency
Office of Air and Radiation
Office of Air Quality Planning and Standards
Research Triangle Park, NC 27711

November 2023

Economic Impact Assessment for the Proposed Supplemental Federal "Good Neighbor Plan" Requirements for the 2015 8-hour Ozone National Ambient Air Quality Standard

U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Health and Environmental Impacts Division
Research Triangle Park, NC

CONTACT INFORMATION

This document has been prepared by staff from the Office of Air and Radiation, U.S. Environmental Protection Agency. Questions related to this document should be addressed to the Air Economics Group in the Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Office of Air and Radiation, Research Triangle Park, North Carolina 27711 (email: OAQPSeconomics@epa.gov).

ACKNOWLEDGEMENTS

In addition to U.S. EPA staff from the Office of Air and Radiation, personnel from the Office of Atmospheric Programs contributed data and analysis to this document.

TABLE OF CONTENTS

LIST OF TABLES

1 INTRODUCTION

Pursuant to the federal Clean Air Act (CAA), the Environmental Protection Agency (EPA) is proposing to disapprove State Implementation Plan (SIP) submittals from Arizona, New Mexico, and Tennessee regarding interstate transport for the 2015 8-hour ozone national ambient air quality standards (NAAQS). The EPA is also proposing Federal Implementation Plan (FIP) requirements to address five states' (Arizona, Iowa, Kansas, New Mexico, and Tennessee) obligations to eliminate significant contribution to nonattainment, or interference with maintenance, of the 2015 ozone NAAQS in downwind states.[1] The FIP would establish nitrogen oxides (NO_x) emissions budgets requiring fossil fuel-fired power plants in five states to participate in an allowance-based ozone season trading program beginning in 2025. The Agency is also proposing to establish NO_x emissions limitations applicable to certain other industrial stationary sources in Arizona with the earliest possible compliance date of 2027. Under CAA section 301(d)(4), the EPA is also proposing to extend the FIP requirements to apply in Indian country located within the upwind geography of a final action on this proposal, including Indian reservation lands and other areas of Indian country over which the EPA or a tribe has demonstrated that a tribe has jurisdiction. This document presents the Economic Impact Assessment (EIA) for the five states covered under this proposed FIP.

The EPA is proposing to implement the necessary EGU emissions reductions as follows. The proposed FIP requirements establish ozone season NO_X emissions budgets for electricity generating units (EGUs) in Arizona, Iowa, Kansas, New Mexico, and Tennessee and require EGUs in these states to participate in the revised version of the Cross-State Air Pollution Rule (CSAPR) NO_X Ozone Season Group 3 Trading Program established in the March 2023 (88 FR 36654 (June 5, 2023)) final Federal "Good Neighbor Plan" for the 2015 Ozone National Ambient Air Quality Standards (final GNP Rule).[2] For states currently covered by the CSAPR NO_X Ozone Season Group 2 Trading Program under SIPs or FIPs (Iowa, Kansas, Tennessee),

[1] In 2022, the EPA approved SIP submissions from Iowa and Kansas for the 2015 ozone NAAQS, which in part addressed the good neighbor provision at CAA section 110(a)(2)(D)(i)(I). Based on updated air quality modeling and definition of a maintenance receptor, both Iowa and Kansas are projected to contribute more than 1 percent of the NAAQS to downwind receptors, leading to an error correction and inclusion in the FIP for these two states. 87 FR 22463 (April 15, 2022) (Iowa) 87 FR 19390 (April 4, 2022) (Kansas)

[2] Although signed on March 15, 2023, it was published in the Federal Register on June 5, 2023 (88 FR 36654; June 5, 2023). Information about the rule was available starting on March 15, 2023, on the following website -- https://www.epa.gov/csapr/good-neighbor-plan-2015-ozone-naaqs.

the EPA is amending existing FIPs to transition EGU sources in these states from the Group 2 program to the revised Group 3 Trading Program, beginning with the 2025 ozone season. The EPA is proposing to issue new FIPs for Arizona and New Mexico, which are not currently covered by any CSAPR NO_X ozone season trading program.

In the final GNP Rule, the EPA identified and finalized FIPs for 23 states with emissions that significantly contribute to nonattainment or interfere with maintenance of the 2015 ozone NAAQS in other states. The EPA used a unified set of nationwide air quality modeling, air quality monitoring data, and technical analysis of emissions control opportunities in defining good neighbor obligations for all states covered in the final GNP Rule. Consistent with the application of the EPA's 4-step interstate transport framework in prior good neighbor rules like CSAPR, the EPA applied emissions control requirements on a uniform basis across those states based on that record.

The EPA is proposing to extend the coverage of the final GNP Rule to the five additional states based on this same set of data and analysis. Just as the final GNP Rule requirements were applied across the entire 23-state region, there is nothing unique among the five additional states that would warrant an approach other than extending the final GNP Rule's requirements to include these states. These five states were not addressed in the final GNP Rule because the EPA was not in a position as a procedural matter to take final rulemaking action to disapprove SIPs or promulgate FIPs for these states at that time. To maintain consistency across all states and ensure that the allocation of responsibility for eliminating states' significant contribution and interference with maintenance of the NAAQS in other states is done on an equitable basis, the EPA is not conducting new analysis within its 4-step interstate transport framework and is applying in this proposal the nationwide findings and determinations contained in the final GNP Rule. In this proposal the EPA is applying to these five states its air quality modeling and contribution information for the analytical years 2023 and 2026 at Steps 1 and 2 of the 4-step interstate transport framework, its analysis of emissions control opportunities and determinations of stringency for EGUs and non-EGUs, including overcontrol analysis, at Step 3, and its implementation programs at Step 4.

1.1 States Included in the Proposal

The EPA is supplementing the final GNP Rule by proposing to find that emissions reductions are required from EGU and non-EGU sources in additional states, including Arizona, Iowa, Kansas, New Mexico, and Tennessee. The EPA will propose to ensure that these NO_X emissions reductions are achieved by issuing FIP requirements for these five states. The EPA is establishing control stringency levels reflecting installation of state-of-the-art combustion controls on certain covered EGU sources in emissions budgets beginning in the 2025 ozone season. The EPA is establishing control stringency levels reflecting installation of new SCR or SNCR controls on certain covered EGU sources in emissions budgets beginning in the 2027 ozone season and phasing in over two years, i.e., 2027 and 2028. Consistent with the emissions limitations established for non-EGU sources in the final GNP Rule, this proposed supplemental action proposes to establish emissions limitations for non-EGU sources in Arizona with the earliest possible compliance date of 2027.

1.2 Air Quality Modeling Linkages

For the proposed *Federal Implementation Plan Addressing Regional Ozone Transport for the 2015 Ozone National Ambient Air Quality Standards*, the EPA performed air quality modeling using the 2016v2 emissions to provide projections of ozone design values and contributions in 2023 and 2026 that reflect the effects on air quality of the 2016v2 emissions platform. The EPA invited and received comments on the 2016v2 emissions inventories and modeling used to support proposals, including the EPA's previous proposals on Arizona and Tennesse, and the EPA's final action on Iowa and Kansas, related to interstate transport under the 2015 ozone NAAQS. In response to these comments, the EPA made a number of updates to the 2016v2 inventories and model design to construct a 2016v3 emissions platform, which was used to update the air quality modeling.

The EPA used this updated modeling to inform the final GNP Rule, and in that rulemaking provided an explanation of the adjustments and other modifications made to construct the 2016v3 platform. Details on the 2016v3 air quality modeling and the methods for projecting design values and determining contributions in 2023 and 2026 are described in the TSD titled "Air Quality Modeling Final Rule TSD – 2015 Ozone NAAQS Good Neighbor

Plan".[3] Additional details related to the updated 2016v3 emissions platform are described in the TSD titled "Preparation of Emissions Inventories for the 2016v3 North American Emissions Modeling Platform."[4]

In this proposed rulemaking, for Steps 1 and 2 of the 4-step interstate transport framework, the EPA primarily relies on modeling based on the updated 2016v3 emissions platform. By using the updated modeling results, the EPA is using the most current and technically appropriate information for this proposed rulemaking.

A summary of the methodology and results of the 2016v3 modeling of 2023, along with the application of the EPA's Step 1 and Step 2 methodology for identifying receptors and upwind states that contribute to those receptors can be found in the Air Quality Modeling Final Rule TSD – 2015 Ozone NAAQS Good Neighbor Plan. The document also contains explanations on how current measured ozone levels based on data for 2021 and 2022 at other monitoring sites (i.e., monitoring sites that are not projected to be receptors in 2023 based on air quality modeling) confirm the likely continuation of elevated ozone levels in 2023 at these locations and confirm that nearly all upwind states in this proposed action are also linked above 1 percent of the NAAQS to one or more of these monitors. The EPA conducted additional analysis for 2026 to ensure a complete Step 3 analysis for future ozone transport contributions to downwind areas. The EPA analyzed 2026 to determine whether any additional emissions reductions that are impossible to obtain by the 2024 attainment date could still be necessary to fully address significant contribution.

1.3 Baseline and Analysis Period

To develop and evaluate control strategies for addressing the transport obligations, it is important to first establish a baseline projection of air quality in the air quality analysis years of 2023 and 2026 taking into account currently on-the-books Federal regulations, enforcement actions, state regulations, population, expected electricity demand growth, and where possible, economic growth. Establishing this baseline projection for the analysis allows us to estimate the

[3] Available in the docket here: EPA-HQ-OAR-2021-0668-1157.
[4] Available in the docket here: EPA-HQ-OAR-2021-0668-1000.

incremental costs and benefits of the additional emissions reductions that will be achieved by this proposed rule.[5]

The analysis in this EIA focuses on benefits, costs, and certain impacts of extending the policy finalized in the final GNP Rule to the five additional states from 2025 through 2044. While the air quality analysis year is 2023, given the timing of this proposal we present results for 2025 because it reflects the timing for installation of state-of-the-art combustion controls on certain covered EGU sources in emissions budgets beginning in the 2025 ozone season. Similarly, given the timing of this proposal, we present results for 2028 because this reflects (i) installation of new SCR or SNCR controls on certain covered EGU sources in emissions budgets beginning in the 2027 ozone season and phased in over two years, i.e., 2027 and 2028, and (ii) the date by which we expect non-EGU controls to be fully installed. Costs, benefits, and other impacts from compliance strategies are likely to persist beyond 2028, and the EIA provides costs and benefits through 2044.

[5] In the modeling in support of the Regulatory Impact Analysis (RIA) for the final GNP Rule, the baseline did not include the impacts of the Inflation Reduction Act (IRA) due to time limitations. However, the RIA did include an appendix that captured the impacts of the IRA on the baseline and policy scenarios. The baseline for this EIA includes the impacts of the IRA.

2 INDUSTRY SUMMARY

This section briefly describes types of existing power-sector sources affected by the regulation and provides background on the power sector and electricity generating units (EGUs). In addition, this section also briefly describes the relevant non-EGU industries included in the proposed supplemental rule. For a complete discussion of the industries please see Chapter 2 of the March 2023 final *Regulatory Impact Analysis for Final Federal Good Neighbor Plan Addressing Regional Ozone Transport for the 2015 Ozone National Ambient Air Quality Standard* (Final GNP RIA).[6]

2.1 EGU

Chapter 2, Section 2.2 of the Final GNP RIA discusses the power sector covered by the final GNP Rule. In the past decade there have been significant structural changes in both the mix of generating capacity and in the share of electricity generation supplied by different types of generation. These changes are the result of multiple factors in the power sector, including normal replacements of older generating units with new units, changes in the electricity intensity of the U.S. economy, growth and regional changes in the U.S. population, technological improvements in electricity generation from both existing and new units, changes in the prices and availability of different fuels, and substantial growth in electricity generation by renewable and unconventional methods. Many of these trends will continue to contribute to the evolution of the power sector. The evolving economics of the power sector, specifically the increased natural gas supply and subsequent relatively low natural gas prices, have resulted in more natural gas being used as base load energy in addition to supplying electricity during peak load. Additionally rapid growth in the penetration of renewables has led to their now constituting a significant share of generation.

2.2 Non-EGUs

Chapter 2, Section 2.4 of the Final GNP RIA discusses the industries covered by the final GNP Rule. For this proposed supplemental rule, the EPA estimated that the Pipeline

[6] Available in the docket for the rulemaking here: https://www.regulations.gov/document/EPA-HQ-OAR-2021-0668-1115.

Transportation of Natural Gas industry would have existing emissions units (reciprocating internal combustion engines) subject to the proposed emissions limits.

This industry includes the storage of natural gas because the storage is usually done by the pipeline establishment and because a pipeline is inherently a network in which all the nodes are interdependent. U.S. Census data for the Pipeline Transportation of Natural Gas industry (North American Industry Classification System [NAICS] 486210) provides an initial overview of aggregated industry expenditures on these inputs (Census Bureau, 2021). In 2019, the total value of shipments was $27.6 billion, annual payroll totaled $3.3 billion, and the industry included 27,294 employees.

3 EMISSIONS REDUCTIONS AND COMPLIANCE COSTS

This section reports the EGU, and non-EGU emissions and compliance costs analyses performed for this proposal, in which the EPA is supplementing the final GNP Rule and proposing that emissions reductions are required from EGU and non-EGU sources in the five additional states.

3.1 EGUs

The EPA used the Integrated Planning Model (IPM)[7] to conduct the electricity generating units (EGU) analysis discussed in this section. As explained in detail below, this section presents analysis for the regulatory controls that limit EGU nitrogen oxides (NO_X) ozone season emissions budgets in the five additional states subject to this action beginning in 2025. The budget levels are calculated assuming the application of different NO_X mitigation technologies. The analysis for EGUs in the section includes effects from certain provisions of the Inflation Reduction Act (IRA) of 2022 in the baseline.

3.1.1 Regulatory Policy Evaluated

This proposal establishes NO_X emissions budgets requiring fossil fuel-fired EGUs in five additional states (Arizona, Iowa, Kansas, Tennessee, and New Mexico) to participate in an allowance-based ozone season (May 1 through September 30) trading program beginning in 2025. The EGUs covered by the FIPs and subject to the budget are fossil-fired EGUs with >25-megawatt (MW) capacity. Table 3-1 below outlines the control technologies assumed for each of the five states subject to this action. For details on the derivation of these budgets, please see Section V.C. of the preamble.

Table 3-1. Regulatory Controls Evaluated for EGUs

Proposed Rule	NO_X Controls Implemented for EGUs within IPM[a, b]
1)	2025 onwards: Fully operate existing selective catalytic reduction (SCRs) during ozone season
2)	2025 onwards: Fully operate existing selective non-catalytic reduction (SNCRs) during ozone season
3)	In 2025 install state-of-the-art combustion controls[c]
4)	In 2028 model run year, impose Engineering Analysis derived emissions budgets that assume installation of SCR controls on coal units greater than 100 MW within Arizona that lack SCR controls
5)	In 2030 model run year, impose backstop emission rate on coal units greater than 100 MW within Arizona that lack SCR controls.[d]

[a] IPM uses model years to represent the full planning horizon being modeled. By mapping multiple calendar years to a run year, the model size is kept manageable. For this analysis, IPM maps the run year 2025 to calendar years 2024-

[7] Information on IPM can be found at the following link: https://www.epa.gov/airmarkets/power-sector-modeling.

2026 and run year 2028 to calendar years 2027-2029. For model details, please see Chapter 2 of the IPM documentation.
[b] NOx mass budgets are imposed in all run years in IPM (2025-2050) consistent with the measures highlighted in this table.
[c] The proposal allows for the reductions associated with state-of-the-art combustion controls to occur by 2026. It is captured in 2025 in this analysis to fully assess the impact of the mitigation measures occuring prior to 2026.
[d] For Arizona, which has EGU obligations that are linked in 2026, the EPA is determining that the selected EGU control stringency also includes emissions reductions commensurate with the retrofit of SCR at coal steam-fired units of 100 MW or greater capacity.

The illustrative emission budgets in this EIA represent EGU NO_X ozone season emission budgets for each state in 2025 and in 2026.[8] The emission budgets for Iowa, Kansas, New Mexico, and Tennessee were developed using uniform control stringency represented by $1,800 per ton of NO_x (2016$) in 2025 (i.e., optimizing existing controls and installation of state-of-the-art combustion controls). The emission budgets for 2028 for Arizona were developed using a uniform control stringency represented by $11,000 per ton of NO_x (2016$) in 2027 (i.e., installation of SCR and SNCR post-combustion controls). The backstop emission rate was imposed in Arizona in the 2030 run year on all coal units that are greater than 100 MW and lack SCR controls (except circulating fluidized bed (CFB) units).

Table 3-2 reports the illustrative EGU NO_X ozone season emission budgets that are evaluated in this EIA for the 2025 – 2030 IPM run years; note the additional five states are presented in the bottom rows of the table. As described above, starting in 2023, IPM is constrained to disallow emissions from affected EGUs in 22 states subject to the final GNP Rule to exceed the sum of emissions budgets but for the ability to use banked allowances from previous years for compliance. In run year 2025, the five additional states are also added to the program. For individual states, IPM is constrained to disallow emissions from exceeding 121% of the state emission budget (the assurance levels). In the IPM modeling, no further reductions in budgets occur after 2030, and budgets remain in place for future years.[9] These budgets are imposed in addition to the control measures outlined in Table 3-1.

[8] Mapping each year in the analysis time period to a representative model run year enables IPM to perform multiple year analyses while keeping the model size manageable. IPM considers the costs in all years in the planning horizon while reporting results only for model run years. Run year 2025 is mapped to 2024-26, run year 2028 is mapped to 2027-29, run year 2030 is mapped to 2030-31, run year 2035 is mapped to 2032-37, run year 2040 is mapped to 2038-42, while run year 2045 is mapped to 2043-47.
[9] In 2030 onwards, dynamic budgets may cause the budgets to decrease. While the EPA does not model this feature, the assumption of continued optimization of existing controls approximates compliance behavior and associated costs that would result from dynamic budgets.

Table 3-2. Illustrative NO_X Ozone Season Emission Budgets (Tons) Evaluated by IPM Run Year

Region	Proposed Rule			
	2023	2025	2028	2030
Alabama	6,595	6,236	6,236	4,610
Arkansas	8,927	4,031	4,031	3,582
Illinois	7,474	5,363	4,555	4,050
Indiana	12,440	8,633	8,633	6,307
Kentucky	13,204	7,862	7,862	7,679
Louisiana	9,311	3,864	2,969	2,969
Maryland	1,206	592	592	592
Michigan	10,275	5,997	5,997	5,691
Minnesota	5,504	2,905	2,905	1,663
Mississippi	5,024	1,859	1,527	1,527
Missouri	12,598	7,329	7,329	6,770
Nevada	2,391	1,051	1,051	818
New Jersey	768	768	768	768
New York	3,858	3,333	3,333	3,333
Ohio	9,134	7,953	6,934	6,399
Oklahoma	10,271	3,842	3,842	3,842
Pennsylvania	8,918	7,146	7,146	4,816
Texas	40,294	22,964	22,407	21,631
Utah	15,755	2,604	2,604	2,604
Virginia	3,065	2,373	2,373	1,951
West Virginia	13,306	9,678	9,678	9,678
Wisconsin	6,295	3,407	3,407	3,407
Arizona	**N/A**	**3,152**	**3,088**	**3,088**
Iowa	**N/A**	**9,077**	**9,077**	**9,077**
Kansas	**N/A**	**4,663**	**4,663**	**4,663**
New Mexico	**N/A**	**1,998**	**1,998**	**1,998**
Tennessee	**N/A**	**2,666**	**2,131**	**1,198**
Aggregated State Emission Budgets	**206,616**	**141,345**	**137,136**	**124,711**

The state emission budgets in this EIA are illustrative for several reasons. First, they reflect an estimate of the future budget based on the EPA's preset budget methodology. However, as described in the preamble, the implemented state budget may be either the preset budget or the dynamic budget starting in 2026. As noted above, other parameters are used to capture the dynamic budget impacts in this modeling, as the future heat input needed to derive that budget number is not yet known. Second, the budgets are illustrative as the utilized 2025 preset budgets reflect full implementation of existing control optimization and upgrade to state-of-the-art combustion control potential. However, the proposed rule state emission budgets and implementation allows the limited number of reductions related to state-of-the-art combustion control to be realized up through 2026.

3.1.2 Methods for Estimating Emissions Reductions and Costs

On April 6, 2022, the EPA proposed the *Federal Implementation Plan Addressing Regional Ozone Transport for the 2015 Ozone National Ambient Air Quality Standards*,[10] and on March 15, 2023 (88 FR 36654 (June 5, 2023)), the EPA finalized the *Federal Good Neighbor Plan Requirements for the 2015 8-hour Ozone National Ambient Air Quality Standards*.[11] EPA relied on an analytical framework incorporating IPM model outputs to evaluate the EGU cost and emissions impacts of the final GNP Rule. This EIA relies on the version of IPM that was used to evaluate the impact of the Inflation Reduction Act on the final GNP Rule, as outlined in Appendix 4a of the Final GNP RIA.[12] The baseline used for this analysis therefore captures the impacts of the IRA as well as the final GNP Rule.

The EPA has used IPM for almost three decades to better understand power sector behavior under future business-as-usual conditions and to evaluate the economic and emissions impacts of prospective environmental policies. The model is designed to reflect electricity markets as accurately as possible. The EPA uses the best available information from utilities, industry experts, gas and coal market experts, financial institutions, and government statistics as the basis for the detailed power sector modeling in IPM. The model documentation provides additional information on the assumptions discussed here as well as all other model assumptions and inputs.[13]

---

[10] https://www.govinfo.gov/content/pkg/FR-2022-04-06/pdf/2022-04551.pdf

[11] https://www.govinfo.gov/content/pkg/FR-2023-06-05/pdf/2023-05744.pdf

[12] For details of the framework used to evaluate the EGU compliance costs and emissions outcomes of the rulemakings, please see Chapter 4 and Appendix 4a of the Final GNP RIA, available at: https://www.epa.gov/system/files/documents/2023-03/SAN%208670%20Federal%20Good%20Neighbor%20Plan%2020230315%20RIA_Final.pdf

[13] Detailed information and documentation of EPA's Baseline run using IPM (v6), including all the underlying assumptions, data sources, and architecture parameters can be found on EPA's website at: https://www.epa.gov/airmarkets/documentation-epas-power-sector-modeling-platform-v6-summer-2021-reference-case.

3.1.3 Emissions Reductions and Compliance Cost Assessment for EGUs

The estimates of incremental costs of supplying electricity for the proposed rule are detailed in Table 3-3. Since the proposed rule generally does not result in significant additional recordkeeping, monitoring, or reporting requirements for EGUs, the costs associated with monitoring, recordkeeping, or reporting requirements are not included within the estimates in this table.

As indicated earlier, the compliance cost estimates are presented in this EIA from 2025 through 2044 and are based on IPM projections.[14] Table 3-3 presents the estimated annual compliance costs, the net present value of these costs over the 2025-44 period, as well as the annualized costs over the 2025-44 period using a 3.75% discount rate. As presented in Table 3-3, projected EGU compliance costs peak at $3.4 million (2016$) in the 2028 run year, consistent with the full tightening of budgets. Compliance costs decline thereafter as budgets do not further tighten, and conditions are more consistent with baseline outcomes.

Table 3-3. National Power Sector Compliance Cost Estimates (millions of 2016$) for the Proposed Rule

	Proposed Rule
2025-2044 (Net Present Value)	$17
2025-2044 (Annualized)	$1.2
2025 (Annual)	$1.0
2026 (Annual)	$1.0
2027 (Annual)	$3.4
2028 (Annual)	$3.4
2029 (Annual)	$3.4
2030 (Annual)	$0.7
2035 (Annual)	$0.7
2040 (Annual)	$0.3
2044 (Annual)	$0.7

"2025-2044 (Net Present Value)" reflects the net present value of the total estimated annual compliance costs levelized over the period 2025 through 2044 and discounted using a 3.75 real discount rate.[15] This does not include compliance costs beyond 2044. "2025-2044 (Annualized)" reflects total estimated annual compliance costs levelized over the period 2025 through 2044 and discounted using a 3.75 real discount rate. This does not include compliance

[14] For more information, please see Chapter 2 of the IPM documentation.

[15] This table reports compliance costs consistent with expected electricity sector economic conditions. An NPV of costs was calculated using a 3.75% real discount rate consistent with the rate used in IPM's objective function for cost-minimization. The NPV of costs was then used to calculate the levelized annual value over a 20-year period (2025-2044).

costs beyond 2044. "2025 (Annual)" through "2044 (Annual)" costs reflect annual estimates in each of those years.[16] The change in production costs is reflective of the costs borne by the power sector to meet the requirements of the proposed rule after netting out the tax incentives in the Inflation Reduction Act. However, the production cost changes do not equal social costs because they do not include a complete accounting of transfers (e.g., taxes paid by the power sector), the tax incentives provided by the Inflation Reduction Act, and effects in other sectors of the economy.

The EPA estimated the change in the retail price of electricity (2016$) using the Retail Price Model (RPM).[17] The RPM was developed by ICF for the EPA and uses the IPM estimates of changes in the cost of generating electricity to estimate the changes in average retail electricity prices. The prices are average prices over consumer classes (i.e., consumer, commercial, and industrial) and regions, weighted by the amount of electricity used by each class and in each region. The RPM combines the IPM annual cost estimates in each of the 64 IPM regions with EIA electricity market data for each of the 25 electricity supply regions in the electricity market module of the National Energy Modeling System (NEMS).[18]

Table 3-4, Table 3-5, and Table 3-6 present the projected percentage changes in the retail price of electricity for the regulatory control alternative in 2025, 2028, and 2030, respectively. Consistent with other projected impacts presented above, impacts on average retail electricity prices at both the national and regional level are projected to be small.

[16] Cost estimates include financing charges on capital expenditures that would reflect a transfer and would not typically be considered part of total social costs.
[17] See documentation available at: https://www.epa.gov/airmarkets/retail-price-model
[18] See documentation available at: https://www.eia.gov/outlooks/aeo/nems/documentation/electricity/pdf/m068(2020).pdf

Table 3-4. Average Retail Electricity Price by Region for the Baseline and the Regulatory Control Alternative, 2025

All Sector	2025 Average Retail Electricity Price (2016 mills/kWh)		Percent Change from Baseline
Region	**Baseline**	**Proposed Rule**	**Proposed Rule**
TRE	79.0	79.0	0.0%
FRCC	97.0	97.0	0.0%
MISW	94.1	94.1	0.0%
MISC	88.3	88.3	0.0%
MISE	94.1	94.1	0.0%
MISS	79.0	79.0	0.0%
ISNE	138.7	138.7	0.0%
NYCW	181.6	181.6	0.0%
NYUP	117.1	117.1	0.0%
PJME	109.8	109.8	0.0%
PJMW	86.0	86.0	0.0%
PJMC	77.8	77.8	0.0%
PJMD	67.5	67.5	0.0%
SRCA	91.3	91.3	0.0%
SRSE	94.4	94.4	0.0%
SRCE	69.8	69.8	0.0%
SPPS	78.4	78.4	0.0%
SPPC	100.8	100.8	0.0%
SPPN	62.9	62.9	0.0%
SRSG	96.9	96.9	0.0%
CANO	152.8	152.8	0.0%
CASO	183.7	183.7	0.0%
NWPP	72.1	72.1	0.0%
RMRG	89.8	89.8	0.0%
BASN	85.7	85.7	0.0%
NATIONAL	96.1	96.1	0.0%

Table 3-5. Average Retail Electricity Price by Region for the Baseline and the Regulatory Control Alternative, 2028

All Sector	2028 Average Retail Electricity Price (2016 mills/kWh)		Percent Change from Baseline
Region	**Baseline**	**Proposed Rule**	**Proposed Rule**
TRE	74.1	74.1	0.0%
FRCC	90.0	90.0	0.0%
MISW	90.4	90.4	0.0%
MISC	85.0	85.0	0.0%
MISE	95.9	95.9	0.0%
MISS	74.5	74.5	0.0%
ISNE	129.9	129.9	0.0%
NYCW	179.9	179.9	0.0%
NYUP	113.9	113.9	0.0%
PJME	100.8	100.8	0.0%
PJMW	84.6	84.6	0.0%
PJMC	73.0	73.0	0.0%
PJMD	68.2	68.2	0.0%
SRCA	87.1	87.1	0.0%
SRSE	88.2	88.2	0.0%
SRCE	66.3	66.3	0.0%
SPPS	75.1	75.1	0.0%
SPPC	97.1	97.1	0.0%
SPPN	63.9	63.9	0.0%
SRSG	90.2	90.2	0.0%
CANO	153.8	153.8	0.0%
CASO	185.7	185.7	0.0%
NWPP	70.0	70.0	0.0%
RMRG	83.8	83.8	0.0%
BASN	81.9	81.9	0.0%
NATIONAL	92.1	92.1	0.0%

Table 3-6. Average Retail Electricity Price by Region for the Baseline and the Regulatory Control Alternative, 2030

All Sector	2030 Average Retail Electricity Price (2016 mills/kWh)		Percent Change from Baseline
Region	**Baseline**	**Proposed Rule**	**Proposed Rule**
TRE	78.8	78.8	0.0%
FRCC	90.7	90.7	0.0%
MISW	87.8	87.8	0.0%
MISC	83.7	83.7	0.0%
MISE	83.5	83.5	0.0%
MISS	74.3	74.3	0.0%
ISNE	137.0	137.0	0.0%
NYCW	182.0	182.0	0.0%
NYUP	109.0	109.0	0.0%
PJME	101.4	101.4	0.0%
PJMW	86.2	86.2	0.0%
PJMC	80.3	80.3	0.0%
PJMD	68.6	68.6	0.0%
SRCA	86.7	86.7	0.0%
SRSE	87.3	87.3	0.0%
SRCE	65.2	65.2	0.0%
SPPS	72.4	72.4	0.0%
SPPC	90.5	90.5	0.0%
SPPN	62.0	62.5	0.9%
SRSG	89.0	89.0	0.0%
CANO	161.0	161.0	0.0%
CASO	188.4	188.4	0.0%
NWPP	70.5	70.5	0.0%
RMRG	82.6	82.6	0.0%
BASN	80.6	80.6	0.0%
NATIONAL	92.3	92.3	0.0%

As indicated earlier, the NO_X emissions reductions are presented in this EIA from 2025 through 2044 and are based on IPM projections. IPM is operating existing and newly installed controls seasonally based on historical operation patterns and seasonal and annual emission constraints within the model. Table 3-7 presents the estimated reduction in power sector ozone season NO_X emissions resulting from compliance with the proposed rule in the five additional states, as well as the impact on other states.

Table 3-7. EGU Ozone Season NO_X Emissions and Emissions Changes (tons) for the Baseline run and Proposed Rule from 2025 - 2044

Ozone Season NO_X		Total Emissions		Change from Baseline run
(Tons)		Baseline	Proposal	
2025	5 States	23,701	22,243	-1,458
	Other States	234,186	234,186	0
	Nationwide	257,887	256,428	-1,459
2026	5 States	23,701	22,243	-1,458
	Other States	234,186	234,186	0
	Nationwide	257,887	256,428	-1,459
2027	5 States	18,270	17,012	-1,258
	Other States	189,571	189,583	12
	Nationwide	207,840	206,595	-1,245
2028	5 States	18,270	17,012	-1,258
	Other States	189,571	189,583	12
	Nationwide	207,840	206,595	-1,245
2029	5 States	18,270	17,012	-1,258
	Other States	189,571	189,583	12
	Nationwide	207,840	206,595	-1,245
2030	5 States	16,184	15,427	-756
	Other States	150,909	150,910	0
	Nationwide	167,093	166,337	-756
2035	5 States	5,967	5,453	-513
	Other States	94,061	94,053	-8
	Nationwide	100,028	99,506	-521
2040	5 States	5,623	4,901	-722
	Other States	77,971	78,010	39
	Nationwide	83,594	82,910	-683
2044	5 States	5,271	4,549	-722
	Other States	71,506	71,506	0
	Nationwide	76,778	76,055	-722

In addition to the ozone season NO_X reductions, there will also be reductions of other air emissions associated with EGUs burning fossil fuels (i.e., co-pollutants) that result from compliance strategies to reduce seasonal NOx emissions. These include the annual total changes in emissions of NOx, SO_2, CO_2, and direct $PM_{2.5}$ emissions. The emissions reductions are presented in Table 3-8 below.

Table 3-8. EGU Annual Emissions and Emissions Changes for Annual NO_X, SO_2, $PM_{2.5}$, and CO_2) for the Baseline run and Proposed Rule from 2025 – 2044

Annual NO_X		Total Emissions		Change from Baseline run
(Tons)		Baseline	Proposal	
2025	5 States	47,758	46,237	-1,521
	Other States	583,583	583,577	-6
	Nationwide	631,341	629,814	-1,527
2026	5 States	47,758	46,237	-1,521
	Other States	583,583	583,577	-6
	Nationwide	631,341	629,814	-1,527
2027	5 States	38,969	37,647	-1,322
	Other States	453,214	453,228	14
	Nationwide	492,183	490,875	-1,308
2028	5 States	38,969	37,647	-1,322
	Other States	453,214	453,228	14
	Nationwide	492,183	490,875	-1,308
2029	5 States	38,969	37,647	-1,322
	Other States	453,214	453,228	14
	Nationwide	492,183	490,875	-1,308
2030	5 States	34,078	33,294	-784
	Other States	351,489	351,507	18
	Nationwide	385,567	384,801	-766
2035	5 States	13,230	12,716	-513
	Other States	199,631	199,628	-4
	Nationwide	212,861	212,344	-517
2040	5 States	8,370	7,648	-722
	Other States	158,504	158,545	41
	Nationwide	166,874	166,193	-682
2044	5 States	6,813	6,091	-722
	Other States	140,729	140,729	0
	Nationwide	147,543	146,820	-722

Annual SO_2		Total Emissions		Change from Baseline run
(Tons)		Baseline	Proposal	
2025	5 States	33,535	33,533	-2
	Other States	776,891	776,434	-457
	Nationwide	810,426	809,967	-459
2026	5 States	33,535	33,533	-2
	Other States	776,891	776,434	-457
	Nationwide	810,426	809,967	-459
2027	5 States	23,648	23,645	-3
	Other States	431,802	431,810	8

	Nationwide	455,450	455,455	5
2028	5 States	23,648	23,645	-3
	Other States	431,802	431,810	8
	Nationwide	455,450	455,455	5
2029	5 States	23,648	23,645	-3
	Other States	431,802	431,810	8
	Nationwide	455,450	455,455	5
2030	5 States	20,414	20,411	-3
	Other States	265,782	265,783	1
	Nationwide	286,196	286,194	-2
2035	5 States	4,107	4,107	0
	Other States	107,014	107,013	-2
	Nationwide	111,121	111,119	-2
2040	5 States	3,010	3,010	0
	Other States	75,111	75,113	2
	Nationwide	78,121	78,123	2
2044	5 States	1,908	1,908	0
	Other States	53,665	53,665	0
	Nationwide	55,573	55,573	0

Annual $PM_{2.5}$		**Total Emissions**		**Change from Baseline run**
(Tons)		**Baseline**	**Proposal**	
2025	5 States	6,594	6,591	-3
	Other States	75,414	75,411	-3
	Nationwide	82,008	82,002	-6
2026	5 States	6,594	6,591	-3
	Other States	75,414	75,411	-3
	Nationwide	82,008	82,002	-6
2027	5 States	5,675	5,671	-5
	Other States	67,607	67,611	4
	Nationwide	73,282	73,282	-1
2028	5 States	5,675	5,671	-5
	Other States	67,607	67,611	4
	Nationwide	73,282	73,282	-1
2029	5 States	5,675	5,671	-5
	Other States	67,607	67,611	4
	Nationwide	73,282	73,282	-1
2030	5 States	5,182	5,179	-4
	Other States	59,919	59,920	1
	Nationwide	65,101	65,099	-2
2035	5 States	1,753	1,753	0
	Other States	43,312	43,309	-3

	Nationwide	45,065	45,062	-3
	5 States	1,304	1,304	0
2040	Other States	38,320	38,324	4
	Nationwide	39,624	39,628	4
	5 States	1,266	1,266	0
2044	Other States	36,921	36,921	0
	Nationwide	38,187	38,187	0

Annual CO_2		Total Emissions		Change from Baseline run
(Thousand short tons)		Baseline	Proposal	
	5 States	107,778	107,762	-15
2025	Other States	1,368,872	1,368,848	-24
	Nationwide	1,476,650	1,476,611	-39
	5 States	107,778	107,762	-15
2026	Other States	1,368,872	1,368,848	-24
	Nationwide	1,476,650	1,476,611	-39
	5 States	95,787	95,765	-21
2027	Other States	1,194,825	1,194,818	-7
	Nationwide	1,290,611	1,290,583	-28
	5 States	95,787	95,765	-21
2028	Other States	1,194,825	1,194,818	-7
	Nationwide	1,290,611	1,290,583	-28
	5 States	95,787	95,765	-21
2029	Other States	1,194,825	1,194,818	-7
	Nationwide	1,290,611	1,290,583	-28
	5 States	87,596	87,564	-33
2030	Other States	1,023,383	1,023,386	2
	Nationwide	1,110,980	1,110,950	-30
	5 States	36,078	36,078	0
2035	Other States	667,318	667,320	2
	Nationwide	703,395	703,397	2
	5 States	26,813	26,813	0
2040	Other States	582,723	582,727	4
	Nationwide	609,536	609,540	4
	5 States	25,965	25,965	0
2044	Other States	560,592	560,593	0
	Nationwide	586,557	586,557	0

3.2 Non-EGUs

On April 6, 2022, the EPA proposed the *Federal Implementation Plan Addressing Regional Ozone Transport for the 2015 Ozone National Ambient Air Quality Standards*,[19] and on March 15, 2023 (88 FR 36654 (June 5, 2023)), the EPA finalized the *Federal Good Neighbor Plan Requirements for the 2015 8-hour Ozone National Ambient Air Quality Standards*.[20] For the April 6, 2022 proposal, the EPA developed an analytical framework to facilitate decisions about industries and emissions unit types for including emissions units in the non-electric generating unit "sector" (non-EGUs) in a proposed Federal Implementation Plan (FIP) for the 2015 ozone national ambient air quality standards (NAAQS) transport obligations. A February 28, 2022 memorandum documents the analytical framework that the EPA used to identify industries and emissions unit types included in the above proposed and final actions.[21] In addition, for the March 15, 2023 (88 FR 36654 (June 5, 2023)) final GNP Rule, the EPA prepared a memorandum summarizing the emissions unit types, applicability criteria, emissions limits, estimated number of emissions units captured by the applicability criteria, and estimated emissions reductions and costs for the year 2026.[22]

As discussed in Section 1.1, in this action the EPA is proposing FIP requirements to address five additional states' transport obligations for the 2015 ozone NAAQS. This proposed FIP establishes emissions limitations for the industries and emissions unit types included in the final GNP Rule for existing and new sources in Arizona, with the earliest possible compliance date of 2027.

3.2.1 Methods for Estimating Emissions Reductions and Costs

For a detailed discussion of methods for estimating emissions unit types, emissions reductions, and costs, see the memorandum titled *Summary of Final Rule Applicability Criteria and Emissions Limits for Non-EGU Emissions Units, Assumed Control Technologies for Meeting*

[19] https://www.govinfo.gov/content/pkg/FR-2022-04-06/pdf/2022-04551.pdf
[20] https://www.govinfo.gov/content/pkg/FR-2023-06-05/pdf/2023-05744.pdf
[21] The memorandum titled *Screening Assessment of Potential Emissions Reductions, Air Quality Impacts, and Costs from Non-EGU Emissions Units for 2026* is available in the docket here: https://www.regulations.gov/document/EPA-HQ-OAR-2021-0668-0150.
[22] The memorandum titled *Summary of Final Rule Applicability Criteria and Emissions Limits for Non-EGU Emissions Units, Assumed Control Technologies for Meeting the Final Emissions Limits, and Estimated Emissions Units, Emissions Reductions, and Costs* is available in the docket here: https://www.regulations.gov/document/EPA-HQ-OAR-2021-0668-0956.

the Final Emissions Limits, and Estimated Emissions Units, Emissions Reductions, and Costs.[23] Based on the review of RACT, NSPS, NESHAP rules, as well as SIPs, consent decrees, and permits, as in the final GNP Rule the EPA assumed certain control technologies could meet the proposed emissions limits.

3.2.2 Emissions Reductions and Compliance Cost Assessment for Non-EGUs

Using the list of emissions units estimated to be captured by the applicability criteria, the assumed control technologies that would meet the emissions limits, and information on control efficiencies and default cost/ton values from the control measures database,[24] the EPA estimated NO_X emissions reductions and costs for the year 2026. We estimated emissions reductions using the actual emissions from the 2019 emissions inventory.

In the proposed regulatory provisions that implement these emissions limits at Step 4, the EPA incorporated mechanisms that are designed to accommodate unique circumstances on a unit-specific basis, such as allowing for an extension of time to install controls or developing an alternative emissions limit where it can be established to be necessary. Given these provisions, the EPA analyzed emissions reductions for the analytic year of 2026 with the earliest possible compliance date of 2027 and full compliance expected by the 2028 ozone season. Because we assume the emissions reductions and costs for non-EGUs are the same each year over the analysis period, we present results for non-EGU emissions reductions and costs starting in 2028. The EPA did not estimate emissions reductions of SO_2, $PM_{2.5}$, CO_2 and other pollutants that may be associated with controls on non-EGU emissions units.

The estimates presented below using the 2019 inventory and information from the control measures database identify proxies for emissions units, as well as emissions reductions, and costs associated with the assumed control technologies that would meet the proposed emissions limits. Emissions units subject to the proposed rule emissions limits may be different than those estimated in this assessment; the estimated emissions reductions from and costs to meet the proposed rule emissions limits may be different than those estimated in this assessment. The costs do not include monitoring, recordkeeping, reporting, or testing costs.

---

[23] Available in the docket here: https://www.regulations.gov/document/EPA-HQ-OAR-2021-0668-0956.
[24] More information about the control measures database (CMDB) can be found at the following link: https://www.epa.gov/economic-and-cost-analysis-air-pollution-regulations/cost-analysis-modelstools-air-pollution.

Table 3-9 summarizes the industries, emissions unit types, assumed control technologies, estimated total annual costs, and estimated ozone season NOx emissions reductions in 2026. For additional summaries see the memorandum titled *Non-EGU Applicability Criteria and Estimated Emissions Reductions and Costs_Proposed Supplemental*.

Table 3-9. Summary of Non-EGU Industries, Emissions Unit Types, Assumed Control Technologies, Estimated Total Annual Costs (2016$), Ozone Season NOx Emissions Reductions in 2026

Industry/Industries	Emissions Unit Type	Assumed Control Technologies that Meet Proposed Emissions Limits	Annual Costs (million 2016$)	Ozone Season Emissions Reductions (tons)
Pipeline Transportation of Natural Gas	Reciprocating Internal Combustion Engine	Layered Combustion (2-cycle Lean Burn)	4.3	329

3.3 Total Emissions Reductions and Compliance Costs for EGUs and Non-EGUs

For select years between 2025 and 2044, Table 3-10 below summarizes the total annual estimated emissions reductions and compliance costs for EGUs and non-EGUs for the five states included in the proposed rule. EGU emission budgets for the 2025 and 2028 run years are derived through the operation of existing controls and the installation of state-of-the-art combustion controls, and the installation of SCR controls at large coal fired power plants that currently lack them in Arizona. As such costs peak in the 2028 run year at $3.4 million (2016$). Post 2030 modeled budgets no longer tighten (although controls are assumed to continue to operate fully) and the generation mix converges to levels consistent with the baseline, resulting in lower cost impacts. Non-EGU costs are analyzed starting in 2028 when full compliance is anticipated and remain constant over the analytic period at $4.3 million each year (2016$).

Table 3-11 below summarizes the present value (PV) and equivalent annualized value (EAV) of the total national compliance cost estimates for EGUs and non-EGUs for the proposed rule. We present the PV of the costs over the twenty-year period 2025 to 2044. We also present the EAV, which represents a flow of constant annual values that, had they occurred in each year from 2025 to 2044, would yield a sum equivalent to the PV. The EAV represents the value of a typical cost for each year of the analysis. The PV and EAV from EGUs and non-EGUs are $67 million and $4.5 million annually using a 3 percent discount rate and $45 million and $4.2 million annually using a 7 percent discount rate.

Table 3-10. Total Estimated NO_x Emissions Reductions (ozone season, thousand tons) and Compliance Costs for EGUs and non-EGUs (million 2016$), 2025-2044

	EGUs	Non-EGUs	Total	EGUs	Non-EGUs	Total
	Emissions Reductions (Ozone season, tons)			Compliance Costs (Million 2016$)		
2025	1,459	-	1,459	$1.0	-	$1.0
2026	1,459	-	1,459	$1.0	-	$1.0
2027	1,245	-	1,245	$3.4	-	$3.4
2028	1,245	329	1,574	$3.4	$4.3	$7.7
2029	1,245	329	1,574	$3.4	$4.3	$7.7
2030	756	329	1,085	$0.7	$4.3	$5.0
2035	513	329	842	$0.7	$4.3	$5.0
2040	683	329	1,012	$0.3	$4.3	$4.6
2044	722	329	1,051	$0.7	$4.3	$4.6

Note: For the EGU emission reduction and cost estimates IPM uses model years to represent the full planning horizon being modeled. For this analysis, IPM considers the costs in all years in the planning horizon while reporting results only for model run years. Run year 2025 is mapped to calendar years 2024-26, run year 2028 is mapped to calendar years 2027-29, run year 2030 is mapped to calendar years 2030-31, run year 2035 is mapped to calendar years 2032-37, run year 2040 is mapped to calendar years 2038-42, and run year 2045 is mapped to calendar years 2043-47.

Table 3-11. Total National Compliance Cost Estimates (millions of 2016$) for the Proposed Rule

	Present Value		Equivalent Annualized Value	
	3 Percent	7 Percent	3 Percent	7 Percent
EGU 2025-2044	$16	$13	$1.1	$1.2
Non-EGU 2025-2044	$50	$32	$3.4	$3.0
Total 2025-2044	**$67**	**$45**	**$4.5**	**$4.2**

3.4 Small Business Screening Assessment

For the proposed rule, the EPA performed a small entity screening analysis for impacts on all affected EGUs and non-EGU facilities by comparing compliance costs to historic revenues at the ultimate parent company level. This is known as the cost-to-revenue or cost-to-sales test, or the “sales test.” The sales test is an impact methodology the EPA employs in analyzing entity impacts as opposed to a “profits test,” in which annualized compliance costs are calculated as a share of profits. The sales test is frequently used because revenues or sales data are commonly available for entities impacted by the EPA regulations, and profits data normally made available are often not the true profit earned by firms because of accounting and tax considerations. Also, the use of a sales test for estimating small business impacts for a rulemaking is consistent with guidance offered by the EPA on compliance with the Regulatory Flexibility Act (RFA)[25] and is consistent with guidance published by the U.S. Small Business Administration's (SBA) Office of Advocacy that suggests that cost as a percentage of total revenues is a metric for evaluating cost increases on small entities in relation to increases on large entities (SBA, 2017).

Making a no SISNOSE (significant economic impacts on a substantial number of small entities) determination reflects an assessment of whether an estimated economic impact is significant and whether that impact affects a substantial number of small entities. We prepared an analysis of small entity impacts for EGUs and non-EGUs in 2028 separately and combined the 2028 results for a SISNOSE determination for the proposed rule. We used 2028 to be consistent with the year of anticipated full compliance. For a complete discussion of the methodology and data used for the small business analysis for both EGU and non-EGU facilities please see Chapter 6 of the Final GNP RIA.

For EGUs in 2028, the analysis indicates that 34 units see a +/- 1 percent change in either summer NOx emissions, summer generation or summer fuel use. Of these units, 4 units are owned by entities that are classified as small entities. None of these are projected to have a cost impact of greater than 1 percent of their revenues. Further, for the proposed supplemental action in 2028 for non-EGUs, there are six engines in Arizona estimated to be impacted by this proposal. Those six engines are owned by a single large company with $16.6 billion in revenue in 2021.

Based on this analysis, for this proposed rule overall we conclude that the estimated costs for the proposed rule will not have a significant economic impact on a substantial number of small entities (SISNOSE).

[25] The RFA compliance guidance to the EPA rule writers can be found at <https://www.epa.gov/sites/production/files/2015-06/documents/guidance-regflexact.pdf >

4 BENEFITS

The Proposed Supplemental Federal Good Neighbor Plan Addressing Regional Ozone Transport for the 2015 Ozone National Ambient Air Quality Standards is expected to reduce emissions of nitrogen oxides (NO_X) transported from states that contribute significantly to nonattainment or interfere with maintenance of the 2015 Ozone National Ambient Air Quality Standards (NAAQS) in downwind states. Implementing the proposed rule is expected to reduce emissions of NO_X, which will in turn reduce concentrations of ground-level ozone and fine particles ($PM_{2.5}$); the proposed rule is also projected to reduce sulfur dioxide (SO_2), direct $PM_{2.5}$ emissions, and carbon dioxide (CO_2) emissions from EGUs. This section reports the estimated monetized health benefits from reducing concentrations of ozone and $PM_{2.5}$ for the five additional states included in this proposed supplemental rulemaking. The section also reports the estimated monetized climate benefits from reducing CO_2 emissions from EGUs.

4.1 Estimated Human Health Benefits

This section describes the methods used to estimate the benefits to human health of reducing concentrations of ozone and $PM_{2.5}$ from affected electricity generating units (EGUs) and non-electricity generating units (non-EGUs). This analysis uses a reduced-form technique called benefit per ton to quantify benefits. The approach for quantifying the number and value of air pollution-attributable premature deaths and illnesses with the benefit per ton method is described in the Technical Support Document (TSD) titled *Estimating the Benefit per Ton of Reducing Directly-Emitted $PM_{2.5}$, $PM_{2.5}$ Precursors and Ozone Precursors from 21 Sectors* (U.S. EPA, 2023a). A second Technical Support Document titled *Estimating $PM_{2.5}$- and Ozone-Attributable Health Benefits* (U.S. EPA, 2023b) describes the rationale for selecting health endpoints to quantify; the demographic, health, and economic data used; modeling assumptions; and the techniques for quantifying uncertainty.

The procedure for calculating the benefit per ton ozone and PM_2 coefficients follows three steps:

1. Using source apportionment photochemical modeling, predict ozone concentrations resulting from VOC or summer season NOx and predict annual average ambient concentrations of primary $PM_{2.5}$, nitrate, and sulfate attributable

to each of 21 emission sectors across the Continental U.S. The source apportionment modeling for the power sector uses the 2017 NEI.

2. For each sector, estimate the health impacts, and the economic value of these impacts, associated with the attributable ambient concentrations of ozone from NOx and $PM_{2.5}$ from primary $PM_{2.5}$, nitrate, and sulfate using the environmental Benefits Mapping and Analysis Program-Community Edition (BenMAP-CE v1.5.8) and the risk and valuation estimates documented in the *Estimating $PM_{2.5}$- and Ozone-Attributable Health Benefits* TSD.
3. For each sector, divide the $PM_{2.5}$-related health impacts attributable to each type of $PM_{2.5}$, and the monetary value of these impacts, by the level of associated precursor emissions. That is, primary $PM_{2.5}$ benefits are divided by direct $PM_{2.5}$ emissions, sulfate benefits are divided by SO_2 emissions, and nitrate benefits are divided by NOx emissions. For each sector, divide the ozone-related benefits by the change in summer season VOC or NOx.

For this proposal, we monetized health benefits of avoided ozone and $PM_{2.5}$-attributable premature deaths and illnesses by multiplying a benefit per ton coefficient by the expected state NOx ozone season and primary $PM_{2.5}$, NOx and SO_2 emissions changes described in Section 3.1.3. Benefit per ton estimates are currently available for 2025, 2030, 2035, and 2040.[26] When estimating the value of improved air quality over a multi-year time horizon, the ozone analysis applies state-level benefit per ton estimates for EGUs from 2025 for the years 2025-2027, from 2030 for the years 2028-2031, from 2035 for the years 2032-2037, and from 2040 for the years 2038-2044. For the non-EGUs, the regional benefit per ton estimates were applied from 2030 for the years 2028-2031, from 2035 for the years 2032-2037, and from 2040 for the years 2038-2044. The benefit per ton calculations for EGUs and non-EGUs have been combined in Tables 4-1, 4-2, 4-3 and 4-4. Table 4-3 and Table 4-4 present streams of benefits discounted over the SAB-recommended 20-year segmented lag at 3 and 7 percent discount rates.

[26] Benefit per ton estimates can be found at: https://www.epa.gov/benmap/estimating-benefit-ton-reducing-directly-emitted-pm25-pm25-precursors-and-ozone-precursors

Table 4-1. Estimated Monetized Health Benefits of Avoided Ozone and $PM_{2.5}$-Attributable Premature Mortality and Illness for the Proposed Rule Emissions Reductions (EGUs and Non-EGUs), 2025–2044: Monetized Benefits Quantified as Sum of Avoided Morbidity Health Effects and Avoided Long-term Ozone and $PM_{2.5}$ Mortality (3 percent discount rate; million 2016$)

Year	Ozone	$PM_{2.5}$	Combined Total
2025	$16 and $110	$32 and $69	$48 and $180
2026	$16 and $110	$32 and $69	$48 and $180
2027	$14 and $96	$4.7 and $9.9	$19 and $110
2028	$18 and $140	$8.3 and $17	$26 and $160
2029	$18 and $140	$8.3 and $17	$26 and $160
2030	$13 and $99	$5.4 and $11	$18 and $110
2031	$13 and $99	$5.4 and $11	$18 and $110
2032	$12 and $95	$4.9 and $9.8	$17 and $100
2033	$12 and $95	$4.9 and $9.8	$17 and $100
2034	$12 and $95	$4.9 and $9.8	$17 and $100
2035	$12 and $95	$4.9 and $9.8	$17 and $100
2036	$12 and $95	$4.9 and $9.8	$17 and $100
2037	$12 and $95	$4.9 and $9.8	$17 and $100
2038	$14 and $120	$4.8 and $9.5	$19 and $130
2039	$14 and $120	$4.8 and $9.5	$19 and $130
2040	$14 and $120	$4.8 and $9.5	$19 and $130
2041	$14 and $120	$4.8 and $9.5	$19 and $130
2042	$14 and $120	$4.8 and $9.5	$19 and $130
2043	$15 and $130	$6 and $12	$21 and $140
2044	$15 and $130	$6 and $12	$21 and $140

Notes: Values rounded to two significant figures. The benefits are associated with two point estimates from two different epidemiologic studies. The lower estimates include ozone mortality estimated using the pooled Katsouyanni et al. (2009), the Zanobetti and Schwartz (2008) short-term risk estimates, and the Wu et al. (2020) long-term $PM_{2.5}$ exposure mortality risk estimate. The higher estimates include ozone mortality estimated using the Turner et al. (2016) long-term risk estimate and the Pope et al. (2019) long-term $PM_{2.5}$ exposure mortality risk estimate. Health benefits are discounted at a rate of 3 and 7 percent over the SAB-recommended 20-year segmented lag. Individual values in the table are not further discounted for purposes of estimating a present value.

Table 4-2. Estimated Monetized Health Benefits of Avoided Ozone and $PM_{2.5}$-Attributable Premature Mortality and Illness for the Proposed Rule Emissions Reductions (EGUs and Non-EGUs), 2025–2044: Monetized Benefits Quantified as Sum of Avoided Morbidity Health Effects and Avoided Long-term Ozone and $PM_{2.5}$ Mortality (7 percent discount rate; million 2016$)

Year	Ozone	$PM_{2.5}$	Combined Total
2025	$14 and $100	$29 and $62	$43 and $160
2026	$14 and $100	$29 and $62	$43 and $160
2027	$12 and $86	$4.2 and $8.9	$16 and $95
2028	$16 and $130	$7.4 and $15	$23 and $150
2029	$16 and $130	$7.4 and $15	$23 and $150
2030	$11 and $89	$4.9 and $10	$16 and $99
2031	$11 and $89	$4.9 and $10	$16 and $99
2032	$10 and $84	$4.4 and $8.9	$14 and $93
2033	$10 and $84	$4.4 and $8.9	$14 and $93
2034	$10 and $84	$4.4 and $8.9	$14 and $93
2035	$10 and $84	$4.4 and $8.9	$14 and $93
2036	$10 and $84	$4.4 and $8.9	$14 and $93
2037	$10 and $84	$4.4 and $8.9	$14 and $93
2038	$13 and $110	$4.3 and $8.5	$17 and $120
2039	$13 and $110	$4.3 and $8.5	$17 and $120
2040	$13 and $110	$4.3 and $8.5	$17 and $120
2041	$13 and $110	$4.3 and $8.5	$17 and $120
2042	$13 and $110	$4.3 and $8.5	$17 and $120
2043	$13 and $110	$5.4 and $11	$18 and $120
2044	$13 and $110	$5.4 and $11	$18 and $120

Notes: Values rounded to two significant figures. The benefits are associated with two point estimates from two different epidemiologic studies. The lower estimates include ozone mortality estimated using the pooled Katsouyanni et al. (2009), the Zanobetti and Schwartz (2008) short-term risk estimates, and the Wu et al. (2020) long-term $PM_{2.5}$ exposure mortality risk estimate. The higher estimates include ozone mortality estimated using the Turner et al. (2016) long-term risk estimate and the Pope et al. (2019) long-term $PM_{2.5}$ exposure mortality risk estimate. Health benefits are discounted at a rate of 3 and 7 percent over the SAB-recommended 20-year segmented lag. Individual values in the table are not further discounted for purposes of estimating a present value.

Table 4-3. Stream of Discounted Human Health Benefits for the Proposed Rule Emissions Reductions (EGUs and Non-EGUs), 2025–2044: Monetized Benefits Quantified as Sum of Avoided Morbidity Health Effects and Avoided Long-term Ozone and $PM_{2.5}$ Mortality (3 percent discount rate; million 2016$)

Year	Proposed Rule
2025	$170
2026	$160
2027	$94
2028	$140
2029	$130
2030	$89
2031	$87
2032	$80
2033	$78
2034	$76
2035	$74
2036	$71
2037	$69
2038	$83
2039	$81
2040	$78
2041	$76
2042	$74
2043	$79
2044	$76
Present Value (PV)	**$1,900**
Equivalent Annualized Value (EAV)	**$130**

Note: Values rounded to two significant figures. Benefits calculation includes ozone-related morbidity effects and avoided ozone-attributable deaths quantified using the Turner et al. (2016) long-term risk estimate and the Pope et al. (2019) long-term $PM_{2.5}$ exposure mortality risk estimate, which are the higher of the two estimates presented in Table 4-1. We assume that there is a cessation lag between the change in exposures and the total realization of changes in mortality effects. Specifically, we assume that some of the incidences of premature mortality related to exposures occur in a distributed fashion over the 20 years following exposure, which affects the valuation of mortality benefits at different discount rates.

Table 4-4. Stream of Discounted Human Health Benefits for the Proposed Rule Emissions Reductions (EGUs and Non-EGUs), 2025–2044: Monetized Benefits Quantified as Sum of Avoided Morbidity Health Effects and Avoided Long-term Ozone and $PM_{2.5}$ Mortality (7 percent discount rate; million 2016$)

Year	Proposed Rule
2025	$140
2026	$130
2027	$72
2028	$100
2029	$97
2030	$62
2031	$58
2032	$51
2033	$47
2034	$44
2035	$41
2036	$39
2037	$36
2038	$43
2039	$40
2040	$38
2041	$35
2042	$33
2043	$31
2044	$29
Present Value (PV)	**$1,200**
Equivalent Annualized Value (EAV)	**$110**

Note: Values rounded to two significant figures Benefits calculation includes ozone-related morbidity effects and avoided ozone-attributable deaths quantified using the Turner et al. (2016) long-term risk estimate and the Pope et al. (2019) long-term $PM_{2.5}$ exposure mortality risk estimate, which are the higher of the two estimates presented in Table 4-1. We assume that there is a cessation lag between the change in exposures and the total realization of changes in mortality effects. Specifically, we assume that some of the incidences of premature mortality related to exposures occur in a distributed fashion over the 20 years following exposure, which affects the valuation of mortality benefits at different discount rates.

4.2 Climate Benefits

We estimate the climate benefits for this proposed rulemaking using estimates of the social cost of greenhouse gases (SC-GHG), specifically the social cost of carbon (SC-CO_2). The SC-CO_2 is the monetary value of the net harm to society associated with a marginal increase in CO_2 emissions in a given year, or the benefit of avoiding that increase. In principle, SC-CO_2 includes the value of all climate change impacts (both negative and positive), including (but not limited to) changes in net agricultural productivity, human health effects, property damage from increased flood risk, natural disasters, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services. The SC-CO_2, therefore, reflects the societal value of reducing emissions of the gas in question by one metric ton and is the theoretically appropriate value to use in conducting benefit-cost analyses of policies that affect CO_2 emissions. In practice, data and modeling limitations naturally restrain the ability of SC-CO_2 estimates to include all the important physical, ecological, and economic impacts of climate change, such that the estimates are a partial accounting of climate change impacts and will therefore, tend to be underestimates of the marginal benefits of abatement. For a complete discussion of the methodology used for calculating the estimated climate benefits please see Chapter 5.2 of the Final GNP RIA.[27]

Table 4-5 shows the estimated monetary value of the estimated changes in CO_2 emissions from EGUs expected to occur over 2025-2044 for this proposed rule. The EPA estimated the dollar value of the CO_2-related effects for each analysis year between 2025 and 2044 by applying the SC-CO_2 estimates to the estimated changes in CO_2 emissions in the corresponding year.

Table 4-5. Stream of Climate Benefits from EGU CO_2 Emissions Reductions, 2025 - 2044 (Millions of 2016$)

	Discount Rate and Statistic			
Year	**5% Average**	**3% Average**	**2.5% Average**	**3% 95th Percentile**
2025	$0.6	$2.1	$3.0	$6.2
2026	$0.6	$2.1	$3.1	$6.3
2027	$0.5	$1.5	$2.2	$4.6
2028	$0.5	$1.5	$2.3	$4.7
2029	$0.5	$1.6	$2.3	$4.8
2030	$0.5	$1.7	$2.5	$5.2
2031	$0.6	$1.8	$2.5	$5.3
2032	$0.0	-$0.1	-$0.2	-$0.4
2033	$0.0	-$0.1	-$0.2	-$0.4
2034	$0.0	-$0.1	-$0.2	-$0.4
2035	$0.0	-$0.1	-$0.2	-$0.4

[27] EPA recently published a set of updated SC-CO_2 estimates in the regulatory impact analysis of EPA's December 2023 final oil and gas standards (U.S. EPA 2023c) that reflects recent advances in the climate science and economics, following an external peer review and a public comment process. For more details, see: https://www.epa.gov/environmental-economics/scghg. As these values were not finalized at the time EPA conducted this analysis, EPA did not use them in this EIA to monetize the estimated climate benefits of this proposed rule. However, EPA requests comments on whether the Agency should proceed with using these updated values in the analysis supporting the final rulemaking.

Discount Rate and Statistic				
2036	$0.0	-$0.1	-$0.2	-$0.4
2037	$0.0	-$0.1	-$0.2	-$0.4
2038	-$0.1	-$0.3	-$0.4	-$0.8
2039	-$0.1	-$0.3	-$0.4	-$0.8
2040	-$0.1	-$0.3	-$0.4	-$0.8
2041	-$0.1	-$0.3	-$0.4	-$0.8
2042	-$0.1	-$0.3	-$0.4	-$0.8
2043	$0.0	$0.0	$0.0	$0.0
2044	$0.0	$0.0	$0.0	$0.0

Note: Individual values in the table are not further discounted for purposes of estimating a present value.

4.3 Total Benefits

Table 4-6 presents the total health and climate benefits for the proposed rule. The total benefits peak in 2025 and 2026 when emission reductions are greatest, with $2.1 million in climate benefits at a 3 percent discount rate, and total benefits estimated at $50 and $180 million at a 3 percent discount rate and $45 and $160 million at a 7 percent discount rate. Climate benefits become negative in later years because of the very small modeled CO_2 emission changes (less than 0.001% nationally). Given how the model solves, this essentially indicates little to no change in emissions.

Table 4-6. Combined Annual Health Benefits and Climate Benefits for the Proposed Rule (Millions of 2016$)

Year	Health and Climate Benefits (Discount Rate Applied to Health Benefits)[a]		Climate Benefits Only
	3%	7%	
2025	$50 and $180	$45 and $160	$2.1
2026	$50 and $180	$45 and $160	$2.1
2027	$21 and $110	$18 and $97	$1.5
2028	$28 and $160	$25 and $150	$1.5
2029	$28 and $160	$25 and $150	$1.6
2030	$20 and $110	$18 and $100	$1.7
2035	$17 and $100	$14 and $93	-$0.1
2040	$19 and $130	$17 and $120	-$0.3
2044	$21 and $140	$18 and $120	$0.0

[a] Health benefits are discounted at a rate of 3 and 7 percent over the SAB-recommended 20-year segmented lag. Climate benefits are based on changes (reductions) in CO_2 emissions and are calculated using estimates of the social cost of carbon (SC-CO_2) 3 percent discount rates. Individual values in the table are not further discounted for purposes of estimating a present value. Values are rounded to two significant figures.

5 DEMOGRAPHIC PROXIMITY ANALYSIS

Demographic proximity analyses allow one to assess the potentially vulnerable populations residing nearby affected facilities as a proxy for exposure and the potential for adverse health impacts that may occur at a local scale due to economic activity at a given location including noise, odors, traffic, and emissions such as NO_2, covered under this EPA action and not modeled elsewhere in this EIA.

Although baseline proximity analyses are presented here for the proposed supplemental rule, several important caveats should be noted. In most areas, emissions are not expected to increase from the rulemaking, so most communities nearby affected facilities should experience decreases in exposure from directly emitted pollutants. However, facilities may vary widely in terms of the impacts on populations they already pose to nearby populations. In addition, proximity to affected facilities does not capture variation in baseline exposure across communities, nor does it indicate that any exposures or impacts will occur and should not be interpreted as a direct measure of exposure or impact. These points limit the usefulness of proximity analyses when attempting to answer question from EPA's EJ Technical Guidance (U.S. EPA, 2016).

Demographic proximity analyses were performed for two subsets of facilities affected by the proposed supplemental rule:

- *Electricity Generating Unit (EGU)*: Comparison of the percentage of various populations (race/ethnicity, age, education, poverty status, income, and linguistic isolation) living nearby covered EGU sources to average national levels.
- *Non-EGU (non-electricity generating units)*: Comparison of the percentage of various populations (race/ethnicity, age, education, poverty status, income, and linguistic isolation) living nearby covered non-EGU sources to average national levels.

5.1.1 EGU Proximity Assessments

The current analysis identified all census blocks with centroids within a 5 km, 10 km and 50 km radius of the latitude/longitude location of each facility, and then linked each block with census-based demographic data.[28] The total population within a specific radius around each facility is the sum of the population for every census block within that specified radius, based on each block's population provided by the decennial Census.[29] Statistics on race, ethnicity, age, education level, poverty status, and linguistic isolation were obtained from the Census' 2015-2019 American Community Survey (ACS) 5-year averages. These data are provided at the block group level. For the purposes of this analysis, the demographic characteristics of a given block group – that is, the percentage of people in different races/ethnicities, the percentage in different age groups (<18, 18-64, and >64), the percentage without a high school diploma, the percentage that are below the poverty level, and the percentage that are linguistically isolated – are presumed to also describe each census block located within that block group.

In addition to facility-specific demographics, the demographic composition of the total population within the specified radius (e.g., 50 km) for all facilities as a whole was also computed (e.g., all EGUs or all non-EGU facilities). In calculating the total populations, to avoid double-counting, each census block population was only counted once. That is, if a census block was located within the selected radius (i.e., 50 km) for multiple facilities, the population of that census block was only counted once in the total population. Finally, this analysis compares the demographics at each specified radius (i.e., 5 km, 10 km, and 50 km) to the demographic composition of the nationwide population.

For this action, a demographic analysis was conducted for nine EGU facilities, assumed to install controls, at the 5 km, 10 km, and 50 km radius distances (Table 5-1). Approximately 7 million people live within 50 km of these nine EGU facilities, representing roughly 2% of the 328 million total population of the U.S. Within 50km of EGU facilities, there is a higher Hispanic/Latino population than the national average (26% versus 19%) and a higher Native American population than the national average (1.9% versus 0.7%). Other demographics of the population within 50km of the EGU facilities are similar to the national averages. Approximately 166 thousand and 716 thousand people live within 5 km and 10 km of the EGU facilities,

[28] Five km and 50 km radii are the default distances currently used for proximity analyses. The 5 km distance is the shortest distance that should be chosen to avoid excessive demographic uncertainty and provides information on near-field populations. The 50 km distance offers a sub-regional perspective. The 10 km distance was added to this analysis as few to no people were within 5 km of some affected facilities.

[29] The location of the Census block centroid is used to determine if the entire population of the Census block is assumed to be within the specified radius. It is unknown how sensitive these results may be to different methods of population estimation, such as aerial apportionment.

respectively. The demographic make-up of the population within 5 km and 10 km of EGU facilities are very similar. Within 5 km and 10 km of EGU facilities, there is a higher Hispanic/Latino population than the national average (60% within 5 km and 53% within 10 km versus 19% nationwide) and a higher Native American population than the national average (5.5% within 5 km and 3.5% within 10 km versus 0.7% nationwide). The populations within 5 km and 10 km of EGU facilities have a higher percentage of people under the age of 18 compared to the national average (29% within both 5km and 10km versus 23% nationwide). The percent of people living below the poverty level is higher than the national average (24% within 5 km and 23% within 10 km versus 13% nationwide). The percent of people over the age of 25 without a high school diploma is higher than the national average (18% within 5 km and 16% within 10 km versus 12% nationwide), and the percent of people living in linguistic isolation is higher than the national average (12% within 5 km and 10% within 10 km versus 5% nationwide).

Table 5-1. Population Demographics for the 9 EGU Facilities Assumed to Install Additional Controls due to the Proposed Supplemental Rule

Demographic Group		Percent of Population Within Each Distance Compared to the National Average[1]			
		5km	10km	50km	National Average
Race/ Ethnicity	White	23%	28%	59%	60%
	African American	9%	10%	7%	12%
	Native American	5.5%	3.5%	1.9%	0.7%
	Other and Multiracial	3%	5%	6%	8%
	Hispanic or Latino[2]	60%	53%	26%	19%
Age	0-17 Years Old	29%	29%	24%	23%
	18-64 Years Old	61%	62%	61%	62%
	>=65 Years Old	9%	9%	15%	16%
Income	People Living Below the Poverty Level	24%	23%	14%	13%
Education	>= 25 Years Old Without a High School Diploma	18%	16%	8%	12%
Language	People Living in Linguistic Isolation	12%	10%	5%	5%
Total Population		**165,712**	**716,296**	**6,742,898**	**328,016,242**

[1] Demographic percentage is based on the Census' 2015-2019 American Community Survey 5-year averages, at the block group level, and include the 50 states, District of Columbia, and Puerto Rico. Total population is based on block level data from the 2010 Decennial Census.

[2] To avoid double counting, the "Hispanic or Latino" category is treated as a distinct demographic category for these analyses. A person who identifies as Hispanic or Latino is counted as Hispanic/Latino for this analysis, regardless of what race this person may have also identified as in the Census.

5.1.2 Non-EGU Proximity Analysis

For this action, a demographic analysis was also conducted for two non-EGU facilities, assumed to install controls, at the 5 km, 10 km, and 50 km radius distances (Table 5-2). Approximately 218 thousand people live within 50 km of these two non-EGU facilities, representing roughly 0.07% of the 328 million total population of the U.S. Within 50 km of the two non-EGU facilities, there is a higher White population than the national average (72% versus 60%), and there is a higher Native American population than the national average (3.8% versus 0.7%). There is also a higher population over the age of 65 than the national average (24% versus 16%). Approximately 200 and 3,000 people live within 5 km and 10 km of the non-EGU facilities, respectively. The demographic make-up of the population within 5 km and 10 km of non-EGU facilities are similar. Within 5 km and 10 km of non-EGU facilities, there is a higher White population than the national average (87% within 5km and 88% within 10 km versus 60% nationwide) and there is a higher Native American population than the national average (2.2% within 5 km and 1.0% within 10 km versus 0.7% nationwide). Concerning the age distribution within 5 and 10km of the 2 non-EGU facilities, the percent of people aged 65 or older is higher than the national average (31% within 5 km and 36% within 10 km versus 16% nationwide). Additionally, the percent of people living below the poverty level within 5 km and 10 km of the non-EGU facilities is higher than the national average (18% within 5 km and 17% within 10 km versus 13% nationwide).

Table 5-2. Population Demographics for the 2 Non-EGU Facilities Assumed to Install Additional Controls due to the Proposed Supplemental Rule

Demographic Group		Percent of Population Within Each Distance Compared to the National Average[1]			
		5km	10km	50km	National Average
Race/ Ethnicity	White	87%	88%	72%	60%
	African American	0%	0%	1%	12%
	Native American	2.2%	1.0%	3.8%	0.7%
	Other and Multiracial	4%	4%	5%	8%
	Hispanic or Latino[2]	7%	7%	19%	19%
Age	0-17 Years Old	5%	6%	17%	23%
	18-64 Years Old	65%	58%	59%	62%
	>=65 Years Old	31%	36%	24%	16%
Income	People Living Below the Poverty Level	18%	17%	14%	13%
Education	>= 25 Years Old Without a High School Diploma	7%	8%	8%	12%
Language	People Living in Linguistic Isolation	0%	0%	2%	5%
Total Population		**204**	**3,193**	**218,256**	**328,016,242**

[1] Demographic percentage is based on the Census' 2015-2019 American Community Survey 5-year averages, at the block group level, and include the 50 states, District of Columbia, and Puerto Rico. Total population is based on block level data from the 2010 Decennial Census.

[2] To avoid double counting, the "Hispanic or Latino" category is treated as a distinct demographic category for these analyses. A person who identifies as Hispanic or Latino is counted as Hispanic/Latino for this analysis, regardless of what race this person may have also identified as in the Census.

For additional information on the EGU or non-EGU proximity analyses, see Section 7.3 of the *Final Good Neighbor Plan Final Rule* as well as the memorandum *Analysis of Demographic Factors for Populations Living Near EGU and Non-EGU Facilities*, in the rulemaking docket.

6 COMPARISON OF COST AND BENEFITS

The EPA performed an analysis to estimate the costs and benefits of compliance with the Proposed Supplemental Federal "Good Neighbor Plan" Requirements for the 2015 8-hour Ozone National Ambient Air Quality Standards. This EIA presents the benefits and costs of the proposed rule from 2025 through 2044. The estimated health benefits are expected to arise from reduced ozone and $PM_{2.5}$ concentrations, and the estimated climate benefits are from reduced CO_2 emissions. The estimated costs for EGUs are the costs of installing and operating controls and the increased costs of producing electricity. The estimated costs for non-EGUs are the costs of installing and operating controls to meet the ozone season emissions limits. The estimated costs do not include monitoring, recordkeeping, reporting, or testing costs. Unquantified benefits and costs are described qualitatively in Chapter 5, Section 5.4 of the Final GNP RIA.

As shown in Section 3, the estimated annual compliance costs to implement the rule, as described in this EIA, are approximately $1.0 million in 2025 and $7.7 million in 2028 (2016$). This EIA uses compliance costs as a proxy for social costs as discussed in the Final GNP RIA. As shown in Section 4, the estimated monetized health benefits from reduced ozone concentrations from implementation of the proposed rule are approximately $48 and $180 million in 2025 and $26 and $160 million in 2028 (2016$, based on a real discount rate of 3 percent). The estimated monetized climate benefits from reduced CO_2 emissions are approximately $2.1 million in 2025 and $1.5 million in 2028 (2016$, based on a real discount rate of 3 percent).

The EPA calculates the monetized net benefits of the proposed rule by subtracting the estimated monetized compliance costs from the estimated monetized health and climate benefits. The benefits include those to public health associated with reductions ozone and $PM_{2.5}$ concentrations, as well as those to climate associated with reductions in CO_2 emissions. The EPA presents estimates of the present value (PV) of the monetized benefits and costs over the twenty-year period 2025 to 2044. To calculate the present value of the social net benefits of the rule, annual benefits and costs are discounted to 2023 at 3 percent and 7 discount rates as recommended by OMB's Circular A-4. The EPA also presents the equivalent annualized value (EAV), which represents a flow of constant annual values that, had they occurred in each year from 2025 to 2044, would yield a sum equivalent to the PV. The EAV represents the value of a typical cost or benefit for each year of the analysis, in contrast to the year-specific estimates mentioned above.

Table 6-1 below includes the streams of health benefits, climate benefits, costs, and net benefits from 2025 to 2044. Table 6-2 below provides the comparison of benefits and costs in PV and EAV terms for the proposed rule. Estimates in the table are presented as rounded values. For the twenty-year period of 2025 to 2044, the PV of the net benefits, in 2016$ and discounted to 2023 is $280 million and $1.8 billion when using a 3 percent discount rate and $180 million and $1.1 billion when using a 7 percent discount rate. The EAV is $19 and $120 million per year when using a 3 percent discount rate and $17 and $110 million per year when using a 7 percent discount rate.

Table 6-1. Streams of Health Benefits, Climate Benefits, Costs, and Net Benefits for 2025 – 2044 (millions of 2016$)

	Health Benefits[a]		Climate Benefits[b]	Costs	Net Benefits[c]	
	3%	7%	3%		3%	7%
2025	$48 and $180	$43 and $160	$2.1	$1.0	$49 and $180	$44 and $160
2026	$48 and $180	$43 and $160	$2.1	$1.0	$49 and $180	$44 and $160
2027	$19 and $110	$16 and $95	$1.5	$3.4	$17 and $100	$14 and $93
2028	$26 and $160	$23 and $150	$1.5	$7.7	$20 and $150	$17 and $140
2029	$26 and $160	$23 and $150	$1.6	$7.7	$20 and $150	$17 and $140
2030	$18 and $110	$16 and $99	$1.7	$5.0	$15 and $110	$13 and $96
2031	$18 and $110	$16 and $99	$1.8	$5.0	$15 and $110	$13 and $96
2032	$17 and $100	$14 and $93	-$0.1	$5.0	$12 and $100	$9.3 and $88
2033	$17 and $100	$14 and $93	-$0.1	$5.0	$12 and $100	$9.3 and $88
2034	$17 and $100	$14 and $93	-$0.1	$5.0	$12 and $100	$9.3 and $88
2035	$17 and $100	$14 and $93	-$0.1	$5.0	$12 and $100	$9.3 and $88
2036	$17 and $100	$14 and $93	-$0.1	$5.0	$12 and $100	$9.3 and $88
2037	$17 and $100	$14 and $93	-$0.1	$5.0	$12 and $100	$9.3 and $88
2038	$19 and $130	$17 and $120	-$0.3	$4.6	$14 and $120	$12 and $110
2039	$19 and $130	$17 and $120	-$0.3	$4.6	$14 and $120	$12 and $110
2040	$19 and $130	$17 and $120	-$0.3	$4.6	$14 and $120	$12 and $110
2041	$19 and $130	$17 and $120	-$0.3	$4.6	$14 and $120	$12 and $110
2042	$19 and $130	$17 and $120	-$0.3	$4.6	$14 and $120	$12 and $110
2043	$21 and $140	$18 and $120	$0.0	$5.0	$16 and $140	$13 and $120
2044	$21 and $140	$18 and $120	$0.0	$5.0	$16 and $140	$13 and $120

[a] We assume that there is a cessation lag between the change in exposures and the total realization of changes in mortality effects. Specifically, we assume that some of the incidences of premature mortality related to exposures

occur in a distributed fashion over the 20 years following exposure, which affects the valuation of mortality benefits at different discount rates.

[b] We include the climate benefits calculated at a 3 percent discount rate.

[c] Individual values in the table are not further discounted for purposes of estimating a present value.

Table 6-2. **Summary of Present Values and Equivalent Annualized Values for the 2025-2044 Timeframe for Estimated Monetized Health Benefits, Climate Benefits, Costs, and Net Benefits for the Proposed Rule (millions of 2016$, discounted to 2023)**

	Health Benefits		Climate Benefits	Cost		Net Benefits	
	3%	7%	3%	3%	7%	3%	7%
2025	$45 and $170	$38 and $140	$1.9	$1.0	$0.9	$46 and $170	$39 and $140
2026	$44 and $160	$35 and $130	$1.9	$1.0	$0.9	$45 and $160	$36 and $130
2027	$17 and $94	$12 and $72	$1.4	$3.0	$2.6	$15 and $92	$11 and $71
2028	$23 and $140	$17 and $100	$1.3	$6.6	$5.5	$17 and $130	$13 and $99
2029	$22 and $130	$16 and $97	$1.3	$6.4	$5.1	$17 and $130	$12 and $93
2030	$15 and $89	$9.9 and $62	$1.4	$4.1	$3.1	$12 and $87	$8.2 and $60
2031	$15 and $87	$9.3 and $58	$1.4	$3.9	$2.9	$12 and $84	$7.7 and $56
2032	$13 and $80	$7.8 and $51	-$0.1	$3.8	$2.7	$9.0 and $76	$5.0 and $48
2033	$13 and $78	$7.3 and $47	-$0.1	$3.7	$2.5	$8.8 and $74	$4.7 and $45
2034	$12 and $76	$6.8 and $44	-$0.1	$3.6	$2.4	$8.5 and $72	$4.4 and $42
2035	$12 and $74	$6.4 and $41	-$0.1	$3.5	$2.2	$8.2 and $70	$4.1 and $39
2036	$12 and $71	$6.0 and $39	-$0.1	$3.4	$2.1	$8.0 and $68	$3.8 and $36
2037	$11 and $69	$5.6 and $36	-$0.1	$3.3	$1.9	$7.8 and $66	$3.6 and $34
2038	$12 and $83	$6.3 and $43	-$0.2	$2.9	$1.7	$9.0 and $80	$4.4 and $41
2039	$12 and $81	$5.9 and $40	-$0.2	$2.8	$1.5	$8.7 and $78	$4.1 and $38
2040	$11 and $78	$5.5 and $38	-$0.2	$2.8	$1.4	$8.4 and $75	$3.9 and $36
2041	$11 and $76	$5.1 and $35	-$0.2	$2.7	$1.4	$8.2 and $73	$3.6 and $34
2042	$11 and $74	$4.8 and $33	-$0.2	$2.6	$1.3	$8.0 and $71	$3.4 and $31
2043	$12 and $79	$4.8 and $31	$0.0	$2.8	$1.3	$8.9 and $76	$3.5 and $30
2044	$11 and $76	$4.4 and $29	$0.0	$2.7	$1.2	$8.6 and $74	$3.2 and $28
PV 2025-2044	**$330 and $1,900**	**$210 and $1,200**	**$9.3**	**$67**	**$45**	**$270 and $1,800**	**$180 and $1,100**
EAV 2025-2044	**$22 and $130**	**$20 and $110**	**$0.6**	**$4.5**	**$4.2**	**$18 and $120**	**$17 and $110**

Note: Values rounded to two significant figures. Rows may not appear to add correctly due to rounding.

7 REFERENCES

Katsouyanni, K, Samet, JM, Anderson, HR, Atkinson, R, Le Tertre, A, Medina, S, Samoli, E, Touloumi, G, Burnett, RT, Krewski, D, Ramsay, T, Dominici, F, Peng, RD, Schwartz, J, Zanobetti, A and Committee, HEIHR (2009). Air pollution and health: a European and North American approach (APHENA). Res Rep Health Eff Inst(142): 5-90.

Office of Management and Budget (OMB). 2003. Circular A-4: Regulatory Analysis. Washington, DC. Available at: https://obamawhitehouse.archives.gov/omb/circulars_a004_a-4/

Pope III, CA, Lefler, JS, Ezzati, M, Higbee, JD, Marshall, JD, Kim, S-Y, Bechle, M, Gilliat, KS, Vernon, SE and Robinson, AL (2019). Mortality risk and fine particulate air pollution in a large, representative cohort of US adults. Environmental health perspectives 127(7): 077007.

Turner, MC, Jerrett, M, Pope, A, III, Krewski, D, Gapstur, SM, Diver, WR, Beckerman, BS, Marshall, JD, Su, J, Crouse, DL and Burnett, RT (2016). Long-term ozone exposure and mortality in a large prospective study. Am J Respir Crit Care Med 193(10): 1134-1142.

U.S. Census Bureau. 2021. "Annual Survey of Manufactures: Summary Statistics for Industry Groups and Industries in the U.S.: 2019 and 2018" Available at: https://data.census.gov/cedsci/

U.S. Environmental Protection Agency (EPA). 2016. Guidance on Considering Environmental Justice During the Development of Regulatory Actions. https://www.epa.gov/sites/default/files/2016-06/documents/ejtg_5_6_16_v5.1.pdf.

U.S. Environmental Protection Agency (U.S. EPA). 2023a. Technical Support Document: Estimating the Benefit per Ton of Reducing Directly-Emitted PM2.5, PM2.5 Precursors and Ozone Precursors from 21 Sectors. U.S. Environmental Protection Agency, Research Triangle Park, NC, April 2023. Available at: https://www.epa.gov/system/files/documents/2021-10/source-apportionment-tsd-oct-2021_0.pdf

U.S. Environmental Protection Agency (U.S. EPA). 2023b. Technical Support Document: Estimating PM2.5- and Ozone-Attributable Health Benefits. U.S. Environmental Protection Agency, Research Triangle Park, NC, January 2023. Available at: https://www.epa.gov/system/files/documents/2023-01/Estimating%20PM2.5-%20and%20Ozone-Attributable%20Health%20Benefits%20TSD_0.pdf

U.S. Environmental Protection Agency (U.S. EPA). 2023c. Regulatory Impact Analysis of the Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review. Available at: https://www.epa.gov/system/files/documents/2023-12/eo12866_oil-and-gas-nsps-eg-climate-review-2060-av16-ria-20231130.pdf

U.S. Government Accountability Office (GAO). 2020. Social Cost of Carbon: Identifying a Federal Entity to Address the National Academies' Recommendations Could Strengthen Regulatory Analysis. Available at: https://www.gao.gov/assets/gao-20-254.pdf

U.S. Small Business Administration (SBA), 2017. "A Guide for Government Agencies: How to Comply with the Regulatory Flexibility Act" Available at: https://advocacy.sba.gov/wp-content/uploads/2019/07/How-to-Comply-with-the-RFA-WEB.pdf

Wu, X., Braun, D., Schwartz, J., Kioumourtzoglou, M. A., & Dominici, F. (2020). Evaluating the impact of long-term exposure to fine particulate matter on mortality among the elderly. *Sci Adv, 6*(29), eaba5692. doi:10.1126/sciadv.aba5692

Zanobetti A, Schwartz J. 2008. Mortality displacement in the association of ozone with mortality: an analysis of 48 cities in the United States. Am J Respir Crit Care Med 177:184–9; doi:10.1164/rccm.200706-823OC.F

United States Environmental Protection Agency	Office of Air Quality Planning and Standards Health and Environmental Impacts Division Research Triangle Park, NC	November 2023