Regulatory Impact Analysis for the Proposed Repeal of Greenhouse Gas Emissions Standards for Fossil Fuel-Fired Electric Generating Units

EPA-452/R-25-002
June 2025

Regulatory Impact Analysis for the Proposed Repeal of Greenhouse Gas Emissions Standards for Fossil Fuel-Fired Electric Generating Units

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ACKNOWLEDGEMENTS

In addition to U.S. EPA staff from the Office of Air and Radiation, personnel from the Office of Policy of the U.S. Environmental Protection Agency contributed data and analysis to this document.

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1 EXECUTIVE SUMMARY

1.1 Introduction

In this action, the U.S. Environmental Protection Agency (EPA) is proposing to repeal all greenhouse gas (GHG) standards for fossil fuel-fired power plants. The EPA is proposing that the Clean Air Act requires it to make a finding that GHG emissions from fossil fuel-fired power plants contribute significantly to dangerous air pollution, as a predicate to regulating GHG emissions from those plants. The EPA is further proposing to make a finding that GHG emissions from fossil fuel-fired power plants do not contribute significantly to dangerous air pollution. [1] The EPA is also proposing, as an alternative, to repeal a narrower set of requirements that include the emission guidelines for existing fossil fuel-fired steam generating units, the carbon capture and sequestration/storage (CCS)-based standards for coal-fired steam generating units undertaking a large modification, and the CCS-based standards for new base load stationary combustion turbines. [2]

In accordance with Executive Orders (E.O). 12866 and 13563, the guidelines of OMB Circular A-4, and *EPA's Guidelines for Preparing Economic Analyses* (U.S. EPA, 2024a), this Regulatory Impact Analysis (RIA) analyzes the regulatory compliance costs and benefits associated with this proposed action, with the proposed action containing both a proposal and alternative proposal as described above. This RIA builds upon modeling prepared for the 2024 final CPS rule regulatory impact analysis (2024 CPS RIA), as that modeling reflects the projected impact of the CPS relative to a baseline without the CPS.[3] In this RIA, we draw upon the "final rules" illustrative scenario and baseline modeling from the 2024 CPS RIA.

The "baseline" is a business-as-usual scenario that ordinarily represents the behavior of the regulated sector under market and regulatory conditions in the absence of a regulatory action. The baseline for the 2024 CPS RIA included numerous rules that had been finalized at the time of that analysis. From the perspective of this proposed action, the 2024 CPS RIA is now in the baseline, and this proposed action is the policy case. Additionally, there are significant market

[1] For more information on the proposal, see Section IV.A of the preamble for this proposed action.
[2] For more information on the alternative proposal, see Section V.A of the preamble for this proposed action.
[3] The 2024 CPS RIA (U.S. EPA, 2024b) is found here: https://www.regulations.gov/document/EPA-HQ-OAR-2023-0072-8913

and regulatory changes that have occurred since the 2024 CPS RIA was developed. As such, EPA commits to conduct additional analysis in the future.

In absence of updated baseline modeling for comparison to projections under this proposal, the compliance cost estimates presented in the 2024 CPS RIA are the EPA's best available estimate of the reduction of compliance costs under this proposed action. Similarly, the projected emission changes of the CPS in the final rules illustrative scenario in the 2024 CPS RIA are the EPA's best available estimate of the emissions changes that will be reversed under this proposed action, along with associated benefits under this proposed action. We have also determined that these projected impacts are the Agency's best available estimate of the total projected impacts of the alternative proposal. Modeling the differences between the proposal and the alternative proposal requirements would likely not result in a meaningful difference in modeling projections, as described in Section 3.2.1. Therefore, throughout this RIA we generally present one set of results for this proposed action unless otherwise noted.

In this RIA, we evaluate the potential impacts of the proposed action using the present value (PV) and equivalent annual value (EAV) of costs, benefits, and net benefits, calculated for the years 2026 to 2047, discounted to 2025 using 3 and 7 percent discount rates.[4] In addition, in Sections 3 and 4, the Agency presents the assessment for specific snapshot years, consistent with historical practice. These snapshot years are 2028, 2030, 2035, 2040 and 2045. We present information about potential impacts of the proposed action on electricity markets, employment, and markets outside the electricity sector. The RIA also presents a discussion of uncertainties and limitations of the analysis. While the results are described and presented in more detail throughout the RIA, we present the high-level results of the analysis here.

1.2 Compliance Cost Savings

The compliance cost estimates presented in this RIA are based on Integrated Planning Model (IPM) projections supplemented with cost estimates for monitoring, reporting, and

[4] Values in the 2024 CPS RIA were converted from 2019 dollars to 2024 dollars by multiplying by 1.204, which was derived from the annual GDP Implicit Price Deflator values in the U.S. Bureau of Economic Analysis' NIPA Table 1.1.9. Adjusting to 2024 dollars accounts for the majority of the change in values between the 2024 CPS RIA and this RIA. Some difference in the change in values is also due to discounting over a timeframe one year shorter (i.e., to 2025 instead of 2024).

recordkeeping (MR&R).[5] Table 1-1 presents the projected compliance cost savings of this proposed action with adjustments to account for updated estimates of MR&R costs.[6]

Table 1-1 Present Value and Equivalent Annualized Value Estimates of Compliance Cost Savings (billion 2024 dollars, discounted to 2025)

3% Discount Rate		7% Discount Rate	
PV	**EAV**	**PV**	**EAV**
19	1.2	9.6	0.87

Note: Values have been rounded to two significant figures.

1.3 Emissions Changes of the Regulated Pollutant

Table 1-2 presents the CO_2 emission changes associated with the proposed action, which are projected to increase relative to the baseline.

Table 1-2 Carbon Dioxide Emissions Changes [a]

	CO_2 (million metric tons)
2028	38
2030	50
2035	123
2040	54
2045	42

[a] This analysis is limited to the geographically contiguous lower 48 states.

1.4 Economic Impacts

As a result of the change in compliance costs incurred by the regulated sector, the proposed action has economic and energy market implications. The energy market impact estimates presented here reflect the opposite of the projected impacts of the CPS in the 2024 CPS RIA. Table 1-3 presents a variety of energy market impact estimates for 2028, 2030, 2035, 2040, and 2045 for the proposed action. However, there are several key areas of uncertainty inherent in these projections as outlined in Section 3.7 of the 2024 CPS RIA.

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

[6] Compliance costs refer to the difference between policy and baseline IPM projected capital, operations and maintenance, fuel, transmission, CO_2 storage and transportation costs, and net tax payments. Other costs are not accounted for. Please see Sections 3.2 and 5.2 for further discussion of the differences between compliance costs and social costs.

Table 1-3 **Summary of Certain Energy Market Impacts**

	2028	2030	2035	2040	2045
Retail electricity prices	1%	-0%	-1%	-0%	-1%
Average price of coal delivered to the power sector	1%	1%	-0%	-0%	32%
Coal production for power sector use	6%	4%	21%	-15%	84%
Price of natural gas delivered to power sector	2%	-0%	-3%	-0%	-0%
Price of average Henry Hub (spot)	2%	1%	-3%	-0%	-0%
Natural gas use for electricity generation	1%	2%	-4%	-0%	-2%

A more detailed version of this table is found in Section 3.2.5 of the 2024 CPS RIA, along with additional discussion of energy market impacts.

More broadly, changes in production in a directly regulated sector may affect other markets when output from that sector is used in the production of other goods. In particular, electricity, the directly regulated sector in this proposed action, is an input to many goods and services throughout the economy. The proposed action may also affect production in upstream industries that supply inputs to the electricity sector and household consumption patterns as a result of electricity, natural gas, and other final good price changes. Changes in firm and household behavior could also interact with pre-existing market distortions, such as taxes. A computable general equilibrium (CGE) model can be used to evaluate the broad economy-wide impacts of a regulatory action and its social cost by accounting for these interactions and feedback.

The EPA used the peer-reviewed CGE model SAGE to evaluate the economy-wide social costs and economic impacts of the proposed action (U.S. EPA Science Advisory Board, 2020; Marten et al., 2024). The annualized social cost estimated in SAGE for the proposed action is approximately -$1.58 billion (2024 dollars) between 2026 and 2047, and -$1.81 billion (2024 dollars) over the period from 2026 to 2081. Note that SAGE does not currently account for the effects of changing environmental quality as a result of this proposed action. Section 5.2 of the RIA provides additional explanation of how the social cost was estimated using SAGE, as well as the potential household distributional impacts.

Environmental regulation may affect groups of workers differently, as changes in abatement and other compliance activities cause labor and other resources to shift. An employment impact analysis describes the characteristics of groups of workers potentially affected by a regulation, as well as labor market conditions in affected occupations, industries, and geographic areas. Employment impacts of the proposed action are discussed in Section 5 of this RIA.

1.5 Net Benefits from the Proposed Action

The net benefits associated with the regulated pollutants are the cost savings of this proposed action presented above in Table 1-1. Consistent with E.O. 14154 "Unleashing American Energy" (90 FR 8353, January 20, 2025) and the memorandum titled "Guidance Implementing Section 6 of Executive Order 14154, Entitled 'Unleashing American Energy'", the EPA did not monetize benefits associated with CO_2 emissions changes in Table 1-2.[7]

The rest of the RIA presents a full discussion of the projected costs, benefits, and net benefits of this proposed action, as well as a discussion of uncertainty and additional impacts that the EPA could not monetize.

This RIA follows the EPA's historical practice of using a technology-rich partial equilibrium model of the electricity and related fuel sectors to estimate the incremental costs of producing electricity under the requirements of proposed and final major EPA power sector rules. In Section 5.2 of this RIA, the EPA has also included an economy-wide analysis that considers additional facets of the economic response to the proposed action. This analysis includes estimates of the full resource requirements the power sector will no longer be required to spend as a result of this proposed action, some of which were paid for through subsidies.

[7] The memorandum titled "Guidance Implementing Section 6 of Executive Order 14154, Entitled 'Unleashing American Energy'" is found here: https://www.whitehouse.gov/wp-content/uploads/2025/02/M-25-27-Guidance-Implementing-Section-6-of-Executive-Order-14154-Entitled-Unleashing-American-Energy.pdf

1.6 References

Marten, A., Schreiber, A., and Wolverton, A. (2024). *SAGE Model Documentation (2.1.1).* Washington, DC. https://www.epa.gov/environmental-economics/cge-modeling-regulatory-analysis.

OMB. (2003). *Circular A-4: Regulatory Analysis*. Washington DC. https://www.whitehouse.gov/wpcontent/uploads/legacy_drupal_files/omb/circulars/A4/a-4.pdf.

U.S. EPA. (2024a). *Guidelines for Preparing Economic Analyses (3rd edition)*. EPA-240-R-24-001. Washington, DC.

U.S. EPA. (2024b). *Regulatory Impact Analysis for the New Source Performance Standards for Greenhouse Gas Emissions from New, Modified, and Reconstructed Fossil Fuel-Fired Electric Generating Units; Emission Guidelines for Greenhouse Gas Emissions from Existing Fossil Fuel-Fired Electric Generating Units; and Repeal of the Affordable Clean Energy Rule*. EPA-452/R-24-009. Office of Air Quality Planning and Standards, Health and Environmental Impacts Division, Research Triangle Park, NC. https://www.regulations.gov/document/EPA-HQ-OAR-2023-0072-8913.

U.S. EPA Science Advisory Board. (2020). *Technical Review of EPA's Computable General Equilibrium Model, SAGE.* EPA-SAB-20-010. Washington, DC.

2 INTRODUCTION AND BACKGROUND

2.1 Introduction

In this action, the U.S. Environmental Protection Agency (EPA) is proposing to repeal all greenhouse gas (GHG) standards for fossil fuel-fired power plants. The EPA is proposing that the Clean Air Act requires it to make a finding that GHG emissions from fossil fuel-fired power plants contribute significantly to dangerous air pollution, as a predicate to regulating GHG emissions from those plants. The EPA is further proposing to make a finding that GHG emissions from fossil fuel-fired power plants do not contribute significantly to dangerous air pollution.[8] The EPA is also proposing, as an alternative, to repeal a narrower set of requirements that include the emission guidelines for existing fossil fuel-fired steam generating units, the carbon capture and sequestration/storage (CCS)-based standards for coal-fired steam generating units undertaking a large modification, and the CCS-based standards for new base load stationary combustion turbines.[9]

2.2 Purpose of RIA

In accordance with Executive Orders (E.O). 12866 and 13563, the guidelines of OMB Circular A-4, and *EPA's Guidelines for Preparing Economic Analyses* (U.S. EPA, 2024), the EPA prepared this RIA for this "significant regulatory action." This action is an economically significant regulatory action because it may have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities. This RIA addresses the regulatory compliance costs, emission impacts, and benefits of this proposed action. Additionally, this RIA includes information about potential impacts of the proposed action on electricity markets, employment, and markets outside the electricity sector.

[8] For more information on the proposal, see Section IV.A of the preamble for this proposed action.
[9] For more information on the alternative proposal, see Section V.A of the preamble for this proposed action.

2.3 Overview of Regulatory Impact Analysis

The starting point for the analysis in this RIA is the modeling conducted for the 2024 CPS RIA. The baseline from the 2024 CPS RIA reflected projected conditions without the CPS, and the final rules illustrative scenario from that RIA reflected projected conditions with the CPS. The comparison of these results showed the projected impact of the CPS. These impacts included evaluation of the benefits, costs, and certain impacts of compliance with an illustrative scenario titled Final Rules (final rules illustrative scenario), which represented compliance with the CPS. This RIA draws upon that analysis to provide estimates of the impacts of this proposed action.

2.3.1 Analysis from 2024 CPS RIA

2.3.1.1 Baseline

The "baseline" is a business-as-usual scenario that, in the context of this analysis, represents expected behavior in the power industry sector under market and regulatory conditions in the absence of a regulatory action. The baseline for the 2024 CPS RIA included numerous rules that had been finalized at the time of that analysis. The version of the IPM model used for the 2024 CPS RIA also included state and federal legislation affecting the power sector, including the Inflation Reduction Act of 2022 (IRA). The modeling documentation, available in the docket, includes a summary of all legislation reflected in that version of the model as well as a description of how that legislation is implemented in the model.[10]

Please see Section 3 of the 2024 CPS RIA for details of the baseline modeling. However, from the perspective of this proposed action, the 2024 CPS RIA is now in the baseline, and there are additional significant market and regulatory changes that have occurred since the 2024 CPS

10 IPM is a cost minimizing, perfect foresight, technology-rich partial equilibrium model. Because the model incorporates sector specific information, EPA finds the model useful in examining the likely effects of regulations on the power sector. Recognizing that complexity of such models may reduce public understanding of IPM, including how the model takes into account behavioral changes likely to occur in the power sector as well as the validity of the model projection (e.g., how well internal projection of natural gas price in IPM tracks the observed natural gas price), EPA works to increase transparency of the IPM model, facilitating public understanding of the strengths and limitations of the model in order to improve public discourse around its results. While the model is proprietary, it periodically undergoes peer reviews, which are available at: https://www.epa.gov/power-sector-modeling/ipm-peer-reviews, and EPA provides detailed documentation of model logic and input assumptions, available at: https://www.epa.gov/power-sector-modeling/2023-reference-case

RIA was developed. We have not updated the baseline for this proposed action to reflect these regulatory and other subsequent changes since the CPS was promulgated in 2024. Rather, we rely on the 2024 CPS RIA policy case analysis as the baseline for this action. Similarly, there may be other regulatory changes before the promulgation of this proposed action, and these too are not accounted for in the baseline for this action. These facts introduce important uncertainties in the analysis within this RIA. Because of these uncertainties, EPA commits to conducting additional analysis that incorporates these changes in the baseline. EPA will also consider whether to include a new air quality assessment to take into account potential changes in the energy market.

2.3.1.2 Years of Analysis

In the 2024 CPS RIA, the EPA evaluated the potential costs, benefits, and net benefits of the final rules illustrative scenario for the years 2024 to 2047 from the perspective of 2024, using the discount rates of two percent, three percent, and seven percent. In addition, the Agency presented an assessment of costs, benefits, and net benefits for specific snapshot years, consistent with historical practice. These snapshot years were 2028, 2030, 2035, 2040 and 2045. The Agency believed that these specific years were each representative of several surrounding years, which enabled the analysis of costs and benefits over the timeframe of 2024 to 2047. The year 2028 was the first year of detailed power sector modeling for the 2024 CPS RIA. However, because the Agency estimated that some monitoring, reporting, and recordkeeping (MR&R) costs would be incurred beginning in 2024, the EPA analyzed compliance costs in years before 2028. Therefore, while the MR&R costs analysis was presented beginning in the year 2024, the detailed assessment of costs, emissions impacts, and benefits began in the year 2028. The analysis timeframe concluded in 2047, as this was the last year that could be represented with the analysis conducted for the specific year of 2045.

2.3.2 Analysis in this RIA

2.3.2.1 Representing the Proposed Action with Modeling from the 2024 CPS RIA

In absence of updated baseline modeling for comparison to projections under this proposal, the compliance cost estimates presented in the 2024 CPS RIA are the EPA's best available estimate of the reduction of compliance costs under this proposal. Similarly, the projected emission changes of the CPS in the final rules illustrative scenario in the 2024 CPS RIA are the EPA's best available estimate of the emissions changes that will be reversed under this proposed action, along with associated benefits under this proposed action. We have also determined that these projected impacts are the Agency's best available estimate of the total projected impacts of the alternative proposal, as described in Section 3.2.1. Therefore, throughout this RIA we generally present one set of results for this proposed action unless otherwise noted.

2.3.2.2 Years of Analysis in this RIA

In this RIA, we evaluate the potential impacts of the proposed action using the present value (PV) of costs, benefits, and net benefits, calculated for the years 2026 to 2047, discounted to 2025. We estimate that 2026 is the first year for which MR&R costs would not be incurred under this proposed action, which is why the timeframe of this RIA begins in 2026. All other impact analyses begin in 2028, as in the 2024 CPS RIA. In addition, in Sections 3 and 4, the Agency presents the assessment for specific snapshot years of 2028, 2030, 2035, 2040 and 2045.

2.4 References

OMB. (2003). *Circular A-4: Regulatory Analysis*. Washington DC. https://www.whitehouse.gov/wpcontent/uploads/legacy_drupal_files/omb/circulars/A4/a-4.pdf.

U.S. EPA. (2024). *Guidelines for Preparing Economic Analyses (3rd edition)*. EPA-240-R-24-001. Washington, DC.

3 COMPLIANCE COSTS, EMISSIONS, AND ENERGY IMPACTS

3.1 Introduction

This section presents the projected regulatory cost impacts of this proposed action. Given that while Phase 1 of the NSPS requirements is in effect, the requirements on existing sources and Phase 2 of the NSPS are not yet in effect and in the absence of updated projections of the power sector under this proposed action compared to an updated baseline, this analysis assumes the costs of the CPS as previously estimated upon original promulgation will be cost reductions under this proposed action.

The cost estimates provided for this proposed action are presented in 2024 dollars, whereas those presented in the 2024 CPS RIA were presented in 2019 dollars.[11] Additionally, the cost estimates provided here reflect the period 2026 to 2047, whereas those provided in the 2024 CPS RIA reflected the period 2024 to 2047. The reduction in costs for this proposed action reflects the previously calculated change in the projected electric power system costs between the base case and the final rules illustrative scenario as presented in the 2024 CPS RIA.[12] These costs include the change in capital costs, variable costs, fixed costs, transmission costs, fuel costs, and MR&R costs[13] that are expected to not be incurred as a result of this proposed action.

3.2 Economic Impacts

As outlined in the 2024 CPS RIA, the projected changes in costs and emissions were derived using IPM, which is a system-wide, least-cost optimization model that projects EGU behavior across the geographically contiguous U.S.[14] IPM projects one possible combination of compliance outcomes under a given policy scenario. The change in production costs and

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[11] Values are adjusted to 2024 dollars using the annual GDP Implicit Price Deflator values in the U.S. Bureau of Economic Analysis' (BEA) NIPA Table 1.1.9, last revised February 27, 2025, which is available at https://apps.bea.gov/iTable/?reqid=19&step=3&isuri=1&1921=survey&1903=13.

[12] See Section 3 of the CPS RIA for a detailed description of the modeled policy.

[13] See Section 3 of the CPS RIA for a detailed discussion of the compliance cost impacts.

[14] 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. IPM considers the costs in all years in the planning horizon while reporting results only for model run years. For this analysis, IPM maps the calendar years 2028 and 2029 to run year 2028, calendar years 2030-31 to run year 2030, calendar years 2032-37 to run year 2035, calendar years 2038-41 to run year 2040, calendar years 2042-47 to run year 2045 and calendar years 2048-52 to run year 2050. For model details, please see Chapter 2 of the IPM documentation, available at: https://www.epa.gov/airmarkets/power-sector-modeling Please see Section 3 of the 2024 CPS RIA for detailed description of IPM scenarios modeled.

associated emissions consistent with the operation of the compliant generating portfolio capture the costs of installation and operation of controls needed to comply with a regulatory action, the costs of building and operating any new resources added to the grid, as well as costs associated with shifts in the production and bulk transmission of electricity and other compliance costs. These impacts are summarized in the following sections.

3.2.1 Representing the Proposed Action with Modeling from 2024 CPS RIA

The 2024 CPS RIA reflected a baseline that included the 2015 NSPS requirements. In other words, the representative generating portfolio under both the baseline and policy scenarios were compliant with the 2015 NSPS.[15] The 2015 NSPS set standards for new, modified, and reconstructed fossil fuel-fired steam generating units based on a highly efficient, supercritical pulverized coal EGU that implements post-combustion partial carbon capture and sequestration/storage technology. For new and reconstructed baseload combustion turbines the 2015 NSPS set standards based on efficient natural gas combined cycle (NGCC) technology and for non-baseload and multifuel-fired units the required use of lower emitting fuels.

Given a confluence of market trends, most notably declining natural gas prices and increasing renewable penetration, the 2015 NSPS requirements have been largely non-binding. The relative economics of coal-fired generation have remained challenging as evidenced by continued retirement, while investors have an incentive to build the most efficient NGCC units possible in order to minimize fuel costs – i.e., building EGUs that are compliant with the 2015 NSPS. Simple cycle turbines are designed to operate more infrequently, resulting in operation that tends to remain below the baseload threshold as defined in the 2015 NSPS.

While demand growth is projected to be higher under the baseline presented in the 2024 CPS RIA than over the prior ten years, a combination of greater renewable penetration (driven by both incentives under the IRA as well as improving cost and performance characteristics over the period) and lower natural gas prices continue to weaken the relative economics of coal-fired EGUs, while capacity factors for the natural gas fleet are projected to decline over the period. In

[15] "Standards of Performance for Greenhouse Gas Emissions From New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units", (80 FR 64510; October 23, 2015) (2015 NSPS) codified in 40 CFR part 60, subpart TTTT.

other words, market forces are leading to compliance with the 2015 NSPS, and this proposed action is not expected to result in any changed decisions or compliance costs changes.

Phase 1 of the NSPS in the CPS requires an efficient generation standard of 800 lbs. CO_2/MWh-gross for baseload combustion turbines operating above a 40 percent capacity factor, 1,170 lbs. CO_2 /MWh-gross for intermediate load combustion turbines operating between a 20 to 40 percent capacity factor, and 160 lbs. CO_2/MMbtu for low load combustion turbines operating at below a 20 percent capacity factor. Within the modeling of the 2024 CPS RIA, performance assumptions taken from the Annual Energy Outlook (AEO) 2023 resulted in new combustion turbine build options that can comply with the standards. Since the generating portfolio under both the baseline and final rules illustrative scenario in the 2024 CPS RIA is compliant with the phase 1 standards, the final rules illustrative scenario modeling is representative of the alternative proposal in this proposed action. This is true even though phase 1 of the CPS remains in the alternative proposal of this action but is not explicitly modeled as part of the baseline scenario of the 2024 CPS RIA.

3.2.2 Emissions Changes Assessment

Table 3-1 shows the total EGU annual emissions of CO_2 in the 2024 CPS RIA and the emissions changes of this proposed action. Positive values for the emission changes column reflect emissions increases.

Table 3-1 EGU Annual CO_2 Emissions and Emission Changes (million metric tons)[16]

Annual CO_2	Total Emissions		
(million metric tons)	Baseline with CPS	Proposed Action	Emissions Change
2028	1,121	1,159	38
2030	1,048	1,098	50
2035	601	724	123
2040	406	459	54
2045	265	307	42

[16] This analysis is limited to the geographically contiguous lower 48 states.

Table 3-2 shows the total EGU annual emissions of NO_x, $PM_{2.5}$, Hg and SO_2 in the 2024 CPS RIA, and the emissions changes of this proposed action. Positive values for the emission changes column reflect emissions increases.

Table 3-2 EGU Annual Emissions and Emissions Changes for NO_X, SO_2, Hg, and $PM_{2.5}$, and Ozone Season NO_X

Annual NO_X	Total Emissions		
(Thousand Tons)	Baseline with CPS	Proposed Action	Emissions Change
2028	441	461	20
2030	374	393	20
2035	210	259	49
2040	166	173	6
2045	83	107	24
Ozone Season NO_X[a]	**Total Emissions**		
(Thousand Tons)	**Baseline with CPS**	**Proposed Action**	**Emissions Change**
2028	183	189	6
2030	168	175	7
2035	100	119	19
2040	82	88	6
2045	45	59	14
Annual SO_2	**Total Emissions**		
(Thousand Tons)	**Baseline with CPS**	**Proposed Action**	**Emissions Change**
2028	420	454	34
2030	313	334	20
2035	150	240	90
2040	139	143	4
2045	13	55	41
Annual Mercury	**Total Emissions**		
(Tons)	**Baseline with CPS**	**Proposed Action**	**Emissions Change**
2028	3.0	3.1	0.1
2030	2.8	2.9	0.1
2035	2.4	2.5	0.1
2040	2.3	2.0	-0.2
2045	1.2	1.4	0.2
Direct $PM_{2.5}$	**Total Emissions**		
(Thousand Tons)	**Baseline with CPS**	**Proposed Action**	**Emissions Change**
2028	69	71	2
2030	65	66	2
2035	49	51	1
2040	39	37	-2
2045	22	24	2

[a] Ozone season is the May through September period in this analysis.

3.2.3 Monitoring, Reporting, and Recordkeeping Costs

In this RIA, we estimate that 2026 is the first year for which MR&R costs would be reduced under this proposed action. Under the proposal, the estimated MR&R costs are the sum of MR&R costs for the CPS and the 2015 NSPS that would be reduced with the proposed repeal of these rules. The MR&R cost reductions associated with repealing the CPS are estimated to be equivalent to the MR&R costs as found in Section 3.3 of the 2024 CPS RIA. The MR&R cost reductions associated with repealing the 2015 NSPS are estimated to be equivalent to those in the Information Collection Request for the 2015 NSPS, with an analysis assumption that these costs continue through 2047. Table 3-3 presents a summary of the MR&R costs. For details on these estimates made for purposes of this economic analysis, see the associated spreadsheet in the docket titled *PV EAV and Net Benefits Analysis – 2025 Proposed Action.xlsx*.

Table 3-3 Summary of State and Industry Annual Respondent Cost of Reporting and Recordkeeping Requirements (million 2024 dollars)

	2015 NSPS			2024 CPS					Total
				NSPS for New, Modified, and Reconstructed Fossil Fuel-Fired Electric Generating Units		EGs for Existing Fossil Fuel Fired Electric Generating Units		Total	
Year	Industry	State	Total	Industry	State	Industry	State		
2026	0.95	-	0.95	0.04	-	-	13	13	14
2027	1.0	-	1.0	0.08	-	-	-	0.08	1.1
2028	1.1	-	1.1	0.13	-	-	-	0.13	1.2
2029	1.2	-	1.2	0.17	-	-	-	0.17	1.3
2030	1.2	-	1.2	0.21	-	-	-	0.21	1.5
2031	1.3	-	1.3	0.25	-	-	-	0.25	1.6
2032	1.4	-	1.4	0.30	-	-	-	0.30	1.7
2033	1.5	-	1.5	0.34	-	-	-	0.34	1.8
2034	1.5	-	1.5	0.38	-	-	-	0.38	1.9
2035	1.6	-	1.6	0.42	-	-	-	0.42	2.0
2036	1.7	-	1.7	0.46	-	-	-	0.46	2.2
2037	1.8	-	1.8	0.51	-	-	-	0.51	2.3
2038	1.8	-	1.8	0.55	-	-	-	0.55	2.4
2039	1.9	-	1.9	0.59	-	-	-	0.59	2.5
2040	2.0	-	2.0	0.63	-	-	-	0.63	2.6
2041	2.1	-	2.1	0.68	-	-	-	0.68	2.7
2042	2.1	-	2.1	0.72	-	-	-	0.72	2.9
2043	2.2	-	2.2	0.76	-	-	-	0.76	3.0
2044	2.3	-	2.3	0.80	-	-	-	0.80	3.1
2045	2.4	-	2.4	0.84	-	-	-	0.84	3.2
2046	2.4	-	2.4	0.89	-	-	-	0.89	3.3
2047	2.5	-	2.5	0.93	-	-	-	0.93	3.4

Notes: Values have been rounded to two significant figures, and some are presented to no more than two decimal places. Values may not appear to add correctly due to rounding. These estimates are for purposes of the analysis in this RIA. For additional information, please see the spreadsheet in the docket titled *PV EAV and Net Benefits Analysis – 2025 Proposed Action.xlsx*.

The difference in the estimated MR&R costs between the proposal and alternative proposal is the 2015 NSPS costs, which are avoided costs under the proposal but not the alternative proposal. This difference is less than $3 million in any year, as shown in Table 3-3. These values are smaller than the rounding throughout the total table at the end of this section (Table 3-7) and the net benefit tables in Section 6.

3.2.4 Compliance, Real Resource, and Social Cost Estimates

The CPS was projected to incur significant compliance costs that are no longer necessary as a result of this proposed action and therefore reflect a reduction in costs in PV and EAV terms. Table 3-4 presents these changes in costs for the representative IPM run years 2028, 2030, 2035, 2040, and 2045 in real 2024 dollars. A negative cost reflects a projected reduction in compliance cost expenditures as a result of this proposed action, while a positive cost denotes an increase. Additionally, annualized costs are presented for the periods 2026 to 2042 and 2026 to 2047 in 2024 dollars. Costs for these periods are annualized using IPM's real discount rate of 3.76 percent and exclude costs for years outside of each of the respective multiple-year time periods.[17] For a detailed description of these cost trends, please see Section 3 of the 2024 CPS RIA.

Table 3-4 National Power Sector Costs (billion 2024$)

2026 to 2042 (Annualized)	-0.58
2026 to 2047 (Annualized)	-1.14
2028 (Annual)	1.56
2030 (Annual)	0.27
2035 (Annual)	-1.54
2040 (Annual)	-0.71
2045 (Annual)	-4.02

IPM provides the EPA's best estimate of the change in costs due to the proposed action to the electricity sector and related energy sectors (i.e., natural gas, coal mining). The projected change in the IPM system cost shown in Table 3-4 is the change in costs paid by the power sector as a result of the EPA actions analyzed in the 2024 CPS RIA. The projected change in IPM system cost includes the cost of additional resources that are used by the sector because of the regulation, such as the cost of additional generation equipment, pollution controls, labor,

[17] The objective function of IPM minimizes the present value of system costs, and a discount rate is used in IPM to convert all future costs to a present value. The private discount rate adopted for modeling investment behavior should reflect the rate at which investors are willing to invest in the sector. For a general discussion of the risk and temporal preferences, tax treatments, and costs of borrowing that inform discount rates, Section 6.4 of the EPA's *Guidelines for Preparing Economic Analyses* (U.S. EPA, 2024a). The real discount rate used in EPA's Power Sector Modeling Platform 2023 Using the Integrated Planning Model, 3.76 percent, equals the real weighted average after-tax cost of capital for various ownership types and technologies. The discount rate used in EPA's modeling is invariant over time. For more information, see Chapter 10 of the *Documentation for EPA's Power Sector Modeling Platform 2023 Using the Integrated Planning Model 2023 Reference Case*, available in the docket (U.S. EPA, 2024b). The private discounting used in IPM to simulate industry behavior differs from the social discounting used to estimate the social net benefits of the regulatory action. The social discount rates used in the net benefits analysis in this RIA reflect the intertemporal preferences of society as a whole, with 3 percent representing the consumption rate of interest and 7 percent representing the social opportunity cost of capital (OMB Circular A-4 (2003), and Section 6.2 of the EPA *Guidelines* (2024a)). As discussed in Section 5.2.1, the discount rate in SAGE varies over time and household depending on intertemporal consumption preferences. The social costs estimates from SAGE apply a discount rate of 4.5 percent, which is consistent with the internal discount rate and average capital rate in the model.

materials, fuel, transport, and storage costs. These "real resources" constitute the additional physical and labor inputs the sector purchases because of the regulation.

The projected change in system cost also accounts for changes in tax and subsidy payments, financing charges for new capital, and insurance. For example, when IPM projects that a new generator will be built, the system cost accounts for the cost to purchase and install and operate the generator as well as the cost to finance the generator and expected taxes and insurance that will be paid on the investment. The system cost also accounts for any production and investment subsidies or tax credits that may offset expenditures on real resources.

Most tax, tax credits, and subsidy payments are transfers (OMB, 2003; U.S. EPA, 2024a).[18] Transfers are shifts in money or resources from one part of the economy (e.g., a group of individuals, firms, or institutions) to another in a way that does not affect the total resources that are available to society. In other words, the loss to one part of the economy is exactly offset by the gain to another. Transfers should be excluded from estimates of the benefits and costs of a regulatory action (Ibid). There are two important sources of tax-related transfers accounted for in the IPM system cost analysis for the 2024 CPS rule: taxes and tax credits on the production and investment of generating resources and air pollution control equipment, such as federal and state income taxes, and the tax credit for sequestration of carbon dioxide.[19]

[18] See "The Difference between Costs (or Benefits) and Transfer Payments" in OMB (2003) and sections 6.4.2 and 8.2.2.2 of U.S. EPA (2024a).

[19] See Chapters 6 and 10 of the IPM documentation (U.S. EPA 2024b). The total value of the transfer associated with taxes accounts for the revenue forgone due to any tax credits (i.e., the value equals the total change in net tax payments). Certain credits may be limited by the total tax obligation of reporting entities or the ability to transfer them to other entities. The IPM analysis in this RIA assumes that the full value of any credits is not limited by total tax obligation of reporting entities or their ability to transfer their value.

Table 3-5 Real Resource Costs Avoided under the Proposed Action (billion 2024 dollars)

	[1] Change in IPM System Costs	[2] Change in Transfers: CO_2 Storage Tax Credits	[3] Change in Transfers: Production and Investment Taxes and Credits	[4] Change in Real Resource Costs
2028	1.63	-0.00	-0.12	1.75
2030	0.31	-0.18	-0.25	0.38
2035	-1.61	-7.52	-1.77	-7.38
2040	-0.70	-6.88	-1.54	-6.05
2045	-3.96	-0.00	-1.63	-2.34
3% Discount Rate				
PV (2026 to 2047)	-19.06	-52.33	-18.19	-53.32
EAV (2026 to 2047)	-1.20	-3.28	-1.14	-3.35
7% Discount Rate				
PV (2026 to 2047)	-9.57	-34.46	-11.11	-33.01
EAV (2026 to 2047)	-0.87	-3.12	-1.00	-2.98

Table 3-5 reports the changes in IPM system costs, transfers, and incremental real resource costs for each IPM model year.[20] The values in Table 3-5 are not incurred under the proposed action. To estimate the incremental resource costs of the CPS, we must identify the portion of the changes in IPM system costs that are due to net changes in production and investment taxes and credits for generation and tax credits for CO_2 storage (i.e., the 45Q tax credit).[21]

To start, Column 1 of Table 3-5 shows the change in IPM system costs (drawn from Table 3-4 in this RIA), which represents the expenditures that the power sector will not have to make as a result of the proposed action. Column 2 reports the projected change in the CO_2 storage tax credits paid *to* the electricity sector under the CPS rule and will not be paid under the proposed action. The total value of the tax credit for carbon storage is reported separately given its scale relative to the changes in the amount of the other transfers. Column 3 reports the other

[20] The IPM system cost in this table excludes changes in payments for energy transmission costs and capacity transfer costs (although the cost of operating reserve capacity is accounted for); this accounts for the difference in compliance cost values between those in Table 3-4 and those in Table 3-5. The change in real resource costs similarly in this table accounts for payments to capital amortized over the financing period of an investment at IPM's internal discount rate.

[21] It is not currently possible to separately report the changes in various investment and production taxes and credits as a result of the proposed repeal of the CPS. However, on net, the avoided taxes exceed the value of the avoided tax credits in those years where the proposed regulation decreases capital investment. (The converse is true in those years where the proposed regulation increases capital investment).

net tax-related transfers paid *by* the sector, which also will be avoided under the proposed action. The projected incremental change in real resource costs presented in Column 4 is calculated as the power system cost change plus the net change in CO_2 tax credits minus the net change in production taxes and tax credits. That is, Column 4 equals the sum of Columns 1 and 2 less Column 3. This is the estimate of the incremental real resource costs that will not be incurred as a result of the proposed action.

All capital costs in Column 4 are amortized at the private cost of borrowing over the assumed financing period (i.e., book life) of the capital investment. The financing period varies by technology and owner-type (Chapter 10, U.S. EPA 2024b).[22]

To estimate the change in social costs of this proposed action, the EPA used information from IPM as an input into the Agency's economy-wide computable general equilibrium model, SAGE. As described in Section 5.2.2.1, the inputs to the SAGE model matched both the real resource requirements for the expected compliance pathway and the impact of the IRA tax credits on the compliance expenditures for the electricity sector. To accomplish this, the real resource requirements that would have been paid for by the IRA tax credits are included in the avoided incremental costs of the CPS (i.e., the incremental costs exclude the production and investment taxes and credits) as similarly presented in Table 3-5.

Like the real resource cost analysis summarized in Table 3-5, the economy-wide analysis is a complement to the more detailed evaluation of sector costs produced by IPM. Both the real resource cost and SAGE analyses improve the characterization of regulatory costs by accounting for changes outside of the directly regulated sector. For example, the partial equilibrium IPM model accounts for impacts in the directly regulated electricity sector as well as the closely-related fuels sectors, but IPM does not account for impacts in the rest of the economy.

[22] Components of private financing costs may reflect omitted real resource costs. If this is the case, excluding these costs may lead to an underestimate of avoided real resource costs. For example, as discussed in Section 6.4.2 of U.S. EPA (2024a), an interest payment reflects a transfer between a borrower and a lender that would net out with social discounting. However, in some contexts, interest rates and insurance may account for risk and uncertainty, that, in expectation, reflect additional resource costs (e.g., actuarily fair insurance premia). Section 6.1.6.2 of U.S. EPA (2024a) cautions, *"While it is technically possible to adjust the discount rate to account for uncertainty, doing so may hide important assumptions and information about the relative effects of discounting and uncertainty from decision-makers. Uncertainty about future values should be treated separately when discounting."*

As shown below in Section 5.2, Table 5-3, the annualized reduction in social cost estimated in SAGE for the proposed action is approximately -$1.58 billion (2024 dollars) between 2026 and 2047 using a 4.5 percent discount rate that is consistent with the internal discount rate in SAGE. Under the assumption that compliance costs from IPM in 2056 continue until 2081, the equivalent annualized value for reduction in social costs in the SAGE model is -$1.81 billion (2024 dollars) over the period from 2026 to 2081 using the same discount rate. The change in social cost estimate reflects the combined effect of the rules' requirements and interactions with IRA[23] tax credits for specific technologies that are expected to see decreased use in response to the proposed action. We are currently not able to identify their relative roles. Note that SAGE does not currently estimate the change in social benefits and their effects on the economy from changing environmental quality. See Section 5.2 for more discussion on the economy-wide analysis with SAGE and estimates of private and social costs.

3.2.5 Impacts on Fuel Use, and Prices

The CPS may have had important energy market implications that will no longer occur as a result of this proposed action. Table 3-6 presents a variety of important national average energy market impacts that were projected for the final rules illustrative scenario in the 2024 CPS RIA (updated to 2024 dollars, where appropriate). The proposed action would reverse these potential impacts, so the signs on these projected impacts are the opposite from what they were in the 2024 CPS RIA.

The projected energy market and electricity retail rate impacts of the CPS are discussed more extensively in Section 3 of the 2024 CPS RIA, which also presents projections of power sector generation and capacity changes by technology and fuel type. The change in wholesale energy prices and the changes in power generation were projected using IPM. The change in

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[23] The Inflation Reduction Act of 2022 (IRA) contains tax credit provisions that affect power sector operations, which are incorporated into the IPM modeling. Details are included the IPM documentation. The Clean Electricity Investment and Production Tax Credits (provisions 48E and 45Y of the IRA) are described in more detail in Section 4 of the IPM documentation (U.S. EPA 2024b). The credit for Carbon Capture and Sequestration (provision 45Q) is described in Section 3. The impacts of the Zero-Emission Nuclear Power Production Credit (provision 45U) are reflected through modifying nuclear retirement limits, as described in Section 4 of U.S. EPA (2024b). The Credit for the Production of Clean Hydrogen (provision 45V) is reflected through the inclusion of an exogenously delivered price of hydrogen fuel, see Section 9 of U.S. EPA (2024b). The Advanced Manufacturing Production Tax Credit (45X) was reflected through adjustments to the short-term capital cost added for renewable technologies, see Section 4 of U.S. EPA (2024b). Documentation available at: https://www.epa.gov/power-sector-modeling

retail electricity prices reported Table 3-6 is a national average. The change in electricity retail prices were projected using outputs of IPM. The average regional electricity price is projected to decrease up to 6 percent or increase as much as 1 percent in 2035 as a result of the proposed action.

Table 3-6 National Impacts on Fuel Prices, Fuel Consumption, and Electricity Prices

		2028	2030	2035	2040	2045
Retail electricity prices (2024 mills/kWh)	Baseline with CPS	116	119	117	115	112
	Proposed Action	117	120	115	115	111
	Percentage Change (%)	0.7%	0.5%	-1.4%	-0.2%	-0.7%
Average price of coal delivered to the power sector (2024 $/MMBtu)	Baseline with CPS	1.8	1.9	1.9	1.9	1.1
	Proposed Action	1.9	1.9	1.9	1.9	1.7
	Percentage Change (%)	1.4%	1.1%	0.5%	-0.5%	31.6%
Coal production for power sector use (million tons)	Baseline with CPS	236	209	112	104	4
	Proposed Action	250	218	141	90	26
	Percentage Change (%)	6%	4%	21%	-15%	84%
Price of natural gas delivered to power sector (2024$/MMBtu)	Baseline with CPS	3.4	3.5	3.5	3.4	3.5
	Proposed Action	3.4	3.5	3.5	3.4	3.5
	Percentage Change (%)	1.5%	0.5%	-3.0%	-0.0%	-0.1%
Price of average Henry Hub (spot) (2024$/MMBtu)	Baseline with CPS	3.3	3.4	3.6	3.4	3.5
	Proposed Action	3.3	3.5	3.5	3.4	3.5
	Percentage Change (%)	1.6%	0.6%	-2.9%	-0.1%	-0.0%
Natural gas use for electricity generation (TCF)	Baseline with CPS	11	12	10	6	4
	Proposed Action	12	12	9	6	4
	Percentage Change (%)	1.0%	1.7%	-4.4%	-0.0%	-1.8%

3.2.6 Total Compliance Costs

Table 3-7 presents the undiscounted power sector generating costs, MR&R costs, and total costs of the proposed action for the 2026 to 2047 timeframe. Table 3-8 presents the present values (PVs) and equivalent annualized values (EAVs), calculated for the 2026 to 2047 timeframe.

Table 3-7 Total Costs of the Proposed Action (billion 2024 dollars, undiscounted)

	Power Sector Generating Costs [a]	Monitoring, Reporting, and Recordkeeping Costs [b]	Total Costs [b]
2026	-	-0.01	-0.01
2027	-	0.00	0.00
2028	1.6	0.00	1.6
2029	1.6	0.00	1.6
2030	0.3	0.00	0.27
2031	0.3	0.00	0.27
2032	-1.5	0.00	-1.5
2033	-1.5	0.00	-1.5
2034	-1.5	0.00	-1.5
2035	-1.5	0.00	-1.5
2036	-1.5	0.00	-1.5
2037	-1.5	0.00	-1.5
2038	-0.71	0.00	-0.71
2039	-0.71	0.00	-0.71
2040	-0.71	0.00	-0.71
2041	-0.71	0.00	-0.71
2042	-4.0	0.00	-4.0
2043	-4.0	0.00	-4.0
2044	-4.0	0.00	-4.0
2045	-4.0	0.00	-4.0
2046	-4.0	0.00	-4.0
2047	-4.0	0.00	-4.0

Notes: Values are undiscounted. Values have been rounded to two significant figures, and some are presented to no more than two decimal places. Values may not appear to add correctly due to rounding.
[a] The discount rate in IPM is 3.76 percent, as described in Section 3.
[b] While the MR&R costs differ slightly between the proposal and the alternative proposal, the difference is smaller than the rounding reflected here.

Table 3-8 Present Value and Equivalent Annualized Value Estimates of Costs (billion 2024 dollars, discounted to 2025) [a]

Power Sector Generating Costs [a]		Monitoring, Reporting, and Recordkeeping Costs [b]		Total Costs [b]	
PV	EAV	PV	EAV	PV	EAV
3% Discount Rate					
-19	-1.2	-0.05	-0.00	-19	-1.2
7% Discount Rate					
-9.6	-0.87	-0.03	-0.00	-9.6	-0.87

Notes: Values have been rounded to two significant figures, and some are presented to no more than two decimal places. Values may not appear to add correctly due to rounding.
[a] The discount rate in IPM is 3.76 percent, as described in Section 3.
[b] While the MR&R costs differ slightly between the proposal and the alternative proposal, the difference is smaller than the rounding reflected here.

3.2.7 References

OMB. (2003). *Circular A-4: Regulatory Analysis*. Washington DC. https://www.whitehouse.gov/wpcontent/uploads/legacy_drupal_files/omb/circulars/A4/a-4.pdf

U.S. EPA. (2024a). *Guidelines for Preparing Economic Analyses (3rd edition)*. EPA-240-R-24-001. Washington, DC. https://www.epa.gov/environmental-economics/guidelines-preparing-economic-analyses-3rd-edition

U.S. EPA. (2024b). *Documentation for EPA's Power Sector Modeling Platform 2023 Using the Integrated Planning Model 2023 Reference Case.* Washington, DC. https://www.epa.gov/system/files/documents/2025-02/epa-2023-reference-case.pdf

4 BENEFITS ANALYSIS

4.1 Introduction

In this section, we present the monetized health impact estimates associated with the emissions changes for the proposed action. The benefit estimates provided for this proposal are presented in 2024 dollars, whereas the benefits estimates presented in the 2024 CPS RIA were presented in 2019 dollars. Similar to Section 3, this section relies on the emissions changes produced for the 2024 CPS RIA analysis to assess the health impacts of the proposed action.

The 2024 CPS RIA provides a detailed discussion of the methods used to estimate the human health impacts of projected changes in the concentrations of $PM_{2.5}$ and ozone resulting from projected emissions changes under the rule. See Section 4 of the 2024 CPS RIA for details on quantifying $PM_{2.5}$ and ozone-related health benefits. Also, see Appendix B of the 2024 CPS RIA for additional details on the air quality modeling and analysis used to create $PM_{2.5}$ and ozone air quality surfaces as well as a presentation of the uncertainties and limitations associated with the methodologies. See also Section 6.4 for a brief discussion of these uncertainties and limitations.

Consistent with E.O. 14154 "Unleashing American Energy" (90 FR 8353, January 20, 2025) and the memorandum titled "Guidance Implementing Section 6 of Executive Order 14154, Entitled 'Unleashing American Energy'", the EPA did not monetize benefits associated with CO_2 emissions changes.[24] For a brief discussion of uncertainties and limitations associated with monetizing CO_2-related domestic climate benefits, see Section 6.4.

4.2 $PM_{2.5}$ and Ozone-Related Human Health Benefits

The 2024 CPS RIA estimated the human health benefits of the reduced exposure to $PM_{2.5}$ and ground-level ozone for the CPS by quantifying the number and economic value of avoided $PM_{2.5}$- and ground-level ozone-related premature deaths, illnesses, and related adverse effects. Under this proposed action, the $PM_{2.5}$ and ozone-related health benefits quantified in the 2024

[24] The memorandum titled "Guidance Implementing Section 6 of Executive Order 14154, Entitled 'Unleashing American Energy'" is found here: https://www.whitehouse.gov/wp-content/uploads/2025/02/M-25-27-Guidance-Implementing-Section-6-of-Executive-Order-14154-Entitled-Unleashing-American-Energy.pdf

CPS RIA are no longer expected. This RIA includes the estimates from the 2024 CPS RIA to quantify the number and economic value of the human health impacts from this proposed action.

The health impacts are derived from estimates originally provided in the 2024 CPS RIA that were calculated using a benefits transfer approach that adapts studies relating changes in $PM_{2.5}$ and ground-level ozone concentrations to incidences of premature death, illness, and related adverse effects that are then monetized using a valuation function. This benefits transfer approach makes it possible to assign a dollar value to the changes in $PM_{2.5}$ and ground-level ozone concentrations that cannot otherwise be directly valued. The 2024 CPS RIA used the Benefits Mapping and Analysis Program – Community Edition (BenMAP-CE) software program to conduct that analysis. For a full description of the methods used, see Section 4 of the 2024 CPS RIA and the BenMAP-CE technical support document titled *Estimating $PM_{2.5}$- and Ozone-Attributable Health Benefits: 2024 Update* (Health Benefits TSD) (U.S. EPA, 2024).

The EPA's methods for estimating health benefits due to changes in $PM_{2.5}$ and ground-level ozone concentrations were reviewed by an EPA Science Advisory Board (SAB) in 2023 (U.S. EPA Science Advisory Board, 2024). This SAB panel concluded that EPA's methods are "scientifically robust and appropriate for regulatory analyses". The panel made several recommendations for improvements, including valuing changes in nonfatal health risks with willingness-to-pay measures or broader measures of the cost of illness, using scenario-based demographic projections, and updating inputs into the calculation of the value of a statistical life.

To determine which $PM_{2.5}$ and ozone-related human health impacts to quantify using the BenMAP-CE model, the Agency consults the Integrated Science Assessment for Particulate Matter (PM ISA) (U.S. EPA, 2019), the Supplement to the ISA for Particulate Matter (U.S. EPA, 2022), and the Integrated Science Assessment for Ozone and Related Photochemical Oxidants (Ozone ISA) (U.S. EPA, 2020). Section 4.3.2 in the 2024 CPS RIA describes the process of selecting air pollution health endpoints to quantify. The Health Benefits TSD fully describes the Agency's approach for quantifying the number and value of estimated air pollution-related impacts as well as the demographic, health and economic data used, and our techniques for quantifying uncertainty.

Table 4-4 in the 2024 CPS RIA reports the $PM_{2.5}$ and ozone-related human health effects that were quantified and those that were not quantified in that RIA. Because the present analysis assumes that all estimated benefits reported for the final rule illustrative scenario in the 2024 CPS RIA will no longer occur for this proposed action, the $PM_{2.5}$ and ozone-related human health effects quantified in the 2024 CPS RIA are the same health effects relevant to this proposed action. Table 4-4 in the 2024 CPS RIA does not contain an exhaustive list of benefit categories that were not quantified. And, among the effects quantified, it was not always possible to quantify completely either the full range of human health impacts or economic values. Section 4.4 and Table 4-24 of the 2024 CPS RIA report other omitted health and environmental benefits expected from the emissions and effluent changes that would have resulted from that rule, such as health effects associated with NO_2 and SO_2, and welfare effects such as acidification and nutrient enrichment.

For more information on health impact functions, see Sections 4.3.3 and 4.4 of the 2024 CPS RIA and the Health Benefits TSD. For more information on the data inputs to the BenMAP-CE model that enable estimation of avoided adverse health effect incidence, see Section 4.3 of the 2024 CPS RIA.

Once incidence of avoided adverse health effects is estimated, BenMAP-CE calculates the expected economic value of the avoided deaths, illnesses, and related adverse effects using valuation functions. For a discussion of valuation functions, see Section 4.3.4 of the 2024 CPS RIA. For some health effects, such as hospital admissions, valuation functions use the cost of treating or mitigating the effect to economically value the health impact. For example, for the valuation of hospital admissions, the avoided medical costs are used as an estimate of the value of avoiding the health effects causing the admission. These cost-of-illness (COI) estimates generally (although not in every case) understate the true value of reductions in risk of a health effect. The COI estimates tend to reflect the direct expenditures related to treatment but not the value of avoided pain and suffering from the health effect.

Estimates of avoided premature mortalities due to this proposed action quantified using the described approach are provided in Table 4-1. Negative numbers indicate avoided premature mortalities that are estimated to no longer occur under this proposed action. The estimated number of reduced premature deaths in each year relative to the baseline is presented along with the 95 percent confidence interval. For the CPS, for a full list of the total count of avoided premature deaths, illnesses, and related adverse effects for each of the representative years 2028, 2030, 2035, 2040, and 2045, please refer to tables 4-5 to 4-14 in the 2024 CPS RIA.

Estimates of the economic value of the avoided premature deaths, illnesses, and related adverse effects are provided in Table 4-2. Ninety-five percent confidence intervals are also reported. Negative numbers indicate estimated $PM_{2.5}$ and ozone-related health benefits that will no longer occur under this proposed action. When estimating the value of improved air quality over a multi-year time horizon, the analysis applies population growth and income growth projections for each future year through 2047 and estimates of baseline mortality incidence rates at five-year increments. Two estimates of economic value are reported for each year and discount rate combination. These estimates were quantified using two different epidemiological estimates for the mortality impact of ozone and two different epidemiological estimates for the mortality impact of PM, as well as their sum. The smaller estimate reports the economic value of all avoided premature mortalities, illnesses, and related effects using a pooled short-term ozone exposure risk estimate based on Katsouyanni et al. (2009) and Zanobetti et al. (2008) and a small estimate of long-term $PM_{2.5}$ exposure mortality risk based on Wu et al. (2020). The larger estimate reports the same economic value but instead uses a long-term ozone exposure risk estimate based on Turner et al. (2016) and a high estimate of long-term $PM_{2.5}$ exposure mortality risk based on Pope et al. (2019). These estimates should not be thought of as representing lower and upper bounds. To see the economic value broken down by pollutant for each of the representative years, please see tables 4-15 to 4-20 in the 2024 CPS RIA. To see the annual stream of economic values discounted using 3 and 7 percent discount rates, see tables 4-22 and 4-23 in the 2024 CPS RIA. Please note that the 2024 CPS RIA provides estimates in 2019 dollars.

Table 4-1 Estimated $PM_{2.5}$ and Ozone-Related Avoided Premature Mortality [a]

	Ozone-related Avoided Premature Mortality [b]	$PM_{2.5}$-related Avoided Premature Mortality [c]
2028	-2.7 (-1.1 to -4.3) and -60 (-42 to -78)	-210 (-180 to -230) and -450 (-320 to -570)
2030	-2.7 (-1.1 to -4.3) and -60 (-42 to -78)	-140 (-120 to -150) and -290 (-200 to -360)
2035	-5.6 (-2.2 to -8.8) and -120 (-85 to -160)	-560 (-490 to -620) and -1,100 (-820 to -1,400)
2040	0.32 (0.50 to 0.13) and 7.0 (4.9 to 9.1)	11 (9.2 to 12) and 22 (16 to 28)
2045	-5.8 (-2.3 to -9.2) and -130 (-89 to -170)	-270 (-240 to -300) and -530 (-380 to -670)

[a] Values rounded to two significant figures. The two benefits estimates are separated by the word "and" to signify that they are two separate estimates. The estimates do not represent lower- and upper-bound estimates and should not be summed.
[b] The first ozone mortality estimate uses the pooled Katsouyanni et al. (2009) and Zanobetti et al. (2008) short-term ozone exposure risk estimate and the second ozone mortality estimate uses the Turner et al. (2016) long-term ozone exposure risk estimate.
[c] The first $PM_{2.5}$ mortality estimate uses the Wu et al. (2020) long-term $PM_{2.5}$ exposure mortality risk estimate and the second $PM_{2.5}$ mortality estimate uses the Pope et al. (2019) long-term $PM_{2.5}$ exposure mortality risk estimate.

Table 4-2 Estimated Economic Value of Avoided $PM_{2.5}$ and Ozone-Related Attributable Premature Mortality and Illnesses for the Proposed Action (95 percent confidence interval; billion 2024 dollars) [a]

	Discount Rate [b]	$PM_{2.5}$ and Ozone-Related Health Benefits [c, d]
2028	3%	-\$3 (-\$0.46 to -\$7.6) and -\$6.8 (-\$0.8 to -\$18)
	7%	-\$2.7 (-\$0.35 to -\$6.8) and -\$6 (-\$0.65 to -\$16)
2030	3%	-\$2.1 (-\$0.33 to -\$5.1) and -\$4.7 (-\$0.57 to -\$12)
	7%	-\$1.8 (-\$0.25 to -\$4.5) and -\$4.2 (-\$0.46 to -\$11)
2035	3%	-\$8 (-\$1.1 to -\$20) and -\$17 (\$-1.9 to -\$46)
	7%	-\$7.1 (-\$0.88 to -\$18) and -\$15 (-\$1.6 to -\$41)
2040	3%	\$0.17 (\$0.42 to \$0.024) and \$0.41 (\$1.1 to \$0.046)
	7%	\$0.15 (\$0.37 to \$0.019) and \$0.36 (\$0.97 to \$0.039)
2045	3%	-\$4.3 (-\$0.62 to -\$11) and -\$9.5 (-\$1.1 to -\$25)
	7%	-\$3.7 (-\$0.48 to -\$9.5) and -\$8.5 (-\$0.9 to -\$23)

[a] Values rounded to two significant figures. The two benefits estimates are separated by the word "and" to signify that they are two separate estimates. The estimates do not represent lower- and upper-bound estimates and should not be summed.
[b] Estimates represent sums of all future benefit streams discounted back to the scenario year (2028, 2030, 2035, 2040, or 2045) to account for lags in the onset of health effects. These estimates have not been discounted to 2025.
[c] The first estimate is the sum of ozone mortality estimated using the pooled short-term ozone exposure risk estimate and the Wu et al. (2020) long-term $PM_{2.5}$ exposure mortality risk estimate.
[d] The second estimate is the sum of the Turner et al. (2016) long-term ozone exposure risk estimate and the Pope et al. (2019) long-term $PM_{2.5}$ exposure mortality risk estimate.

Data, time, and resource limitations prevented the EPA from quantifying the estimated health impacts or monetizing estimated benefits for the 2024 CPS RIA associated with incremental changes in direct exposure to NO_2 and SO_2, independent of the role NO_2 and SO_2 play as precursors to $PM_{2.5}$ and ozone, as well as ecosystem effects, and visibility impairment that might result from emissions changes associated with compliance with the final requirements. While all health benefits and welfare benefits were not quantified, it does not imply that there were not additional benefits associated with reductions in human exposures to NO_2 or SO_2 and ecosystem exposure to air pollutants would have potentially resulted from emissions changes under the CPS.

Table 4-3 presents the undiscounted stream of annual monetized $PM_{2.5}$ and ozone-related health benefits and total benefits. Table 4-4 presents the present values (PVs) and equivalent annualized values (EAVs), calculated for the 2026 to 2047 timeframe.

Table 4-3 $PM_{2.5}$ and O_3-related Health Benefits (billion 2024 dollars, undiscounted) [a, b]

	Discount Rate	
	3%	7%
2026	-	-
2027	-	-
2028	-6.8	-6.0
2029	-6.9	-6.2
2030	-4.7	-4.2
2031	-4.8	-4.2
2032	-16	-14
2033	-16	-15
2034	-17	-15
2035	-17	-15
2036	-17	-16
2037	-18	-16
2038	0.39	0.35
2039	0.40	0.36
2040	0.41	0.36
2041	0.42	0.37
2042	-9.2	-8.2
2043	-9.3	-8.3
2044	-9.4	-8.4
2045	-9.5	-8.5
2046	-9.6	-8.6
2047	-9.7	-8.6
Non-Monetized Disbenefits		
From increases in HAP emissions and GHG emissions		
To water quality and availability		
To ecosystems from increases in emissions of CO_2, NO_X, SO_2, PM, and HAP		
From increases in exposure to ambient NO_2 and SO_2		
Decreased visibility (increased haze) from $PM_{2.5}$ emissions increases		

Notes: Benefits analysis begins in 2028.
[a] Values have been rounded to two significant figures. Values may not appear to add correctly due to rounding.
[b] The $PM_{2.5}$ and O_3-related health benefits estimates use the larger of the two benefits estimates presented in Table 4-1. Monetized health benefits include those related to public health associated with changes in $PM_{2.5}$ and ozone concentrations. The health benefits are associated with several point estimates.

Table 4-4 Present Value and Equivalent Annualized Value Estimates of $PM_{2.5}$ and O_3-related Health Benefits (billion 2024 dollars, discounted to 2025) [a, b]

3% Discount Rate		7% Discount Rate	
PV	**EAV**	**PV**	**EAV**
-130	-8.0	-76	-6.9

[a] Values have been rounded to two significant figures. Values may not appear to add correctly due to rounding.
[b] The $PM_{2.5}$ and O_3-related health benefits estimates use the larger of the two benefits estimates presented in Table 4-1. Monetized health benefits include those related to public health associated with changes in $PM_{2.5}$ and ozone concentrations. The health benefits are associated with several point estimates.

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5 SOCIAL COSTS AND ECONOMIC IMPACTS

This section discusses potential energy market impacts, economy-wide social costs and economic impacts, small entity impacts, and labor impacts associated with the proposed action. The social cost and economy-wide impacts are estimated using EPA's SAGE model. Note that SAGE does not currently estimate changes in emissions nor account for environmental impacts resulting from the proposed action. For additional discussion of impacts on fuel use and electricity prices, see Section 3.

5.1 Energy Market Impacts

The energy sector impacts presented in Section 3 of this RIA include potential changes in the prices for electricity (the change in retail electricity prices reported here is a national average across residential, commercial, and industrial consumers), natural gas, and coal resulting from the proposed action. Table 5-1 summarizes the impact of these potential changes on other markets. We refer to these changes as secondary market impacts.

The projected energy market and electricity retail rate impacts of the proposed action are discussed more extensively in Section 3 of the 2024 CPS RIA, which also presents projections of power sector generation and capacity changes by technology and fuel type.

Table 5-1 Summary of Certain Energy Market Impacts

	2028	2030	2035	2040	2045
Retail electricity prices	1%	-0%	-1%	-0%	-1%
Average price of coal delivered to the power sector	1%	1%	-0%	-0%	32%
Coal production for power sector use	6%	4%	21%	-15%	84%
Price of natural gas delivered to power sector	2%	-0%	-3%	-0%	-0%
Price of average Henry Hub (spot)	2%	1%	-3%	-0%	-0%
Natural gas use for electricity generation	1%	2%	-4%	-0%	-2%

5.2 Economy-wide Social Costs and Economic Impacts

This section analyzes the potential economy-wide impacts of the proposed action using a computable general equilibrium (CGE) model. CGE models are designed to capture substitution possibilities between production, consumption, and trade; interactions between economic sectors; and interactions between a policy shock and pre-existing market distortions, such as taxes that have altered consumption, investment, and labor decisions. As such, CGE models can provide insights into the effects of regulation that occur outside of the directly regulated sector because they are able to represent the entire economy in equilibrium in the baseline and under a regulatory or policy scenario. A CGE model can also be used to estimate the social cost of a regulation (or the social benefit of removing a regulation).[25]

For this analysis, we use version 2.1.1 of the EPA's SAGE (SAGE is an Applied General Equilibrium) model of the U.S. economy (Marten et al., 2024).[26] The SAGE model is a forward-looking, intertemporal CGE model that assumes that for some discrete period of time an economy can be characterized by a set of conditions in which supply equals demand in all markets (referred to as equilibrium). When the imposition of a regulation alters conditions in one or more markets, the SAGE model estimates a new set of relative prices and quantities for all markets that return the economy to a new equilibrium. The social cost of the regulation is estimated as the change in economic welfare in the post-regulation simulated equilibrium from the pre-regulation "baseline" equilibrium. Table 5-2 summarizes model dimensions (time periods, sectors, regions, representative households, and capital stocks). More details on the SAGE model including complete documentation, source code, and build-stream are available on the EPA's website.[27]

[25] As discussed in EPA's *Guidelines for Preparing Economic Analyses*, social costs are the total economic burden of a regulatory action (U.S. EPA, 2024). This burden is the sum of all opportunity costs incurred due to the regulatory action, where an opportunity cost is the value lost to society of any goods and services that will not be produced and consumed because of reallocating some resources towards pollution mitigation.

[26] To ensure that SAGE is consistent with economic theory and reflects the latest science, EPA initiated a separate SAB panel to conduct a technical review of SAGE, completed in August 2020 (U.S. EPA Science Advisory Board, 2020). Peer review of SAGE was in accordance with requirements laid out for a Highly Influential Science Assessment (HISA) consistent with OMB guidelines. The report included recommendations for refining and improving the model, including several changes that the SAB advised EPA to incorporate before using the model in regulatory analysis (denoted as Tier 1 recommendations by the SAB). These Tier 1 recommendations are incorporated into the model version used in this analysis (v2.1.1), as are several of the SAB's other medium- and long-run recommendations.

[27] https://www.epa.gov/environmental-economics/cge-modeling-regulatory-analysis

Table 5-2 SAGE Dimensional Details

Time Periods	Sectors	Census Regions	Households (income)	Capital Vintage
2016-2081	Agriculture, forestry, fishing, and hunting	Northeast	<30k	Extant
(5-year time steps)	Crude oil	South	30-50k	New
	Coal mining	Midwest	50-70k	
	Metal ore and nonmetallic mineral mining	West	70-150k	
	Electric power		>150k	
	Natural gas			
	Water, sewage, and other utilities			
	Construction			
	Food and beverage manufacturing			
	Wood product manufacturing			
	Petroleum refineries			
	Chemical manufacturing			
	Plastics and rubber products manufacturing			
	Cement manufacturing			
	Primary metal manufacturing			
	Fabricated metal product manufacturing			
	Electronics and technology manufacturing			
	Transportation equipment manufacturing			
	Other manufacturing			
	Transportation			
	Truck transportation			
	Services			
	Healthcare services			

5.2.1 Linking IPM Partial Equilibrium Model to SAGE CGE Model

The approach for linking the model outputs from IPM to SAGE model inputs is described in Section 5.2.3 of the 2024 CPS RIA and in Schreiber et al., (2023). IPM incremental costs are translated into the SAGE framework by: (1) mapping IPM model years to SAGE model years;[28] (2) mapping IPM regions to SAGE regions; (3) splitting delivered fuel costs to separate

[28] IPM year 2028 is mapped to SAGE model year 2026. Subsequent IPM years (2030-2055) are mapped to the SAGE model year that is one year later (2031-2056). Because SAGE has a longer time horizon than IPM (to 2081), IPM incremental costs in 2055 are expected to continue into the future and are mapped to SAGE model years 2061-2081. Due to this mapping methodology, the different timeframes of the models, and the internal discount rate in SAGE, the discounted value of the resource costs used as inputs to the SAGE model in this section may differ from the corresponding results in other sections of this RIA. For a final action, the EPA is considering an alternative mapping between IPM and SAGE model years in which the IPM inputs to SAGE are further adjusted to improve consistency in how the information from IPM is used as an input to SAGE.

transportation costs; (4) mapping variable operations and maintenance costs to specific inputs in SAGE according to the reference cost structure in the model; (5) attributing fixed operations and maintenance costs to labor; (6) attributing incremental costs on existing and new generation to production with extant and new capital, respectively;[29] and (7) removing taxes and other transfers from capital payments using the difference between the capital charge rate and the capital recovery factor to recover the real resource costs.

Because SAGE does not include an explicit representation of the Inflation Reduction Act of 2022 (IRA) in the baseline, the model linkage methodology must be adjusted to account for IRA investment and production tax credits (i.e., ITC/PTC and 45Q). We calibrate the model to match both the real resource requirements for the expected compliance pathway and the impact of the IRA tax credits on the compliance expenditure for the electricity sector. The SAGE model is closed by assuming the government budget is balanced through lump sum transfers with households. Aggregate changes in government budgets can occur in model simulations due to changes in the use of the IRA tax credits and changes in revenues from other taxes (e.g., output, capital, and labor) as the economy adjusts in response to the proposed rules.

5.2.2 Results

This section summarizes the estimated economy-wide impacts of the proposed action. SAGE model results include aggregate social costs, macroeconomic impacts, sectoral impacts, and distributional impacts. Note that SAGE does not currently estimate changes in emissions nor account for the effects of changes in environmental quality on the economy (i.e., the social benefits of reducing environmental externalities).

5.2.2.1 Economy-wide Social Costs

Table 5-3 presents the economy-wide, general equilibrium social costs of the proposed action, calculated as equivalent variation. In this context, equivalent variation is an estimate of the amount of money that society would be willing to pay to avoid the compliance requirements

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[29] Production with extant and new capital is not equivalent to differentiating existing and new generation in the IPM modeling framework. For example, the lifespan of existing generators in IPM can be extended through investments in ways that are not directly comparable to production with extant capital in the SAGE model. In this analysis, we attribute all incremental costs associated with existing generation to production with extant capital until 2051. Incremental costs on existing generation in model years after 2051 are levied on production with new capital.

of the proposed action, setting aside health, climate, and other benefits (quantified or described qualitatively elsewhere in the RIA). For comparison, Table 5-3 also presents the compliance costs estimated by IPM to be paid by the electricity sector for real resources – and which exclude all transfer payments – mapped to the SAGE model years. For both the compliance costs and the general equilibrium social costs, Table 5-3 presents the present value and annualized costs using a discount rate of 4.5 percent, which is consistent with the internal discount rates in the SAGE model. Compliance costs and transfer changes are presented as they are input into the SAGE model. Present value and equivalent annualized value estimates of the IPM inputs to SAGE reported in Table 5-3 are not comparable to those reported in Sections 3 or 6 and are provided here for transparency and as a point of comparison for the social cost estimates.

The annualized social cost estimated in SAGE for the proposed action is approximately -$1.58 billion (2024 dollars) between 2026 and 2047 using the 4.5 percent discount rate that is consistent with the internal discount rates in the model.[30] Under the assumption that the compliance costs from IPM in 2056 continue until 2081, the equivalent annualized value for social costs in the SAGE model is -$1.81 billion (2024 dollars) over the period from 2026 to 2081, again using a 4.5 percent discount rate. This social cost estimate reflects the combined effects of the proposed action and interactions with IRA tax credits for specific technologies that are expected to see decreased use in response to the proposed action. We are currently not able to identify their relative roles. See Section 5.2.4.1 of the 2024 CPS RIA for a discussion of the differences between social cost and compliance cost estimates.

[30] The SAGE model estimates the present value of costs (i.e., equivalent variation) for each representative household in the model and sums those estimates to calculate the present value of social costs. The present value of costs for a representative household is based on its calibrated intertemporal utility function and the equilibrium solution. Implicit in those estimates are endogenous discount rates that vary by household and over time. The intertemporal preferences of households are calibrated such that their average discount rate over the first 20 years of the model is consistent with a discount rate of 4.5 percent, which based on the effective marginal capital tax rate in the model, is consistent with a 7.0 percent social rate of return to capital. See Section 3.4 of the SAGE model documentation at https://www.epa.gov/environmental-economics/cge-modeling-regulatory-analysis.

Table 5-3 Compliance Costs, Transfers, and Social Costs (billion 2024 dollars)

SAGE Model Year	Compliance Costs - Input to SAGE (Excluding Transfers)	Change in Transfers - Input to SAGE	General Equilibrium Social Costs
2026	1.75	0.12	-1.37
2031	0.38	-0.07	-1.52
2036	-7.38	5.76	-1.65
2041	-6.05	5.34	-1.77
2046	-2.34	-1.63	-1.91
2051	-1.13	-0.59	-2.07
2056	-0.89	-1.17	-2.24
Present Value (2026 to 2047, 4.5%)	-31.67	28.71	-25.00
Equivalent Annualized Value (2026 to 2047, 4.5%)	-2.00	1.81	-1.58
Present Value (2026 to 2081, 4.5%)	-38.40	21.82	-40.58
Equivalent Annualized Value (2026 to 2081, 4.5%)	-1.72	0.98	-1.81

Notes: Social costs are calculated as equivalent variation. Present value and annualized cost estimates are calculated by interpolating between SAGE model years and use a discount rate of 4.5 percent, which is consistent with the internal discount rate in SAGE. Compliance costs and the change in the transfer amounts are calculated from the IPM outputs. Transfers include changes in tax payments on capital and production and investment tax credits (e.g., the 45Q tax credit). Negative transfer values reflect decreases in net additional payments out of the sector or increases in payments into the sector (e.g., subsidies) due to the proposed action. Incremental monitoring and reporting costs are not accounted for in this analysis. Compliance costs and transfer changes are reported as they are input into the SAGE model. Section 5.2.1 discusses assumptions on mapping IPM model years to SAGE model years. Present value and equivalent annualized value estimates are based on this mapping and are therefore not directly comparable to estimates in Sections 3 and 6.

Equivalent variation is a theoretically appropriate measure of social cost (U.S. EPA Science Advisory Board, 2017). However, equivalent variation by definition does not provide detail on how the social costs of a regulation are borne over time.[31] Changes in real full consumption, which is the value of changes in the consumption of goods, services, and leisure, better communicates the temporal evolution of impacts from a regulation. As a result, changes in full consumption may also more closely align with the temporal pattern of compliance costs in Table 5-3. Furthermore, the present value of this cost metric closely approximates equivalent variation. Changes in real full consumption has been used to approximate social cost in CGE models, for example with alternative expectations that constrain the intertemporal utility maximization problem (McKibbin and Wilcoxen, 1999). For these reasons, the EPA is considering presenting changes in full consumption from SAGE as an alternative point of

[31] See Table 5-3 note for how we allocated equivalent variation over time.

comparison to the (negative) social benefits of a regulation in future regulatory analyses to better reflect the temporal pattern of impacts and provide a better point of comparison to compliance cost estimates calculated over a limited time horizon.

5.2.2.2 Macroeconomic Impacts

The estimated percent change in real gross domestic product (GDP), or the real value of the goods and services produced by the U.S. economy, and its components are presented in Figure 5-1. GDP is defined as the sum of the value (price times quantity) of all market goods and services produced in the economy and is equal to Consumption (C) + Investment (I) + Government (G) + (Exports (X) – Imports (M)). The proposed action is estimated to decrease GDP in 2026 and 2031 by 0.015 percent and 0.020 percent due to decreases in near term investment, but subsequently increase GDP with a peak increase of 0.017 percent in 2036.[32]

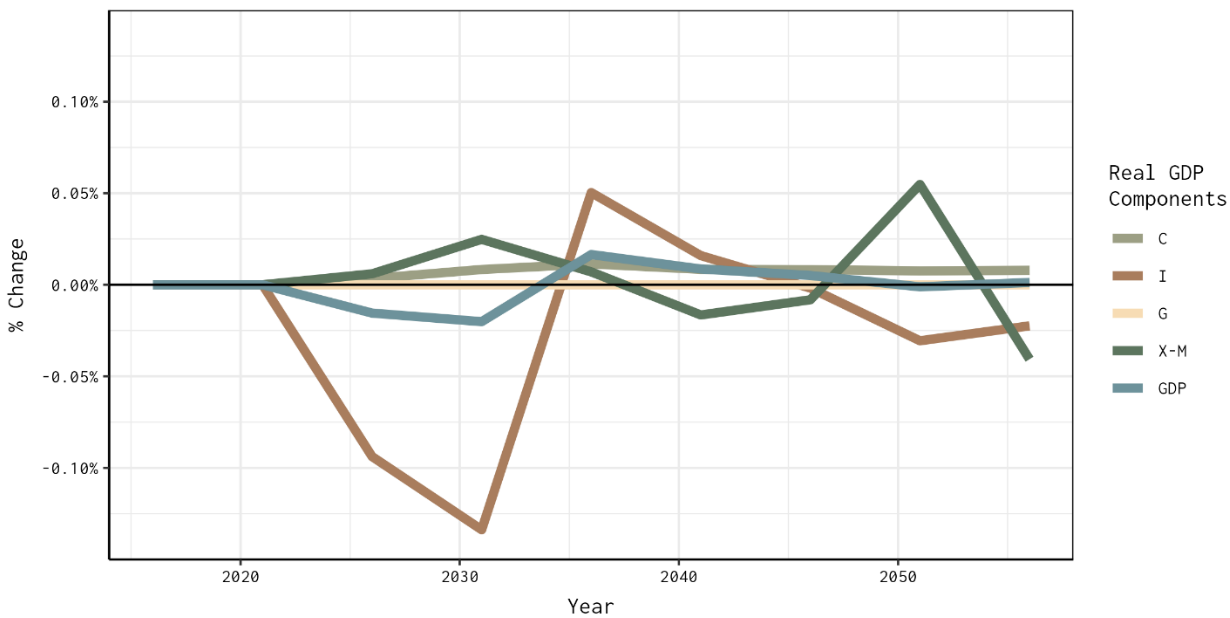

Figure 5-1 Percent Change in Real GDP and Components

[32] GDP is a measure of economic output and not a measure of social welfare. Thus, the expected social cost of a regulation will generally not be the same as the expected change in GDP (U.S. EPA, 2015). U.S. EPA Science Advisory Board (2017) notes: “GE models are strongly grounded in economic theory, which allows social costs to be evaluated using equivalent variation or other economically-rigorous approaches. Simpler measures, such as changes in gross domestic product or in household consumption, do not measure welfare accurately and are inappropriate for evaluating social costs.”

Figure 5-1 also reports changes in the components of GDP from the expenditure side. The proposed action is expected to decrease investments in the electricity sector, leading to a reduction in aggregate investment in 2026 and 2031 (0.09 percent and 0.13 percent, respectively). A reduction in investment reallocates resources toward consumption and as a result, the proposed action increases consumption throughout the model time horizon. Aggregate investment is expected to then increase and then fall again in later model years. The proposed action is also expected to impact the net trade balance, including a modest increase in net exports in the initial years through changes in domestic relative prices due to avoided compliance.

5.2.2.3 Sectoral and Labor Impacts

Figure 5-2 presents the percent change in output and real output prices for each sector in model years 2026, 2031, 2036, and 2041.[33] Changes in output reflect the estimated shifts in generation sources in addition to an economy-wide demand response to increases in electricity prices. Similarly, the estimated changes in sector output prices reflect compliance cost reductions associated with the proposed action as well as demand side increases in electricity use from both firms and households. As the price of electricity falls, the economy is expected to increase demand for electricity through a variety of pathways. Measured in terms of percent change from the baseline, output and price changes in the electricity, coal mining, and natural gas sectors are expected to be relatively larger than in other sectors of the economy. Modest output increases are estimated in some relatively more energy-intensive sectors (e.g., chemical manufacturing) and those that support coal use in the electricity sector (e.g., transportation), whereas output decreases in sectors associated with capital formation in 2026 and 2031 due to reductions in investments attributable to the proposed action.

Impacts to sectoral labor demand follows similar trends across sectors to changes in sectoral output. Labor demand impacts are relatively larger in the electricity, coal mining, and natural gas sectors, whereas labor demand responses in other sectors of the economy tend to be driven by increases in demand for labor in sectors that are more energy-intensive and reductions

[33] CGE models report prices in relative terms. We denominate output prices in terms of a consumer price index (CPI) internal to the SAGE model, which reflects the overall change in end-use prices for the bundle of goods demanded by households. Characterizing prices relative to this CPI allows a comparison of changes in the magnitude of output prices to overall trends in the economy (i.e., a percentage change that is positive reflects a price that increases more than the average price changes across the economy).

in sectors associated with capital formation. Figure 5-3 presents the percent change in select sectors for 2026, 2031, 2036, and 2041. Across model years, the percent change in total economy-wide labor demand ranges from -0.005 percent to 0.004 percent. As with many other CGE models, SAGE assumes an economy with full employment, meaning that the labor market in the model adjusts to the new equilibrium such that there is no involuntary unemployment (i.e., all workers that want to work at the new prevailing wage can find a job). Any net changes in employment levels are associated with voluntary changes in labor.[34] In contrast, Section 5.4 of this RIA characterizes employment impacts of the proposed action in the power and fuels sectors, providing detailed estimates by capacity and fuel type, without accounting for changes in prices, wages, and interactions with other sectors in the economy.

[34] While SAGE does not capture any near-term transition dynamics in the labor market, recent economics research suggests that they likely are a small component of overall welfare costs of environmental regulation (Rogerson 2015; Hafstead and Williams 2018).

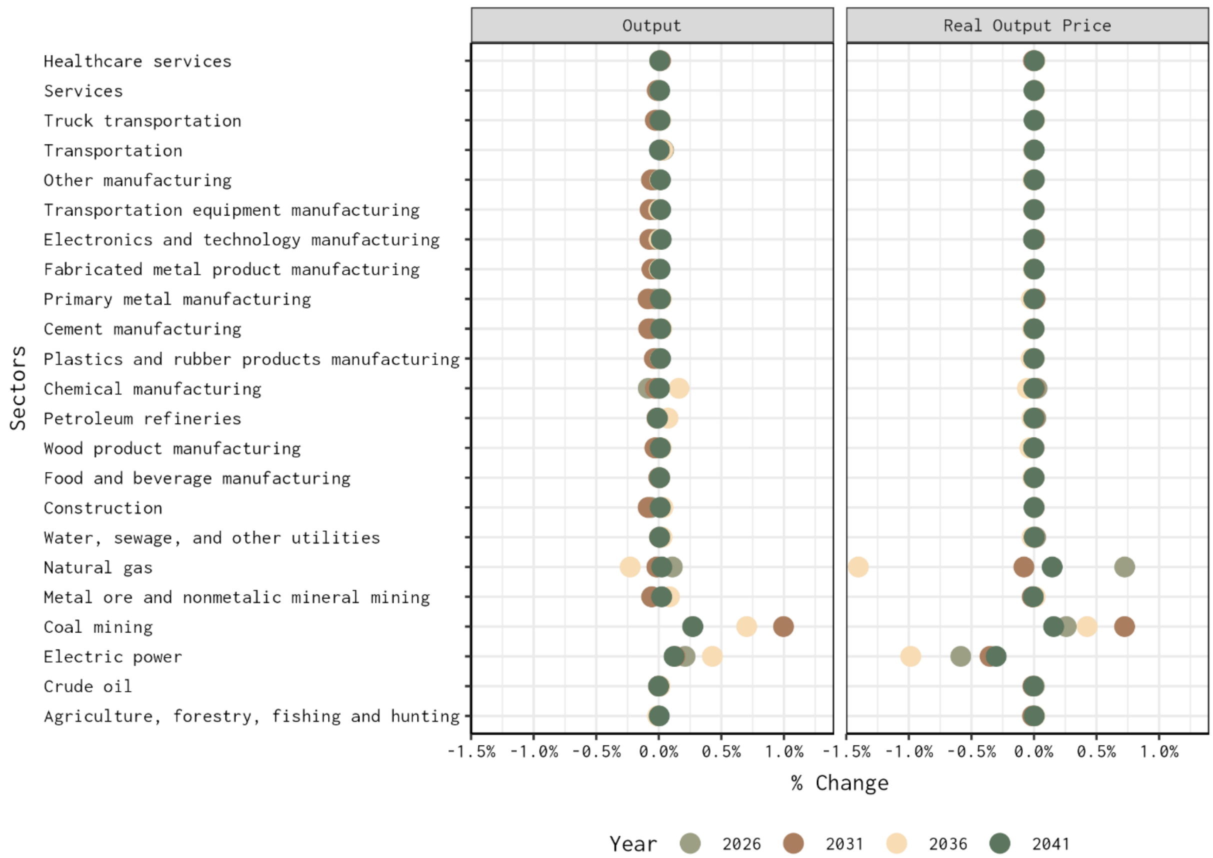

Figure 5-2 Percent Change in Sectoral Output and Real Output Prices

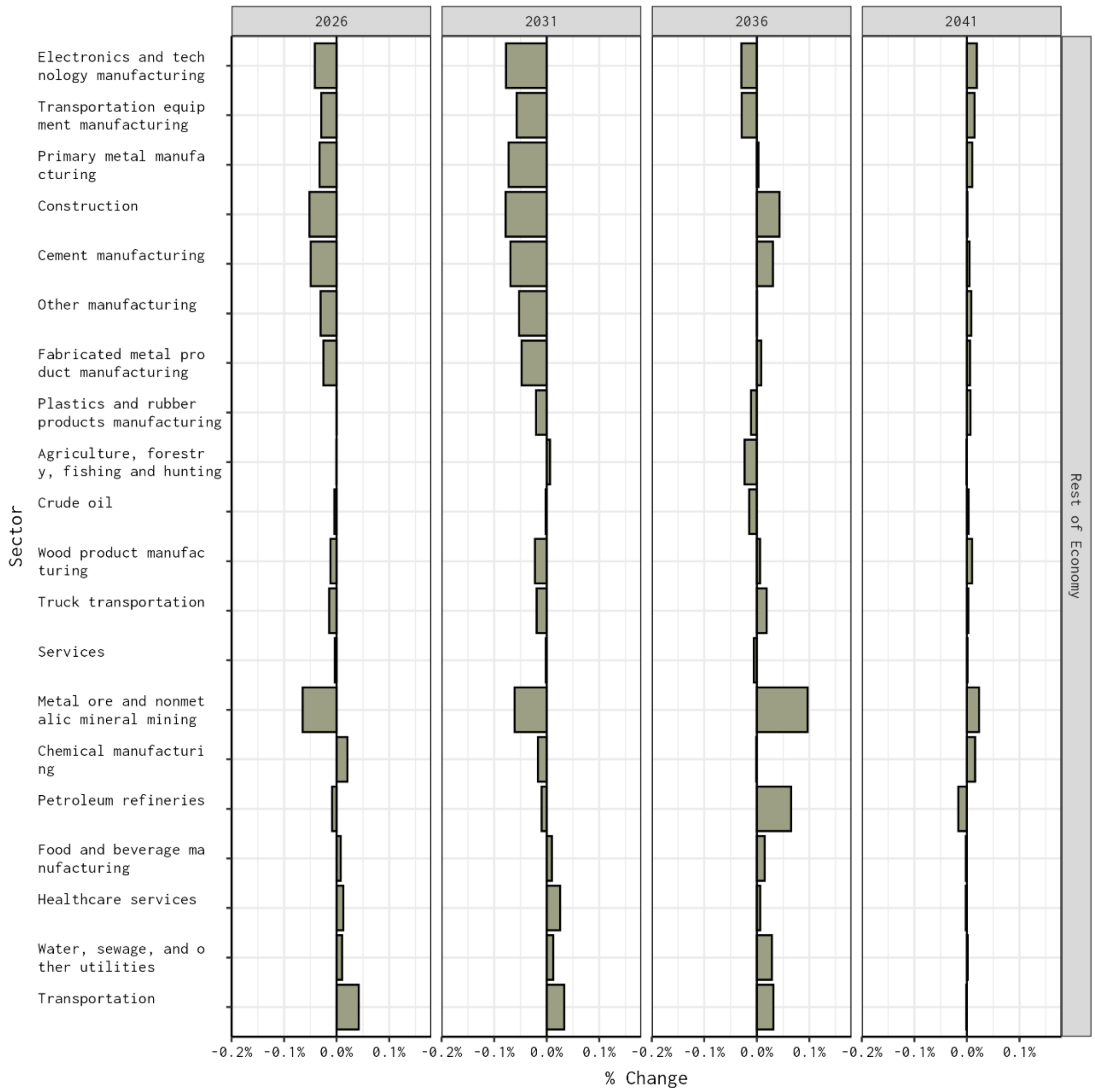

Figure 5-3 Percent Change in Labor Demand in Select Sectors

5.2.2.4 Distributional Impacts

The social costs of regulation are ultimately borne by households through changes in final goods prices or changes in labor, capital, and resource income. For model years, overall consumer prices are expected to fall by 0.01 percent to 0.03 percent. The SAGE model also characterizes representative households by income quintiles in each of the four Census regions. This allows the social costs to be separately estimated across the income distribution and for different regions of the country, as presented in Figure 5-4.[35] In general, avoided household social costs are expected to increase with income. Estimates in Figure 5-4 reflect a combined effect of the proposed action requirements and interactions with IRA subsidies that are expected to see decreased use in response to the proposed action.[36]

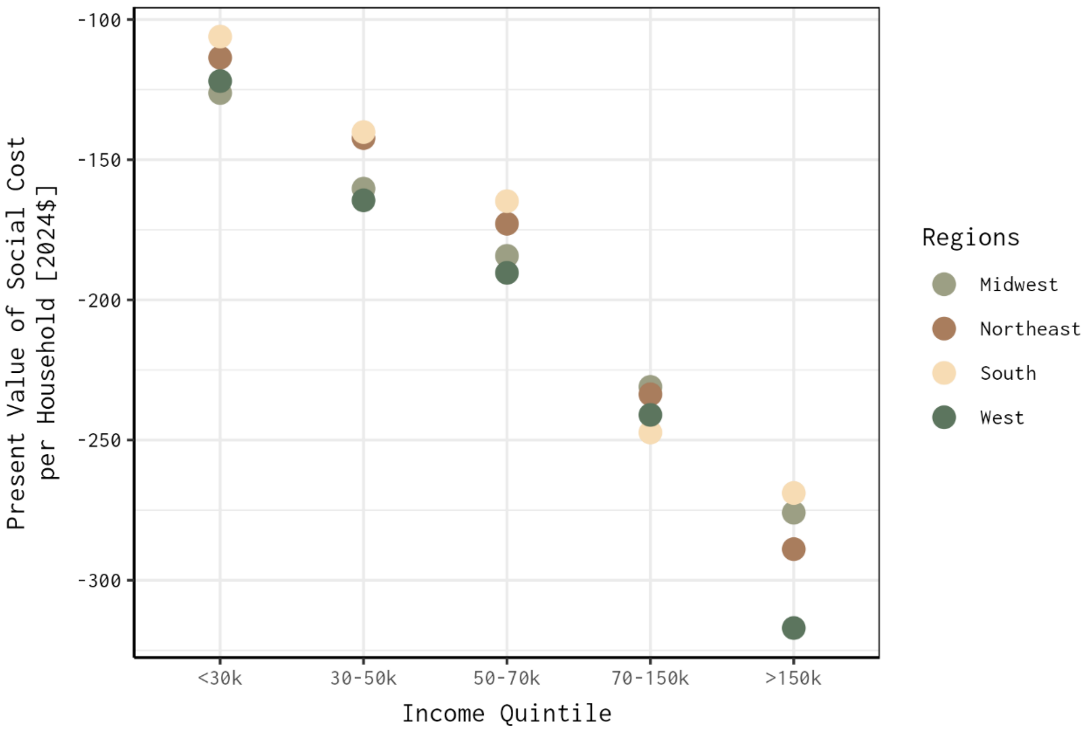

Figure 5-4 Distribution of General Equilibrium Social Costs

SAGE's representation in the incidence of regulatory changes on domestic households is affected by its ability to distinguish between the sources and uses of income for domestic and foreign consumers and asset owners. For example, SAGE distinguishes between domestic and foreign asset owners of government debt (e.g., bonds) and thus the change in the value of debt

[35] Distributional cost estimates are calculated for the period 2025 to 2047 and divided by the total number of households of a given income quintile and region using 2016 estimates from the Census' Current Population Survey.

[36] A regulation may affect the value of government expenditures through relative prices of goods and services purchased by the government. In addition, it may affect tax revenues through impacts on the value of the base for ad valorem taxes (e.g., labor and capital taxes). In these cases, a CGE model must implement a closure rule to ensure that the government has the funds necessary to support its expenditures. A common assumption in CGE models is to balance the government's budget through lump sum transfers between households and the government as a non-distortionary approach to closing the model. This is the approach used in the SAGE model. Given uncertainties in the accounting for the IRA subsidies in this analysis, we are unable to determine the relative role of this effect in the distributional estimates at this time.

due to a regulation. It further represents the effects of trade on income earned in the U.S. and the costs of goods and services to domestic households. However, SAGE does not distinguish between the ownership of physical capital in the U.S. between domestic and foreign investment by sector. SAGE also does not account for how the value domestic owned assets outside the U.S. may be affected by a regulatory change. Further refining how changes in U.S. regulation affect the welfare of domestic households in SAGE is an area of ongoing work.

5.2.3 Limitations

The SAGE model and methodology for aligning IPM outputs for use as inputs in SAGE reflect the best available science for conducting economy-wide modeling of the proposed action. However, both the use of SAGE in a regulatory analysis and the framework for linking IPM with the SAGE model are subject to uncertainty and limitations. See Section 5.2.5 of the 2024 CPS RIA for an overview of these potential limitations.

5.3 Small Entity Analysis

As outlined in Section 5 of the 2024 CPS RIA, the EPA assessed the impact of the 2024 CPS on small entities by using the ratio of compliance costs to the value of revenues from electricity generation, focusing in particular on entities for which this measure is greater than 1 percent. Of the 14 entities that own NGCC units considered in this analysis, three were projected to experience compliance costs greater than or equal to 1 percent of generation revenues in 2035 and none were projected to experience compliance costs greater than or equal to 3 percent of generation revenues in 2035. This proposed action will no longer require these compliance costs and will therefore not have a significant economic impact on a substantial number of small entities.

5.4 Labor Impacts

5.4.1 Overview of Methodology

See the 2024 CPS RIA and the U.S. EPA Methodology for Power Sector-Specific Employment Analysis in the docket for a detailed overview of the methodology followed for this analysis, including all underlying assumptions and the types of employment represented. This analysis is a complement to the economy-wide analysis presented in Section 5.2 of the 2024 CPS

RIA using the SAGE model, which projects medium- to long-run shifts in the expected use of labor across aggregate sectors as a result of those rules.

5.4.2 Overview of Power Sector Employment

Employment in electric power generation, as well as coal and natural gas extraction, is the focus of this analysis using available data. Other segments not discussed here include the extraction or production of other fuels (e.g., hydrogen), energy efficiency, transmission, and distribution. To contextualize the analysis, this section presents national data from the 2020 United States Energy and Employment Report (USEER), which reports employment data from 2019. See Section 5.4.2 of the 2024 CPS RIA for an explanation on the importance of using this data instead of data from more recent years.

In 2019, the electric power generation sector employed nearly 900,000 people. Relative to 2018, this sector grew by over 2 percent. Job losses related to nuclear and coal generation were offset by increases in employment related to other generating technologies, including natural gas, solar, and wind. The largest component of total 2019 employment in this sector was construction (33 percent). Other components of the electric power generation workforce include utility workers (20 percent), professional and business service employees (20 percent), manufacturing (13 percent), wholesale trade (8 percent), and other (5 percent). In 2019, jobs related to solar and wind generation represented 31 percent and 14 percent of total jobs, respectively, and jobs related to coal generation represented 10 percent of total employment.

In addition to generation-related employment, we also look at employment related to coal and natural gas in the electric power sector. In 2019, the coal industry employed about 75,000 workers. Mining and extraction jobs represented most coal-related employment in 2019 (74 percent). Likewise, about 60 percent of the 276,000 jobs in the 2019 natural gas fuel sector were related to mining and extraction.

5.4.3 Projected Sectoral Employment Changes

Electric generating units subject to the proposed action will not implement various GHG mitigation measures originally projected under the modeling of the 2024 CPS RIA. See Section 3.6.3 of the 2024 CPS RIA for more details on these power sector modeling projections.

Based on these power sector modeling projections, we estimate a reduction in 7,900 construction-related job-years related to the reduced installation of new pollution controls under the proposed action in 2030 and a reduction of 10,200 construction-related job-years for the reduction of new pollution controls in 2035. We estimate a reduction of 45,300 job-years in 2028 related to the reduction of constructed new capacity in that year, and a reduction of approximately 181,300 construction-related job-years in 2035 related to the reduction of constructed battery storage systems. In 2030 and 2040, however, we estimate increases of 21,000 construction-related job-years and 107,500 construction-related job-years, respectively.

The changes in the year-over-year results primarily from relatively small temporal changes in the projected deployment of renewable energy and battery storage capacity in the modeling. Of note is that the employment factors related to battery storage are relatively high and relatively uncertain, as it is a relatively new technology for which there is limited data to base assumptions. Without including battery storage in the total estimate, we estimate the proposed action to result in decreases in 2028, 2030, 2035, and 2045 of 46,100, 7,300, 18,300, and 42,600 job-years, respectively, related to the decreased construction of new capacity in those years and an increase of 11,300 job-years in 2040.

Construction-related job-year changes are one-time impacts, occurring each year of the multi-year periods during which construction of new capacity is completed. Construction-related figures in Table 5-4 represent a point estimate of incremental changes in construction jobs for each year (e.g., for a three-year construction projection, this table presents one-third of the total jobs for that project).

Table 5-4 Changes in Labor Utilization: Construction-Related (number of job-years of employment in a single year

	2028	2030	2035	2040	2045
New Pollution Controls	<100	-7,900	-10,200	<100	<100
New Capacity	-45,300	21,000	-181,300	107,500	-41,800

Note: These values describe changes under the proposed action relative to a projected baseline. A large share of the construction-related job years is attributable to construction of battery storage, a relatively new technology on which there is limited data to base labor assumptions.

We also estimate changes in the number of job-years related to recurring non-construction employment. Recurring employment changes are job-years associated with annual recurring operating, maintenance, and fuel extraction jobs. Newly built generating capacity creates a recurring stream of positive job-years, while retiring generating capacity and avoiding capacity builds create a stream of negative job-years. The proposed action is projected to generally forgo or delay the replacement of relatively labor-intensive coal capacity with less labor-intensive capacity, which results in an overall increase of non-construction jobs between 2028 and 2045. The total net estimated increase of recurring employment in any given analysis year is a small percentage of total 2019 power sector employment reported in the 2020 USEER (approximately 900,000 generation-related jobs, 75,000 coal-related jobs, and 276,000 natural gas-related jobs). Table 5-5 provides detailed estimates of recurring non-construction employment changes.

Table 5-5 Changes in Labor Utilization: Recurring Non-Construction (number of job-years of employment in a single year)

	2028	2030	2035	2040	2045
Pollution Controls	<100	200	300	<100	-100
Existing Capacity	2,000	3,900	8,700	5,100	7,600
New Capacity	-3,000	-3,400	-4,100	-3,000	-6,300
Fuels (Coal, Natural Gas, Uranium)	1,200	400	800	-1,100	1,100
Coal	*900*	*300*	*1,800*	*-1,100*	*1,200*
Natural Gas	*300*	*<100*	*-1,100*	*<100*	*-100*
Uranium	*<100*	*<100*	*<100*	*<100*	*<100*

Note: These values describe changes under the proposed action relative to a projected baseline. "<100" denotes an increase or decrease of less than 100 job-years; Numbers may not sum due to rounding

5.4.4 Conclusions

Generally, there are significant challenges when trying to evaluate the employment effects from the repeal of an environmental regulation due to a wide variety of other economic changes to labor markets and the state of the macroeconomy. The analysis of employment impacts in this section evaluates first-order employment effects at a detailed level for construction and recurring non-construction employment utilization for pollution control equipment and operation of different capacity and fuel types. For EGUs, the proposed action may result in decreases and shifts over time of construction-related jobs related to the installation of new pollution controls and construction of new capacity. The proposed action also is projected to result, generally, in an increase of relatively labor-intensive coal capacity compared to less labor-intensive generating capacity, which results in an overall increase of non-construction jobs. It is important to note that this analysis does not estimate the employment losses likely to result from the expected decrease in development and construction of new transmission and distribution capacity throughout the U.S. due to the proposed action.

5.5 References

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6 COMPARISON OF BENEFITS AND COSTS

6.1 Introduction

This section provides the estimates of the costs, benefits, and net benefits of the proposed action, as well as discusses unquantified impacts. The reduced expenditures on compliance costs reported in this section are not social costs; instead, we use compliance costs as a proxy for social costs. The projected real resource costs and economy-wide social costs are separately estimated and discussed in Section 3.2.4 (real resource costs) and Section 5.2 (economy-wide social costs), respectively, but those estimates are not applied in this section. Therefore, in this section, we do not account for changes in costs and benefits due to changes in economic welfare in the broader economy arising from shifts in production and consumption that may be induced by the proposed action. Furthermore, costs and benefits due to interactions with pre-existing market distortions outside the electricity sector are omitted, as are changes in social costs that may be associated with the net change in transfers attributable to the proposed action. Additional limitations of the analysis and sources of uncertainty are described throughout the RIA and summarized later in this section.

6.2 Methods

The EPA calculated the PV and EAV of costs, benefits, and net benefits for the years 2026 through 2047, using the discount rates of 3 percent and 7 percent from the perspective of 2025. The calculations of PV and EAV use an annual stream of values from 2026 to 2047 timeframe.

The EPA used IPM to estimate cost and emission changes for the projection years 2028, 2030, 2035, 2040 and 2045. In the IPM modeling for this RIA, the 2028 projection year is representative of 2028 and 2029, the 2030 projection year is representative of 2030 and 2031, the 2035 projection year is representative of 2032 to 2037, the 2040 projection year is representative of 2038 to 2041, and the 2045 projection year is representative of 2042 through 2047. Estimates of costs and emission changes in other years are determined from the mapping of projection years to the calendar years that they represent. Consequently, the cost and emission estimates from IPM in each projection year are applied to the years which it represents.

$PM_{2.5}$ and ozone-related health benefits are based on projection year emission estimates and also account for year-specific variables that influence the size and distribution of the benefits. These variables include population growth, income growth, and baseline mortality rates.

The 2024 CPS RIA followed the EPA's historical practice of using a technology-rich partial equilibrium model of the electricity and related fuel sectors to estimate the incremental costs of producing electricity under the requirements of major EPA power sector rules. In Section 5.2 of this RIA, we also included an economy-wide analysis that considers additional facets of the economic response to the proposed action, including the full resource requirements of the expected compliance pathways, some of which were paid for through subsidies in the partial equilibrium analysis in the 2024 CPS RIA final rules illustrative scenario.

6.3 Results

Table 6-1 and Table 6-2 compare benefits with costs as well as present net benefits estimated from this proposed action. For comparison, the social cost estimates in the economy-wide analysis discussed in Section 5.2 also exceed the estimated benefits of the proposed action, such that the net benefits are negative using the economy-wide cost estimate.

Table 6-1 Net Benefits of the Proposed Action (billion 2024 dollars, undiscounted) [a]

	$PM_{2.5}$ and O_3-related Health Benefits [b]		Compliance Costs [c]	Net Benefits	
	3%	7%		3%	7%
2026	-	-	-0.01	0.01	0.01
2027	-	-	0.00	0.00	0.00
2028	-6.8	-6.0	1.6	-8.3	-7.6
2029	-6.9	-6.2	1.6	-8.5	-7.7
2030	-4.7	-4.2	0.27	-5.0	-4.4
2031	-4.8	-4.2	0.27	-5.1	-4.5
2032	-16	-14	-1.5	-15	-13
2033	-16	-15	-1.5	-15	-13
2034	-17	-15	-1.5	-15	-13
2035	-17	-15	-1.5	-16	-14
2036	-17	-16	-1.5	-16	-14
2037	-18	-16	-1.5	-16	-14
2038	0.39	0.35	-0.71	1.10	1.10
2039	0.40	0.36	-0.71	1.10	1.10
2040	0.41	0.36	-0.71	1.10	1.10
2041	0.42	0.37	-0.71	1.10	1.10
2042	-9.2	-8.2	-4.0	-5.2	-4.2
2043	-9.3	-8.3	-4.0	-5.3	-4.3
2044	-9.4	-8.4	-4.0	-5.4	-4.3
2045	-9.5	-8.5	-4.0	-5.5	-4.4
2046	-9.6	-8.6	-4.0	-5.6	-4.5
2047	-9.7	-8.6	-4.0	-5.7	-4.6
Non-Monetized Disbenefits					
From increases in HAP emissions and GHG emissions					
To water quality and availability					
To ecosystems from increases in emissions of CO_2, NO_X, SO_2, PM, and HAP					
From increases in exposure to ambient NO_2 and SO_2					
Decreased visibility (increased haze) from $PM_{2.5}$ emissions increases					

[a] Annual values from 2026 to 2047 are not discounted. PV and EAV values discounted to 2025. Values have been rounded to two significant figures and are presented no smaller than two decimal places. Values may not appear to add correctly due to rounding.
[b] The $PM_{2.5}$ and O_3-related health benefits estimates use the larger of the two benefits estimates presented in Table 4-1. Monetized health benefits include those related to public health associated with changes in $PM_{2.5}$ and ozone concentrations. The health benefits are associated with several point estimates.
[c] The discount rate in IPM is 3.76 percent, as described in Section 3.

Table 6-2 Net Benefits, Present Value, and Equivalent Annualized Value Estimates of the Proposed Action (billion 2024 dollars, discounted to 2025) [a]

	$PM_{2.5}$ and O_3-related Health Benefits [b]		Compliance Costs [c]		Net Benefits	
	3%	**7%**	**3%**	**7%**	**3%**	**7%**
2026	-	-	-0.01	-0.01	0.01	0.01
2027	-	-	0.00	0.00	0.00	0.00
2028	-6.2	-4.9	1.4	1.3	-7.6	-6.2
2029	-6.2	-4.7	1.4	1.2	-7.5	-5.9
2030	-4.1	-3.0	0.23	0.19	-4.3	-3.2
2031	-4.0	-2.8	0.23	0.18	-4.2	-3.0
2032	-13	-8.9	-1.3	-0.96	-12	-7.9
2033	-13	-8.5	-1.2	-0.90	-12	-7.6
2034	-13	-8.1	-1.2	-0.84	-12	-7.3
2035	-13	-7.8	-1.1	-0.78	-12	-7.0
2036	-13	-7.4	-1.1	-0.73	-12	-6.7
2037	-12	-7.0	-1.1	-0.68	-11	-6.4
2038	0.27	0.1	-0.5	-0.29	0.75	0.44
2039	0.26	0.1	-0.5	-0.28	0.73	0.41
2040	0.26	0.1	-0.5	-0.26	0.72	0.39
2041	0.26	0.1	-0.4	-0.24	0.70	0.37
2042	-5.60	-2.6	-2.4	-1.3	-3.2	-1.3
2043	-5.50	-2.5	-2.4	-1.2	-3.1	-1.3
2044	-5.40	-2.3	-2.3	-1.1	-3.1	-1.2
2045	-5.30	-2.2	-2.2	-1.0	-3.1	-1.1
2046	-5.20	-2.1	-2.2	-0.97	-3.0	-1.1
2047	-5.10	-1.9	-2.1	-0.91	-3.0	-1.0
	$PM_{2.5}$ and O_3-related Health Benefits		**Compliance Costs [c]**		**Net Benefits**	
	3%	**7%**	**3%**	**7%**	**3%**	**7%**
PV	**-130**	**-76**	**-19**	**-9.6**	**-110**	**-67**
EAV	**-8.0**	**-6.9**	**-1.2**	**-0.87**	**-6.8**	**-6.0**
Non-Monetized Disbenefits						
From increases in HAP emissions and GHG emissions						
To water quality and availability						
To ecosystems from increases in emissions of CO_2, NO_X, SO_2, PM, and HAP						
From increases in exposure to ambient NO_2 and SO_2						
Decreased visibility (increased haze) from $PM_{2.5}$ emissions increases						

[a] Annual values from 2026 to 2047 are not discounted. PV and EAV values discounted to 2025. Values have been rounded to two significant figures and are presented no smaller than two decimal places. Values may not appear to add correctly due to rounding.
[b] The $PM_{2.5}$ and O_3-related health benefits estimates use the larger of the two benefits estimates presented in Table 4-1. Monetized health benefits include those related to public health associated with changes in $PM_{2.5}$ and ozone concentrations. The health benefits are associated with several point estimates.
[c] The discount rate in IPM is 3.76 percent, as described in Section 3.

The compliance cost values in Table 6-1 and Table 6-2 above differ from the compliance cost values in Table 1-1. In Table 1-1, we present positive compliance cost values as cost savings.

6.4 Uncertainties and Limitations

Throughout the RIA, we considered several sources of uncertainty, both quantitatively and qualitatively, regarding the emissions changes, benefits, and costs estimated for the proposed repeal. We summarize these discussions as well as other important uncertainties here.

Compliance costs of the baseline: The IPM-projected cost estimates of private compliance costs provided in this analysis and based on the modeling performed for the 2024 CPS RIA is intended to estimate the change in production and transmission costs to the power sector in response, in this RIA, to the proposed action. As discussed in more detail in Section 3.7 of the 2024 CPS RIA, there are several key areas of uncertainty related to the electric power sector that are worth noting, including assumptions about electricity demand, natural gas supply and demand, longer-term planning by utilities, and assumptions about the cost and performance of controls. Additional uncertainties in the cost analysis are introduced by the fact that the "true" baseline in this RIA is different than the baseline modeling that informed the 2024 CPS RIA which provides the estimates of compliance cost here.

Uncertainty in modeled CCS costs and CO_2 reduction efficiency of the baseline: As explained in Section V of the preamble, the EPA is proposing to determine that CCS with 90 percent capture is not the BSER for long-term existing coal-fired steam generating units because it has not been adequately demonstrated and the costs are unreasonable. Furthermore, because it is unlikely that infrastructure necessary for CCS can be deployed by the January 1, 2032, compliance date, the EPA is proposing to determine that the degree of emission limitation in the CPS for long-term coal-fired steam generating units is not achievable. Consequently, the EPA is proposing to repeal the requirements in the emission guidelines pertaining to long-term existing coal-fired steam generating units.

In the RIA for this action, which is based upon the 2024 CPS RIA, the EPA compliance modeling indicated substantial uptake of CCS under the CPS relative to the baseline, particularly in analysis year 2035.[37] If CCS is more costly or less effective at CO_2 removal than modeled in the 2024 CPS RIA, it is possible that there would have been less CCS uptake under the CPS. As result, costs and benefits of the CPS final rule may have been different had alternative CCS cost and removal efficiency assumptions been used, and we note this conclusion as an important uncertainty in this proposal RIA.

Additionally, the 2024 CPS RIA baseline contained assumptions based on the latest available data as of Summer 2023 around the total demand for electricity as well as announced fleet retirements and additions. In light of changing market conditions, current projections point towards a significantly higher electricity demand environment, while some owners and operators have announced plans to delay retirement decisions. All else equal, both these trends may result in cost savings and disbenefits that are higher than those estimated in this analysis, should the EPA revisit its earlier assumptions.

As noted earlier, the EPA relies on the modeling conducted in support of the 2024 CPS in this RIA. That modeling included CCS cost and performance assumptions for new NGCC builds that included a 45Q subsidy stream that was available for twelve years, with model plants choosing compliance pathways and dispatching based on relative economics. In that modeling, we observe that under the final rules, 18 GW of economic NGCC additions occur by 2035, and of these units 870 MW of NGCCs install CCS in 2035.

Model plants that are projected to install CCS are projected to continue to operate at higher capacity factors post expiration of credits since they are either located in markets subject to a CCS price or can take advantage of EOR opportunities. As noted in the preamble, the majority of NGCC units would likely not be able to benefit from these market conditions, and would therefore revert to lower levels of utilization post 45Q availability. This is consistent with the lower uptake of CCS projected within this source category.

Monetizing CO_2-related domestic climate benefits of the baseline: There are significant uncertainties related to the monetization of greenhouse gases that include, but are not limited to: the magnitude of the change in climate due to a change in GHG emissions; the

[37] To account for parasitic load as a result of installation of CCS, IPM includes a heat rate penalty and capacity penalty on model plants that incorporate CCS as well as CCS retrofit options. These assumptions are detailed in chapter 6 of the IPM documentation, available at: https://www.epa.gov/system/files/documents/2024-04/chapter-6-co2-capture-storage-and-transport.pdf

relationship between changes in the climate and the economy and therefore, the resulting economic impacts; future economic and population growth which are important for estimating vulnerability, willingness to pay to avoid impacts, and the ability to adapt to future changes; future technological advancements that would reduce vulnerability and impacts; the share of impacts from GHG emissions that affect citizens and residents of the United States; and the appropriate discount rates to use when discounting in an intergenerational context. Consistent with the memorandum titled "Guidance Implementing Section 6 of Executive Order 14154, entitled 'Unleashing American Energy'", the EPA did not monetize impacts from changes in GHG emissions from this proposed action. Monetizing these impacts could potentially result in flawed decision-making due to overreliance on highly uncertain values.

Monetized $PM_{2.5}$ and ozone-related benefits of the baseline: The analysis of monetized $PM_{2.5}$ and ozone-related impacts includes many data sources as inputs that are each subject to uncertainty. Input parameters include projected emissions inventories, projected compliance methods, projected emissions changes, air quality data from models (with their associated parameters and inputs), population data, population estimates, health effect estimates from epidemiology studies, economic data, and assumptions regarding the future state of the world (i.e., regulations, technology, and human behavior). When compounded, even small uncertainties can greatly influence the size of the total quantified benefits. The uncertainty in health effect estimates from epidemiology studies may be larger for ambient pollution levels with fewer observations, such as very low levels. In order to quantitatively characterize the uncertainty in the relationship between exposure and mortality, EPA reports multiple estimates of (here forgone) avoided mortality based on different estimates of the exposure-mortality relationship. To quantitively characterize additional sources of uncertainty, EPA reports the 2.5^{th} and 97.5^{th} percentiles of a Monte Carlo simulation (see Section 4.3 of the 2024 CPS RIA and Section 6 of the Health Benefits TSD).

Non-quantified benefits of reductions in carbon capture and sequestration (CCS) system installation and operation. The installation and operation of CCS systems can result in emissions of pollutants. A CO_2 capture plant can impact emissions of HAP and VOC. A reduction in installation and operation of CCS under this rule could reduce HAP and VOC emissions from CCS systems. The EPA is unable to quantify the health benefits of this change. The installation and operation of CCS systems can also impact emissions of criteria pollutants including SO_2, PM, and NO_X. In the CPS, the EPA assumed that these releases would be controlled by installation of SCR and/or FGD. This proposed action would therefore not be expected to alter the emissions of SO_2, PM, or NO_X due to the reduction in installation and operation of CCS.

Interaction of the proposed action with NAAQS attainment: Had the CPS been implemented, the projected emissions changes under the action would likely have affected ambient of $PM_{2.5}$ and ozone concentrations in parts of the U.S. Affected areas may have included locations both meeting and exceeding the NAAQS for $PM_{2.5}$ and ozone. States with nonattainment areas designated as moderate or higher are required to achieve concentration reductions in those areas sufficient to attain the NAAQS. The 2024 CPS RIA did not account for how interaction with NAAQS compliance would affect the benefits and costs projected under the rule. The emissions reductions projected under the CPS for most years of analysis may have contributed to concentration reductions that aided states in achieving attainment. As these emissions reductions will not occur under the proposed action, states may need to pursue emissions reductions from other sources to obtain the standards, incurring costs for those sources. Similarly, in the analysis years where emissions increased until the CPS, states may have needed to identify additional approaches to reduce emissions from local sources relative to the baseline to comply with the NAAQS. If this is the case, from a nationwide perspective, the projections of avoided compliance costs and forgone emissions impacts and associated health impacts under this proposed rule may be under- or over-estimated depending on the specifics of how this proposed action interacts with NAAQS compliance.

United States Environmental Protection Agency	Office of Air Quality Planning and Standards Health and Environmental Impacts Division Research Triangle Park, NC	Publication No. EPA-452/R-25-002 June 2025