Always On Energy Research

Comments on

Repeal of Greenhouse Gas Emissions Standards for Fossil Fuel-Fired Electric Generating Units
EPA–HQ–OAR–2025–0124; FRL–12674–01– OAR

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Executive Summary

Always On Energy Research (AOER) has modeled the impact of the Repeal of Greenhouse Gas Emissions Standards for Fossil Fuel-Fired Electric Generating Units rules proposed by the Trump administration on the reliability and affordability of the electric grid in the subregions consisting of the Midcontinent Independent System Operator (MISO), a regional transmission organization (RTO) serving 45 million people, spanning from Minnesota to Mississippi.[1]

AOER's analysis determined that the Environmental Protection Agency (EPA) is vastly underestimating the economic and reliability benefits of the proposed Repeal of Greenhouse Gas Emissions Standards for Fossil Fuel-Fired Electric Generating Units, hereafter referred to as the Trump Proposal.

Our modeling indicates that by repealing the Biden Administration's Carbon Pollution Standards (CPS), the Trump Proposal will result in $560.7 billion in benefits through 2055 when discounted at a rate of 3.76 percent, in just the MISO region of the country. The Trump Proposal would also avert 8.8 million megawatt hours (MWh) of blackouts from 2030 through 2055, valued at $53.6 billion, compared to a modeled scenario (the Avoiding Biden Blackouts scenario) where the installed capacity in the modeled MISO grid in the Biden administration's Carbon Pollution Standards (Final Biden CPS Rules) Integrated Planning Model (IPM) output files is increased to prevent blackouts from occurring.

The benefits generated from the Trump Proposal far outweigh its potential costs. Our analysis found that additional societal costs associated with emissions of PM2.5 and other pollutants regulated under the National Ambient Air Quality Standards (NAAQS) would increase by $246.1 billion if the Final Biden CPS Rules are repealed.

[1] Midcontinent Independent System Operator, "About MISO," Accessed July 15, 2025, https://www.misoenergy.org/meet-miso/about-miso/.

As a result, AOER's analysis determined the net benefits of the Trump Proposal would be $314.6 billion through 2055 in the MISO region.

EPA's Regulatory Impact Analysis (RIA) for the Trump Proposal did not capture these massive economic and reliability benefits because the administration did not conduct its own electric generating unit (EGU) analysis using the IPM to determine the impact of the Trump Proposal on the likely makeup of the power generation fleet in the future.

Instead, the EPA determined the Trump Proposal would produce $19 billion in benefits under a 3 percent discount rate from 2026 through 2047 by reversing the compliance costs of the Biden Final CPS Rules and counting those avoided costs as benefits in the Trump Proposal. The Trump Proposal also disregarded the costs associated with emissions of NAAQS pollutants and greenhouse gas emissions.

This "Reverse Uno" of the costs and benefits of the Biden Final CPS Rules misses the bigger picture: The cost/benefit calculations in the Biden Final CPS Rules RIA were based on a fatally flawed and unrealistic policy baseline (the Base Case) that hid 90 percent of the cost of complying with the Biden Final CPS Rules and building the MISO grid EPA modeled in its IPM output files.[2] As a result, the Trump administration's RIA only calculated the costs associated with the tip of the iceberg—the Biden Final CPS Rules— missing the vast majority of the benefits that would flow to Americans by reversing the Biden Final CPS Rules.

Without conducting its own analysis of the likely impacts of the Trump Proposal and the phase-out of the subsidies for wind and solar generators in the One Big Beautiful Bill Act (OBBBA), the Trump administration cannot produce the economic and reliability estimates needed to fully demonstrate how these rules make America stronger.

Americans will reap the significant economic and reliability benefits of the Trump administration's proposal because it creates the essential regulatory certainty needed for the owners of the nation's existing coal generators to continue operating these low cost, reliable assets, and removes impediments to the construction of new natural gas facilities, which are necessary to meet surging electricity demand from data centers and manufacturing.

We encourage the Trump administration to utilize the methods used in this report to conduct a thorough, nationwide reliability and economic assessment of the Trump Proposal. This analysis would compare the grid modeled in the Biden Final CPS Rules IPM output files to a Trump Policy Scenario that offers more flexibility to preserve today's diverse existing generating fleet and the reliability value it provides.

[2] U.S. Environmental Protection Agency, "Analysis of the Final Greenhouse Gas Standards and Guidelines," Baseline (zip), https://www.epa.gov/power-sector-modeling/analysis-final-greenhouse-gas-standards-and-guidelines.

About Always On Energy Research

AOER is a 501 (c) (3) organization dedicated to ensuring that every state in America has the affordable, reliable energy needed to power the nation and to fuel a robust, rapidly growing economy now and into the future.

AOER was founded by a group of leading energy modelers and policy analysts to bring quality cost and reliability data to policy discussions that often lack them. Our modeling has been used by multiple state agencies, think tanks, and industry stakeholders to model the cost and electric reliability impacts of proposed legislation, regulations, and intervene in Integrated Resource Plans.

We have modeled energy systems in Arizona, Connecticut, Colorado, Maine, Massachusetts, Michigan, Minnesota, Pennsylvania, New Hampshire, North Carolina, North Dakota, Rhode Island, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, the Midcontinent Independent Systems Operator (MISO), the Independent System Operator of New England (ISO-NE) and the Southwest Power Pool (SPP).

Introduction

These comments calculate the economic and reliability benefits of the Trump Proposal by modeling the costs and benefits of four separate scenarios described briefly below:

1. **The Biden Base Case Scenario**: This scenario models the cost of the Biden Administration's "Baseline" Power Sector Modeling scenario in MISO to determine the extent to which the prior administration hid the costs of complying with its CPS regulations in its baseline scenario.

   Our modeling found the Biden administration hid the vast majority (90 percent) of the compliance costs of its Final CPS regulations by attributing changes in the power sector to the IRA and state policies, rather than its regulations. As a result, reverting back to this modeled MISO grid will not convey the large reliability and economic benefits of the Trump administration's actions.

2. **The Biden Final CPS Rules Scenario:** This scenario models the cost and reliability of the Biden EPA Final CPS Regulations to determine the cost of compliance with the regulations as laid out by the EPA IPM power modeling and whether this buildout would maintain reliable electricity service in the MISO territory.

   Our modeling found that the capacity buildout for the Biden Final CPS regulations was unable to maintain grid reliability for all hours of the year.

3. **The Avoiding Biden Blackouts Scenario:** To account for the blackouts found in the Biden Final CPS regulations, this scenario models the cost of an increased capacity

buildout that would maintain reliability and achieve similar emissions rates per megawatt-hour (MWh) as the Final CPS regulations as modeled by the EPA, which is why it's called the Avoiding Biden Blackouts Scenario. This scenario also takes into account the higher load growth expectations since the last power modeling of the Final CPS regulations by the EPA.

4. **The Trump Proposal Scenario:** The Trump Proposal models the cost of building adequate capacity to supply for the same load growth expectations as the Avoiding Biden Blackout Scenario after the repeal of the CPS regulations. This scenario accounts for the renewable and net-zero goals of individual states within the MISO territory and utilizes existing thermal capacity and new natural gas facilities to achieve a thermal reserve margin of 15 percent without relying on intermittent wind and solar facilities.

First, we model the economic and reliability impacts of the Biden administration's Baseline scenario, hereafter referred to as the Biden Base Case, to highlight the flaws in this base case that make it unsuitable as the basis of a rulemaking.

Second, we model the cost and reliability implications of the modeled MISO grid in the Final Biden CPS Rules, as outlined in the IPM output files. This is important because the Biden Final CPS Rules are considered the new Baseline Scenario in the Trump Proposal RIA.

AOER's modeling determined that the modeled MISO grid in the Biden Final CPS Rules Scenario would cause massive rolling blackouts in the region and was therefore unsuitable as a basis for determining the cost of the Biden Final CPS Rules. As a result, another scenario was modeled, the "Avoiding Biden Blackouts Scenario," to determine the cost of building a system large enough to reliably meet electricity demand while meeting the same greenhouse gas emissions rate as the Biden Final CPS Rules.

Lastly, we model the cost and reliability benefits of an illustrative Trump Proposal scenario in the MISO region that allows utilities to continue operating their existing coal assets and build new natural gas assets, and potentially build new coal plants, absent the Biden Final CPS Rules.

Section 1: Why the Biden Base Case is Unsuitable for Rulemaking

Ordinarily, it would seem reasonable to assume that the benefits of reversing a regulation could be determined by reversing the estimated cost of complying with said regulation.

However, it is crucial for the Trump administration to understand the extent to which the Biden EPA's base case, the IMP "Baseline" scenario, hereafter referred to as the Biden Base Case, obscured the true costs of the modeled MISO grid in the Biden Final CPS Rules RIA and created

an unreliable foundation for the Biden Final CPS Rules that resulted in massive rolling blackouts in the MISO region.[3]

The Biden Base Case was based upon the EPA's 2023 update to its Power Sector Platform, which used the IPM to establish a baseline for the analysis of the Biden Final CPS Rules.[4] In its RIA for the Biden Final CPS Rules, the Biden EPA wrote that the agency:

> "Frequently updates the power sector modeling baseline to reflect the latest available electricity demand forecasts from the U.S. Energy Information Administration (EIA) as well as expected costs and availability of new and existing generating resources, fuels, emission control technologies, and regulatory requirements.
>
> "This version of the model ("EPA's Power Sector Platform 2023 using IPM 2022") also includes recent updates to state and federal legislation affecting the power sector, including Public Law 117-169, 136 Stat. 1818 (August 16, 2022), commonly known as the Inflation Reduction Act of 2022 (IRA)."

As a result, the Biden Base Case did not provide a comparison of the impacts of the Final Biden CPS Rules relative to the current conditions in the U.S. power sector, but rather a comparison of Final Biden CPS Rules relative to an imagined future U.S. power sector that the Biden EPA assumed would be in service, which included a heavy emphasis on the subsidies in the now-partially repealed IRA.

For example, 95 percent of the changes in EGU capacity from the MISO grid in 2025 through 2055 were due to the assumptions in the Biden Base Case, not the Biden Final CPS Rule, as described in further detail below.

Capacity Changes in the Biden Base Case and the Biden Final CPS Rules

The current composition of the generating fleet in MISO consists largely of dispatchable thermal resources, although wind and solar account for a growing share of overall installed capacity and electricity generation.

As of May 2025, 74 percent of the installed capacity (ICAP) of the MISO grid consisted of thermal resources, with natural gas accounting for 40 percent, coal accounting for 23 percent, nuclear 6.4 percent, and petroleum accounting for 2.2 percent.[5] Non-dispatchable wind and solar resources accounted for 15.8 percent and 7.9 percent of the ICAP on MISO, respectively.

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[3] U.S. Environmental Protection Agency, "Analysis of the Final Greenhouse Gas Standards and Guidelines," Final Rules (zip), https://www.epa.gov/power-sector-modeling/analysis-final-greenhouse-gas-standards-and-guidelines.

[4] U.S. Environmental Protection Agency, "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, April 2024, https://downloads.regulations.gov/EPA-HQ-OAR-2023-0072-8913/content.pdf.

[5] Data were obtained from EIA forms 861 and 923.

Under the Biden Base Case, this resource portfolio is modeled to undergo significant changes resulting from state decarbonization policies, the finalization of several EPA rules, and subsidies made available in the Inflation Reduction Act (IRA). Figure 1 illustrates the installed capacity of the MISO fleet in 2025, and EPAs assumed changes to the MISO fleet in the model years 2028, 2030, 2035, 2040, 2045, 2050, and 2055 using the agency's Biden Base Case assumptions.

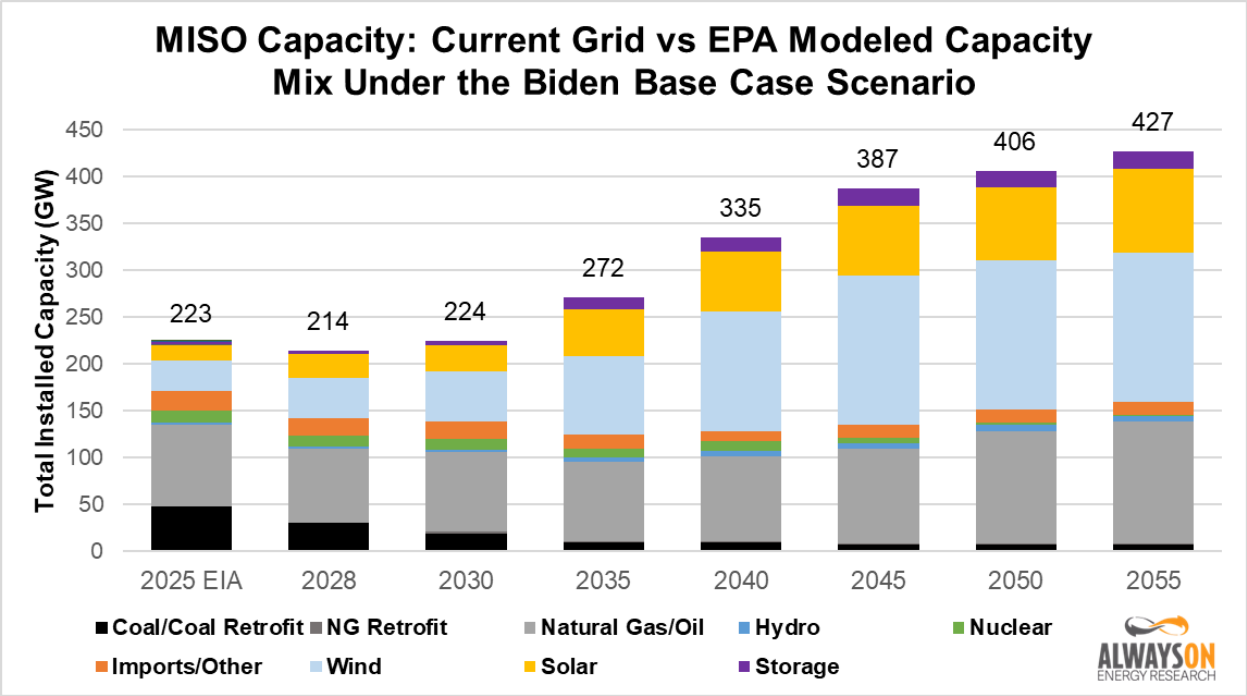

Figure 1. EPA's modeled resource portfolio in MISO undergoes significant changes in each of the model years, with installed capacity increasing 1.92 times in 2055 compared to 2025.

Between 2025 and 2055, the EPA projected that installed capacity on the MISO system under the Biden Base Case would grow from 223 GW of installed capacity to 427 GW despite the retirement or retrofitting of much of the coal fleet by 2035. As a result, EPA is assuming the installed capacity of the MISO grid will grow by a factor of 1.92 over the next 30 years, with most of this new installed capacity consisting of onshore wind, solar, combustion turbine (CT) natural gas, and battery storage.

The same is true for the Biden Final CPS Rules. According to the IPM output files, the modeled MISO region under the Biden Final CPS Rules will have only 10 GW of additional total installed capacity, shown in Table 1. This is due to the fact that the Biden Base Case was responsible for 87 percent of the coal and 100 percent of the nuclear retirements and 96 percent of the wind and solar additions in the modeled MISO grid between the two IPM scenarios used by the previous administration.

Change in Modeled MISO Capacity by 2055: Biden Base Case vs. Biden Final CPS Rules				
Resource	MISO Capacity (May 2025)	Biden Base Case (GW)	Biden Final CPS Rule (GW)	Difference Attributable to Base Case (%)
Coal/Coal Retrofit	47	7	0	87%
NG Retrofit	0	2	1	207%
Natural Gas/Oil	88	130	136	89%
Hydro	2	6	6	100%
Nuclear	13	1	1	100%
Imports/Other	21	14	14	101%
Wind	32	160	167	95%
Solar	16	89	94	95%
Storage	3	18	18	98%
Total	223	427	437	95%

Table 1. The Biden Base Case was responsible for 87 percent and 100 percent of the coal and nuclear retirements, respectively, and 95 percent, 95 percent, and 98 percent of the wind, solar, and battery storage additions, respectively, compared to the current MISO generating fleet.

Despite the massive increase in electricity generation capacity placed into service in the modeled MISO grid in the Biden Base Case, AOER's reliability modeling determined it would be unable to reliably serve demand in every hour of the year in the EPA model years examined based on historical hourly wind and solar capacity factors and hourly fluctuations in electricity demand.

Biden Base Case Reliability Modeling

Grid operators and regulatory agencies have often used reserve margin analyses and resource adequacy studies to model the reliability of electric power systems. However, the shift away from dispatchable thermal resources toward intermittent wind and solar generators increases the complexity and uncertainty in these analyses and makes them increasingly dependent on the quality of the assumptions used to construct capacity accreditations.[6]

This is likely a key reason why the Biden EPA distinguished between resource adequacy and reliability in the Resource Adequacy Technical Support Document (TSD) for the Biden Proposed CPS Rules:

"As used here, the term **resource adequacy** is defined as the provision of adequate generating resources to meet projected load and generating reserve requirements in each power region,

[6] Isaac Orr and Mitch Rolling, "Comments on 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 (Docket ID No. EPA–HQ–OAR–2023–0072; FRL–8536–02– OAR)," Docket ID No. EPA–HQ–OAR–2023–0072; FRL–8536–02–OAR, August 8, 2023, https://files.americanexperiment.org/wp-content/uploads/2023/08/American-Experiment-Comments-on-the-Proposed-Section-111-Rules.pdf?v=1691603779&_gl=1*1pz8un3*_gcl_au*ODk2OTQzNjgzLjE3NTI2NzIyODQ..

while **reliability** includes the ability to deliver the resources to the loads, such that the overall power grid remains stable." **[emphasis added].**" EPA goes on to say that "resource adequacy … is necessary (but not sufficient) for grid reliability."[7]

As the grid becomes more reliant upon non-dispatchable generators with lower reliability values, it is crucial to "stress test" the modeled MISO grid in the Biden Base Case by conducting an hourly reliability analysis by comparing historic hourly electricity demand and wind and solar capacity factors against EPA's installed capacity assumptions from the Biden Base Case output files.

Even though the Biden Base Case accounts for 87 percent and 100 percent of the coal and nuclear retirements, respectively, in the modeled MISO grid in the Final Biden CPS Rules, and 95-98 percent of the new wind, solar, and battery storage capacity added in the Biden Final CPS Rules IPM output files, relative to the current grid, **the Biden administration did not perform a resource adequacy or reliability analysis on the Biden Base Case; it simply assumed it to be adequate and reliable, as it stated in its RIA:**

"The focus of the analysis is on comparing the illustrative proposed rules scenario from the RIA to a base case (absent the proposed requirements) *that is assumed to be adequate and reliable [emphasis added]."*[8]

Given the massive changes in the U.S. electric grid that the Biden EPA attributed to the IRA in the Biden Base Case, it is indefensible that the EPA did not conduct a resource adequacy or reliability analysis of the modeled MISO grid in the Biden Base Case IPM output files.

To make a pointed analogy, the Biden EPA's narrow tailoring of its resource adequacy analysis to only examine the difference in resource adequacy between the Biden Base Case and the Biden Final CPS Rules without assessing the resource adequacy or reliability of the Biden Base Case was the regulatory equivalent of making sure the top floor of a 100-story building is built to code without doing the same for the preceding 99 floors, with the expected disastrous results.

To demonstrate the unsuitability of the Biden Base Case as a basis for rulemaking, AOER modeled the reliability of the Biden EPA's modeled MISO generating portfolio in the Biden Base Case using historical hourly demand and wind and solar capacity factors observed in 2020, 2021,

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[7] Resource Adequacy Analysis Technical Support Document, 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 Proposal Docket ID No. EPA-HQ-OAR-2023-0072 U.S. Environmental Protection Agency Office of Air and Radiation April 2023.

[8] Resource Adequacy Analysis Technical Support Document, 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 Proposal Docket ID No. EPA-HQ-OAR-2023-0072 U.S. Environmental Protection Agency Office of Air and Radiation April 2023.

2022, 2023, and 2024 to "stress test" the capacity on the modeled MISO grid in the Biden Base Case[9,10]

AOER used generous assumptions for this analysis by scaling these hourly demand profiles upward to meet the projected peak demand in the Biden Final CPS Rules output files. New wind and solar capacity factors were also scaled upward to reach the average annual capacity factors for wind (45 percent) and solar (26 percent) in the output files.

The 2020 HCY resulted in a devastating 28.6 GW capacity shortfall, i.e., rolling blackout, in July 2040, representing 20.6 percent of the demand at the time of the capacity shortfall, meaning one in five homes would be subjected to rolling power outages, shown in Figure 2.

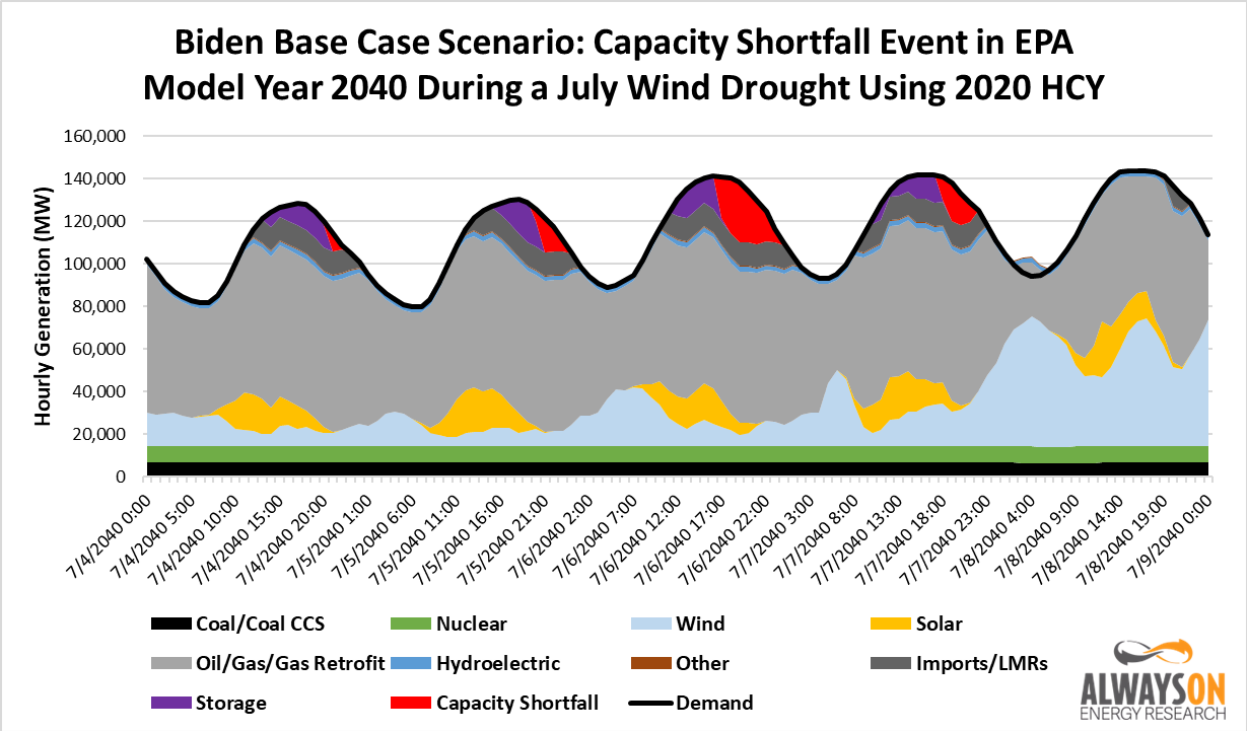

Figure 2. During a hypothetical 5-day period in July 2040, the Biden Base Case would be unable to reliably meet demand for a total of 20 hours, resulting in 243,720 megawatt-hours of unserved demand. At its peak, the capacity shortfalls would account for 20.6 percent of total electricity demand in the MISO region.[11]

[9] U.S. Environmental Protection Agency, "Analysis of the Final Greenhouse Gas Standards and Guidelines," Baseline (zip), https://www.epa.gov/power-sector-modeling/analysis-final-greenhouse-gas-standards-and-guidelines.

[10] Hourly demand data and wind and solar generation were obtained from the U.S. Energy Information Administration's Hourly Grid Monitor. Historical wind and solar installed capacity data were obtained from MISO's 2023-2024 Wind and Solar Capacity Credit Report. https://cdn.misoenergy.org/2023%20Wind%20and%20Solar%20Capacity%20Credit%20Report628118.pdf

[11] This week would experience 20 hours of blackouts; however, the entire year would experience 38 hours of capacity shortfalls.

These blackouts occur because there are not enough reliable, dispatchable power plants on the modeled MISO grid in the Biden Base Case to meet demand during periods of low wind and solar output, and there is insufficient battery storage to save excess wind and solar generation to maintain reliability during these periods, resulting in massive economic damages for MISO residents.

The Social Cost of Blackouts

Blackouts are costly. They frequently result in food spoilage, lost economic activity, and can also be deadly.

For example, on April 28th, 2025, 50 million people in Spain were affected by a massive country-wide blackout that lasted for 12 to 14 hours.[12] According to the estimates from the main Spanish business advocacy group, the outage was estimated to cost $1.82 billion in economic losses.[13] The blackouts also caused at least ten deaths, including a family of three that died of carbon monoxide poisoning.[14]

AOER calculated the Social Cost of Blackouts in the MISO region using the latest Value of Lost Load (VOLL) estimates for the MISO region. On May 8th, 2025, the Federal Energy Regulatory Commission (FERC) approved MISO's request to increase its VOLL value, which is an estimate of how much electricity customers would be willing to pay to avoid an outage, from $3,500 per megawatt hour (MWh) of unserved load to $10,000 per MWh.[15]

Based on our reliability modeling, the Biden Base Case would result in $2.6 billion in damages in EPA model year 2040 in the MISO region based on historic hourly wind and solar capacity factors and electricity demand fluctuations for the 2020 HCY, constituting a massive unpriced externality in both the Biden Base Case and the Biden Final CPS Rules.

Despite the massive increase in overall installed capacity on the modeled MISO system in the Biden Base Case output files, the grid is unable to perform its most essential function: keep the lights on for American families and businesses. This massive increase in installed capacity will

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[12] Rodrigo Orihuela, Joao Lima, and Thomas Gualtieri, "Crippling Power Outage in Spain Likely Caused by Generation Loss," *Bloomberg,* April 29, 2025, https://www.bloomberg.com/news/articles/2025-04-29/crippling-power-outage-in-spain-likely-caused-by-generation-loss.

[13] Joan Faus, Companies Count the Costs After Blackout in Spain and Portugal, " Insurance Journal, April 30, 2025, https://www.insurancejournal.com/news/international/2025/04/30/821937.htm#:~:text=Spain%20and%20Portugal-,Companies%20Count%20the%20Costs%20After%20Blackout%20in%20Spain%20and%20Portugal,not%20everyone%20could%20find%20cash..

[14] LGI, "The Death Toll From the Massive Blackout That Affected All of Spain Has Risen to Ten," La Gaceta, April 30,2025, https://gaceta.es/espana/asciende-a-diez-el-numero-de-muertos-causado-por-el-apagon-masivo-que-afecto-a-toda-espana-20250430-1126/.

[15] Cameron Odegaard, "MISO's VOLL Change Could Reshape Scarcity Pricing and Reliability Signals," Amperon, May 8, 2025, https://www.amperon.co/blog/misos-voll-change-could-reshape-scarcity-pricing-and-reliability-signals.

increase the cost of electricity for MISO retail electricity customers by hundreds of billions of dollars.

Biden Base Case Cost Modeling

AOER modeled the cost of the Biden Base Case and the Biden Final CPS Rules based on the capacity additions in the IPM output files to demonstrate the extent to which the costs of the Biden Final CPS Rules were hidden by the assumptions used in the Biden Base Case.

This includes the assumptions that coal and nuclear retirements, as well as wind and solar capacity additions, would be primarily driven by factors like the IRA and state policies, and that the Biden Final CPS rules would have little influence on the overall composition of the MISO grid of the future.

Burying Costs in the Base Case

The Biden administration claimed that its Final CPS Rules would only increase costs by $19 billion over a 24-year period, spanning from 2024 through 2047, using a 2 percent discount rate.[16] However, this modest compliance cost is entirely due to the fact that most of the expenses for the modeled MISO grid in the Biden Final CPS Rules IPM output files are incurred in the Biden Base Case.

Figure 3 shows the costs of operating the current generating portfolio in the MISO region and compares them to the costs of building and operating the MISO grids outlined in the Biden Base Case and the Biden Final CPS Rules found in the IPM output files.[17]

Our modeling indicates that the modeled MISO grid in the Biden Base Case would cost $362.1 billion, using the subsidy phaseout timeline established in the OBBBA, and the Biden Final CPS would cost $404.1 billion.[18] The difference in costs between these scenarios, $42.9 billion, is what the Biden EPA considered a compliance cost, even though American families and businesses would see massive increases to their energy bills as a result of building the generation capacity in the modeled MISO grid in the Biden Base Case and the Biden Final CPS Rules.

[16] The Biden Final Rule RIA discounts the costs to 2024 in 2019 dollars, whereas the Trump Proposal RIA compares the costs by discounting to 2025 in 2024 dollars.

[17] The cost of the current MISO grid was calculated using FERC Form 1 data for the ten largest utilities in the MISO region. These data allowed AOER to calculate the cost of electricity generated from existing resources on a per megawatt hour (MWh) basis. For more details, see the Appendix.

[18] AOER calculated the cost of these portfolios using the cost estimates in the 2025 Annual Energy Outlook produced by the U.S. Energy Information Administration. Capacity factors for each resource are determined by EPA assumptions.

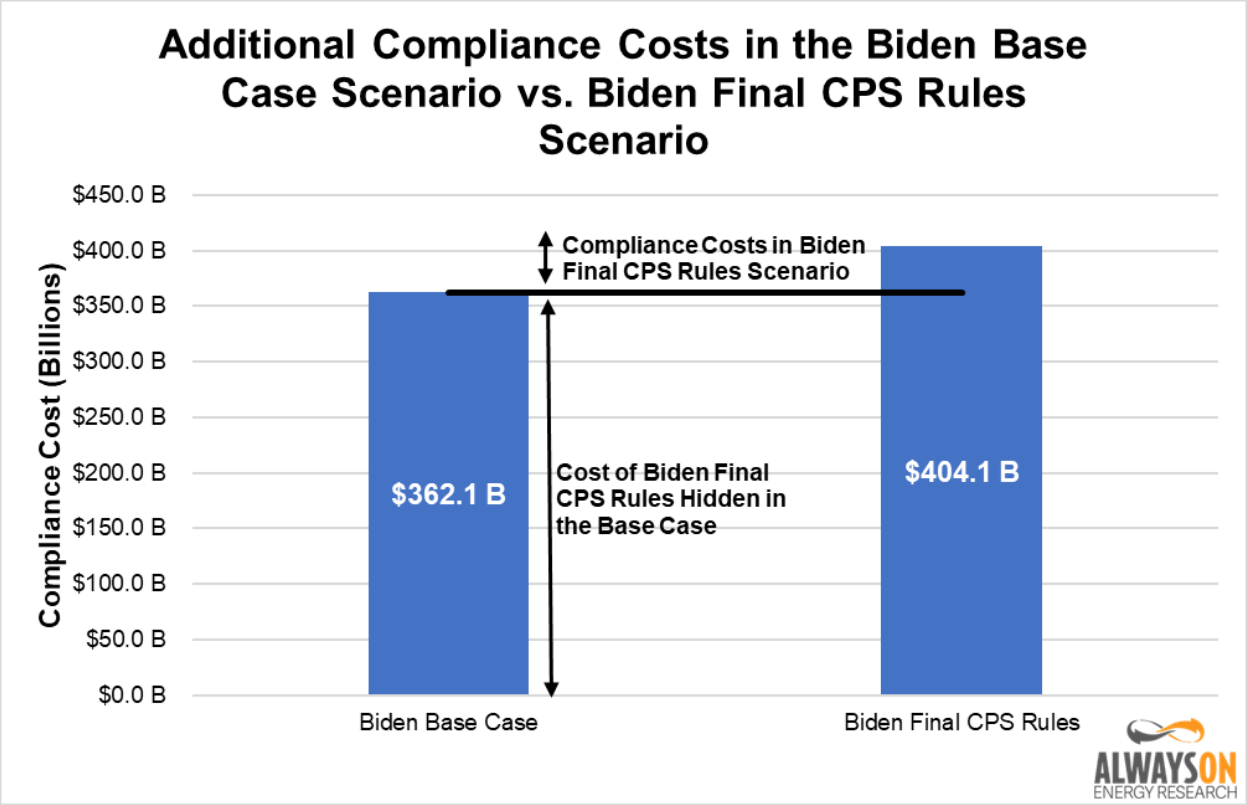

Figure 3. This figure shows the cost of operating the electric grid in the MISO under the Biden Base Case and the Biden Final CPS Rules. 90 percent of the compliance costs for the Biden Final CPS Rules are hidden in the Biden Base Case.

Because the Biden Base Case is responsible for the vast majority of the changes observed in the modeled MISO grid in the Biden Final CPS Rules, it is responsible for driving the vast majority of the cost of the changing resource portfolio. It is also responsible for the vast majority of the blackouts that would occur under this resource portfolio, rendering it unsuitable for use in this rulemaking.

The Biden Base Case is Predicated on Outdated Assumptions

The Biden Base Case is expensive, unreliable, and also predicated on unrealistic assumptions. The Biden Administration assumed most of the power sector trends assumed in its base case would be due to the IRA subsidies, state policy mandates, and prevailing trends in the power generation sector.[19,20]

Under the IRA, wind and solar subsidies would continue in perpetuity until U.S. greenhouse gas emissions fell below 25 percent of 2022 levels. Research from the Cato Institute suggests such

[19] U.S. Environmental Protection Agency, "Table 3-29 State Power Regulations Included in EPA 2023 Reference Case, Accessed July 23, 2025, https://www.epa.gov/system/files/documents/2024-04/table-3-29-state-power-regulations-included-in-epa-2023-reference-case.pdf.
[20] U.S. Environmental Protection Agency, "Documentation for EPA's Power Sector Modeling Platform Using the Integrated Planning Model 2023 Reference Case, April 2024, https://www.epa.gov/system/files/documents/2025-02/epa-2023-reference-case.pdf.

reductions may never happen.[21] This subsidy structure enabled the Biden EPA to assume the subsidies for wind and solar would continue through its analysis.

However, the passage of the OBBBA, which phases out subsidies for wind and solar projects in the next several years, and subsequent reconsideration of eligibility requirements for wind and solar projects through updated guidance concerning beginning of construction (BOC) and foreign entity of concern (FEOC) at the U.S. Treasury Department render the Biden EPA's assumptions about IRA subsidies being a driving force for change in the electricity market a moot point.

Secondly, states with aggressive carbon-free electricity mandates, such as California and New York, are delaying the implementation of emissions standards to maintain the reliability of their respective electric systems. For example, California officials extended operations at three natural gas power plants in Southern California to avoid another bout of the rolling blackouts that occurred in the state in 2020.[22] Similarly, New York also postponed the retirement of natural gas plants to maintain reliability and has delayed the implementation of the state's "Cap and Invest" law, an economy-wide price on carbon dioxide emissions that the Hochul administration has been promising since 2023.[23,24]

Policymakers understand that failing to deliver reliable power is an electoral liability, and thus they will make the exceptions necessary to preserve the resources needed to keep the lights on.

Lastly, surging electricity demand for data centers is creating a reliability challenge for the U.S. electric grid, and this challenge has led to shifting market dynamics that support the use of coal-fired power plants for the foreseeable future. These shifts include higher capacity prices in RTOs like PJM and MISO, as well as decisions by Investor-Owned Utilities (IOUs) like Georgia Power to announce that they will delay the retirement of their coal facilities to serve data center customers.[25,26]

In short, the energy world looks much different than it did just 18 months ago, rendering the Biden Base Case unsuitable for use in this rulemaking.

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[21] Travis Fisher and Joshua Loucks, "Answering Frequently Asked Questions about the Inflation Reduction Act's Energy Subsidies," March 17, 2025, The Cato Institute, https://www.cato.org/blog/answering-frequently-asked-questions-about-inflation-reduction-acts-energy-subsidies.
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[23] Reuters, "New York Postpones Retiring Four Power Plants to Maintain NYC Supply," November 21, 2023, https://www.reuters.com/business/energy/new-york-postpones-retiring-four-power-plants-maintain-nyc-supply-2023-11-21/.
[24] Colin Kinniburgh, "Climate Groups Sue Hochul Administration Over Climate Law Backtracking," New York Focus, March 31, 2025, https://nysfocus.com/2025/03/31/new-york-climate-law-lawsuit-hochul.
[25] Ethan Howland**,** *PJM Capacity Prices Set Another Record With 22% Jump,* Utility Dive, July 23, 2025. https://www.utilitydive.com/news/pjm-interconnection-capacity-auction-prices/753798/
[26] Ethan Howland, *Georgia Regulators Approve Georgia Power's IRP, Keeping Coal Plants Online And Adding Gas To Serve Data Centers,* Utility Dive, July 17, 2025. https://www.utilitydive.com/news/georgia-power-irp-coal-gas-plants-data-centers/753170/

Biden Base Case Conclusions

The Biden Base Case obscures the true cost of the Biden Final CPS Rules, cannot keep the lights on, and is based on outdated assumptions. Therefore, we urge the Trump administration to discard its use in this regulatory proceeding in favor of comparing the cost of the Biden Final CPS Rules to an illustrative Trump Proposal policy scenario that better reflects the current state of the electricity industry.

Section 2: The Biden Final CPS Rules Are Unaffordable and Unreliable

AOER remains skeptical of the previous administration's claim that the IRA, rather than the Biden Final CPS Rules, would be the primary driver of transformation in the U.S. power sector envisioned in the Biden administration's Power Sector Modeling output files. However, the phase-out of the IRA subsidies discussed above renders this point moot.

Absent the IRA, the primary driver of power sector changes will be the Biden Final CPS Rules, which means the costs of achieving the same emissions rate as the levels modeled by the Biden EPA must be attributed to the Biden Final CPS Rules.

Capacity Changes Biden Final CPS Rules

AOER's analysis of the IPM output files found that the Biden Final CPS Rules caused additional incremental retirements of thermal units in its modeled MISO grid, thus increasing the cost of replacing the electricity generated from this capacity and increasing the number of capacity shortfalls (blackouts) observed in our reliability modeling.

Figure 4 shows the total installed capacity in MISO in 2025 compared to the modeled MISO grid for the model years in Biden Final CPS Rules output files. It also shows the Biden EPA's projected peak demand for each of the model years.[27]

The Biden Final CPS Rules result in a 1.96-fold increase in total installed capacity, even as the MISO region's coal and nuclear fleets are almost entirely shut down, and by 2035, the modeled MISO grid in the Biden Final CPS Rules output files would be dependent upon contributions from wind, solar, and battery storage to keep the lights on.

[27] The Biden administration's estimated peak demand forecast was used for this exercise, rather than an updated forecast reflecting higher load growth due to data center demand, because it would be unfair to measure its capacity additions against a higher load growth scenario.

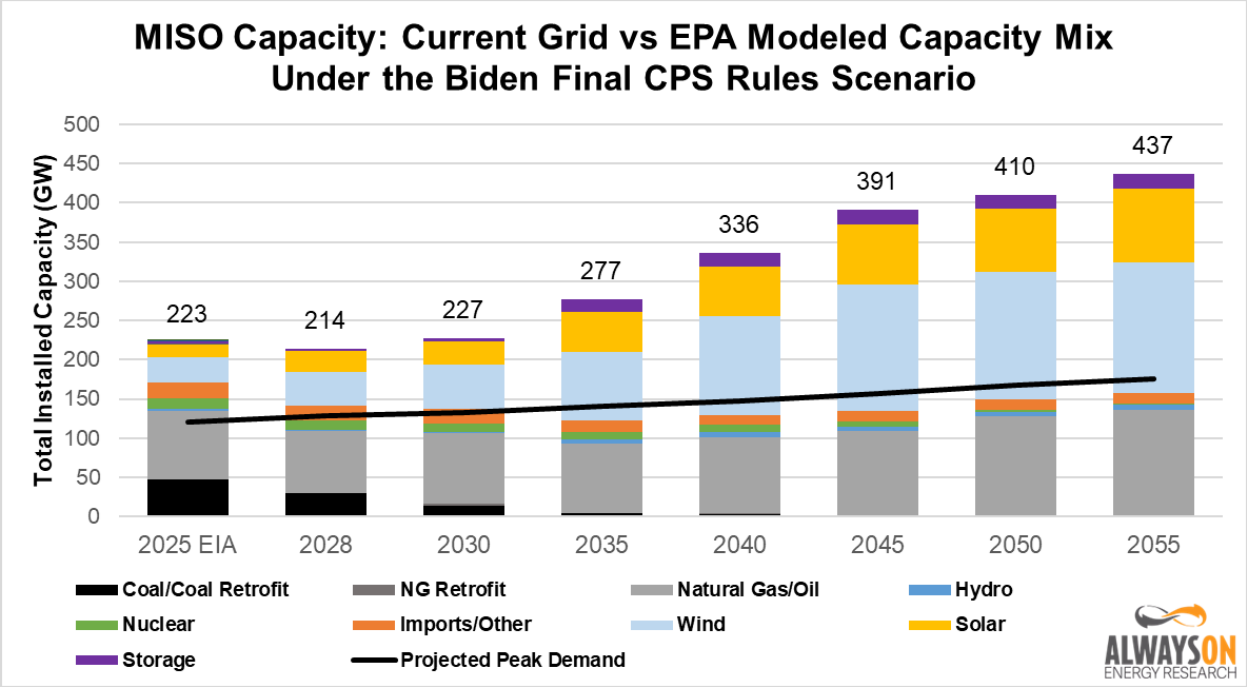

Figure 4. The modeled MISO grid in the Biden Final CPS Rules output files would increase the overall size of the grid by a factor of 1.96, with almost all of the new capacity being wind, solar, battery storage, and natural gas.

However, like the modeled MISO grid in the Biden Base Case output files, this increase in installed capacity in the Biden Final CPS Rules output files is unable to maintain reliability when stress tested against historical hourly electricity demand profiles and wind and solar capacity factors.

Biden Final CPS Rules Reliability Modeling

AOER conducted a reliability analysis by comparing the Biden EPA's modeled MISO generation portfolio in the Biden Final CPS Rules output files to the historic hourly electricity demand and hourly capacity factors for wind and solar in 2020, 2021, 2022, 2023, and 2024. These data were obtained from the U.S. Energy Information Administration (EIA) Hourly Grid Monitor to assess whether the installed resources would be able to serve the load for all hours in each Historic Comparison Year (HCY).

Comparing hourly historic electricity demand and wind and solar output to EPA's modeled MISO grid under the Biden Final CPS Rules, our modeling found that EPA's grid would be unable to keep the lights on for all hours of the model run. In fact, our modeling determined that blackouts would occur starting in 2030 through 2055 in EPA's modeled years, depending on the HCY used (See Table 2).

Biden Final CPS Rules Total Hours of Shortfalls							
Historic Comparison Year	**2028**	**2030**	**2035**	**2040**	**2045**	**2050**	**2055**
2020	0	9	73	45	28	7	4
2021	0	3	54	14	2	0	0
2022	0	0	5	0	0	0	0
2023	0	0	10	2	0	0	0
2024	0	0	10	2	0	0	0

Table 2. EPA's modeled MISO grid is insufficient to reliably meet electricity demand for every model year after 2028. The extent of the blackouts depends on which historic comparison year is used. Blackouts occur in EPA model years from 2030-2055 for the 2020 HCY.

Each of the modeled HCYs from 2030 through 2055 experienced rolling blackouts, with 2035 experiencing 152 hours of capacity shortfalls and 2040 experiencing 63 hours of blackouts. The 2020 and 2021 HCYs produced the largest number of shortfall hours due to two specific wind drought events observed in the EIA hourly data, an 80-hour wind drought in the 2020 HCY where wind operated below 10 percent of its potential output, and a wind drought lasting133 straight hours in 2021 where the wind operated at less than 20 percent of its potential output.

The longest capacity shortfall would last 13 hours, occurring in a theoretical 4-day period in June-July 2035 in the 2021 HCY after the regulations have been implemented if the grid experienced the same hourly electricity demand and wind and solar generation as it did in 2021 (See Figure 5).

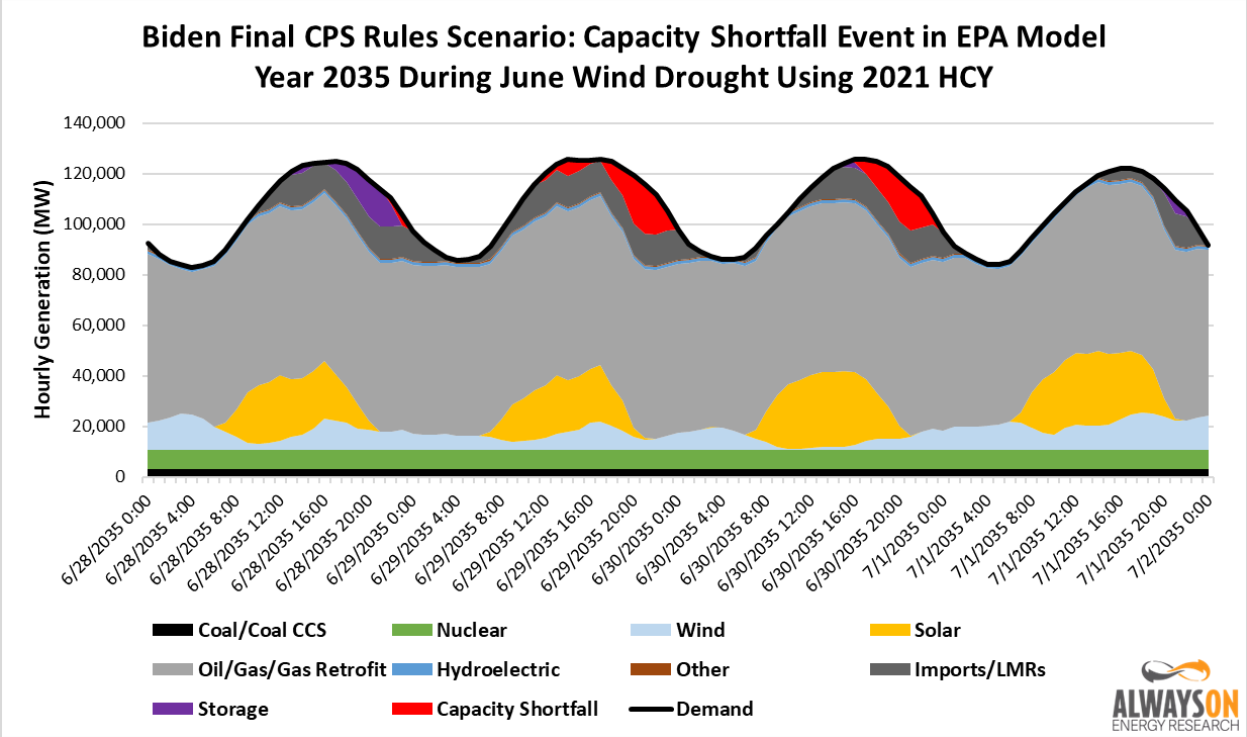

Figure 5. This figure shows the generation of resources on the Biden EPA's modeled MISO grid during

a theoretical 4-day period in 2035 after the Biden Final CPS Rules are implemented. The purple portions of the graph show the battery storage discharging to provide electricity during periods of low wind and solar generation. Unfortunately, the battery storage does not last long enough to avoid blackouts, shown in red, during a wind drought.

These blackouts would occur because the Biden EPA's modeled MISO grid in 2035 did not have enough dispatchable natural gas capacity to meet all of MISO's electricity demand. As a result, the region would be dependent upon generation from wind and solar resources, imports from neighboring regions, and battery storage facilities to meet demand. Unfortunately, due to the long duration of the wind drought, the wind resources in MISO would not be able to recharge the batteries needed to maintain reliability, resulting in 13 consecutive hours of blackouts in January of the 2035 model year.

The Scope of the Blackouts

Many of the observed blackouts are significant. For example, the largest blackout we observed in our analysis found EPA's modeled grid would result in a massive blackout totaling over 31,000 MW (31 GW) in capacity shortfalls in the 2040 EPA model year using the 2020 HCY (See Figure 6).

For context, this represents 22.5 percent of the electricity demand on the MISO system at the time of the capacity shortfall, meaning 22.5 percent of homes would be subjected to rolling power outages.

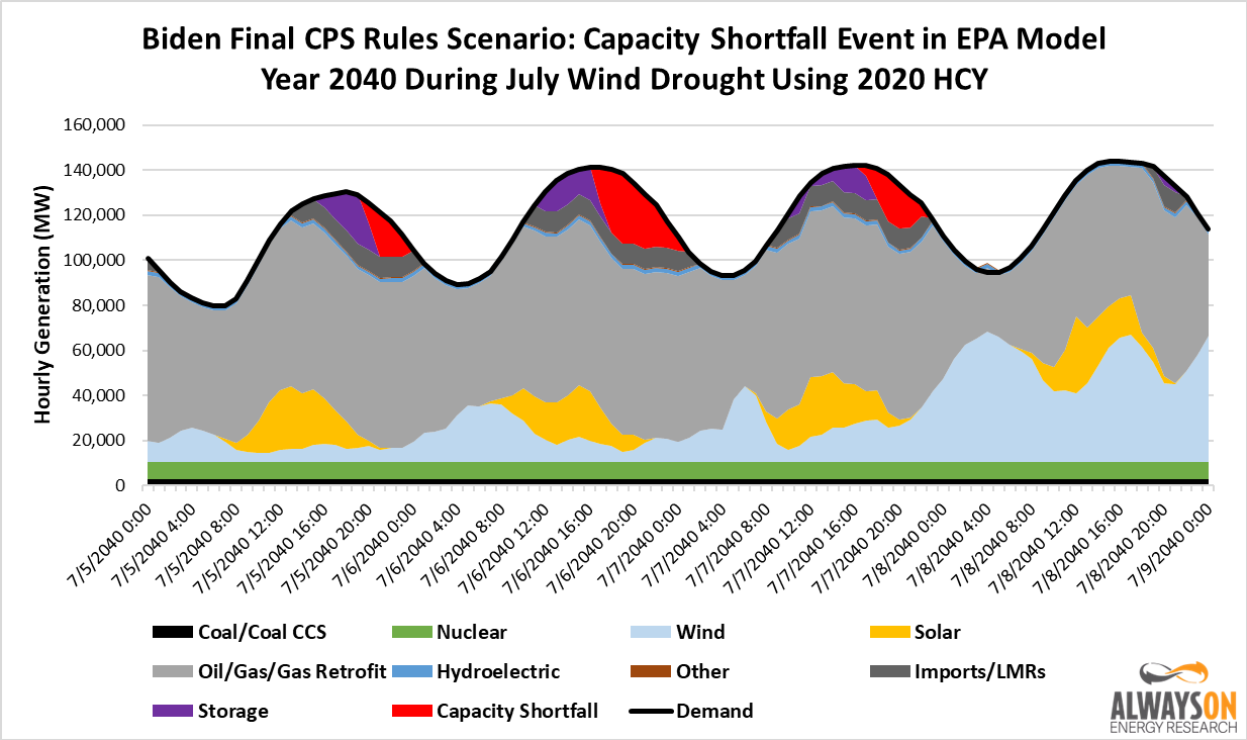

Figure 6. The blackouts occurring in July of 2040 using the 2020 HCY would be massive, constituting 31 GW, which is 22.5 percent of the electricity demand on the system at the time.

Such large capacity shortfalls would be difficult to manage, resulting in undue economic hardship on grid operators and the customers they serve.

The Social Cost of Blackouts

Our modeling indicates that the blackouts occurring in the 2020 HCY would cost the MISO region $88.2 billion from 2030 through 2055, or an average of $3.4 billion each year (See Table 3).

Value of Lost Load							
Historic Test Year	**2028**	**2030**	**2035**	**2040**	**2045**	**2050**	**2055**
2020	$0	$523,030,000	$8,603,870,000	$4,583,060,000	$2,873,220,000	$925,120,000	$577,980,000
2021	$0	$192,890,000	$4,113,620,000	$1,254,020,000	$101,410,000	$0	$0
2022	$0	$0	$516,180,000	$0	$0	$0	$0
2023	$0	$0	$953,850,000	$66,430,000	$0	$0	$0
2024	$0	$0	$682,050,000	$105,340,000	$0	$0	$0

Table 3. Using the VOLL, AOER calculated that MISO would experience over $8.6 billion in damages from blackouts in EPA model year 2035 in the 2020 HCY.

These blackouts constitute an enormous externality cost that EPA is not capturing in its RIA because it did not model the reliability of the Biden Final CPS Rules. This shortcoming builds upon previous errors made by the Biden administration, which assumed their Biden Base Case was reliable.

There is no world where policymakers or the American public would tolerate such massive and economically devastating blackouts year after year due to the generation portfolio in the Biden Final CPS Rules. As a result, the modeled MISO grid is so unreliable that it is not a realistic basis for understanding the financial impact of the Biden Final CPS Rules, as discussed in further detail below.

Conclusions on Reliability

Reliability is the most crucial function of the electricity industry. It is integral to human health and welfare and the lifeblood of the digital economy. An unreliable electric grid will impose billions of dollars in economic damages and result in the completely avoidable and unnecessary deaths of American citizens.

The modeled MISO grid in the Biden Final CPS Rules output files was unable to fully preserve grid reliability in any of the HCYs examined in AOER's modeling, and therefore, there is no reason to believe this grid would be sufficient to maintain reliability in the future.

Calculating the True Cost of the Biden Final CPS Rules

AOER modeled the cost of the Biden Final CPS Rules under two scenarios: one to show the extent to which the cost of the modeled MISO grid in Biden Final CPS Rules output files was hidden in the Biden Base Case, and one that models the cost of building a power system capable of reliably meeting electricity demand at all hours of the year and accounts for growing electricity demand from datacenters, called the "Avoiding Biden Blackouts" scenario.

Calculating the Cost of the MISO Grid in the Biden Final CPS Rules Output Files

The dramatic changes in the composition of the MISO grid in the Biden Final CPS Rules output files would be a major driver of cost for the region's families and businesses.

This is particularly true in the MISO region, where many of the largest utilities operate under cost-of-service regulation that allows the utility to recover the full cost of an asset, plus a rate of return, for any new infrastructure that is built, so long as that expense is approved by regulators.

In several instances, utilities have cited pending or anticipated regulations on carbon dioxide emissions as a reason to request permission from regulators to prematurely retire their existing coal units, lending credence to the argument that the Biden Final CPS Rules, or similar anticipated regulations, were already affecting resource planning nationwide.[28] Thus, any costs associated with building new capacity in the modeled MISO grid, as presented in the Biden Final CPS Rules output files, are passed on to ratepayers in the form of higher retail electricity prices.

AOER calculated the cost of the modeled MISO grid in the Biden Final CPS Rules and determined it would cost MISO ratepayers an additional $404.1 billion at a 3.76 percent discount rate, relative to current costs, by 2055.[29] This additional cost would be higher if not for the subsidy phaseout timeline established by the U.S. Senate in the OBBBA, which reduces the total cost by approximately $20 billion.

Figure 7 shows the additional costs associated with the Biden Final CPS Rules, as well as fuel savings generated from this portfolio, as increasing penetrations of wind and solar reduce the run time of natural gas plants. However, the higher fixed costs of the additional wind, solar, and battery storage capacity far exceed the fuel cost savings, resulting in a net increase in expenses of $404.1 billion.

[28] Arizona Public Service, "Integrated Resource Plan," November 2023, https://www.aps.com/-/media/APS/APSCOM-PDFs/About/Our-Company/Doing-business-with-us/Resource-Planning-and-Management/APS_IRP_2023_PUBLIC.pdf?la=en&hash=F601897086C6836F7FD33C5C2F295F47.
[29] See the Methodology Section for cost calculation methods.

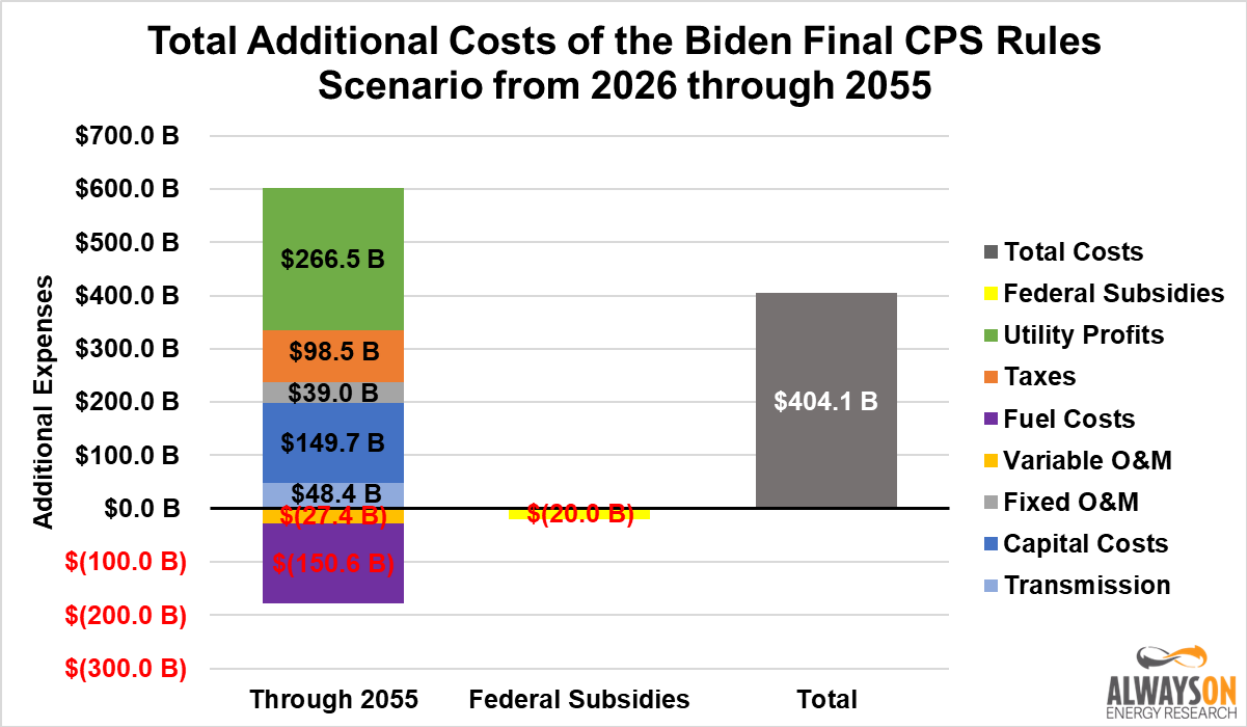

Figure 7. IRA subsidies reduce the cost of compliance with the Biden Final CPS Rules by approximately $20 billion. However, these subsidies do not reduce the cost of the grid; they simply shift $20 billion in costs to taxpayers, rather than ratepayers.

As discussed earlier, the modeled MISO grid in the Biden Final CPS Rules also results in massive rolling blackouts, causing $88.2 billion in damages through 2055, rendering it unsuitable for estimating the cost of the regulations. Therefore, AOER has modeled the cost of the Biden Final CPS Rules when enough additional capacity is built to maintain electric grid reliability.

Section 3: The Cost of Building an Avoiding Biden Blackouts Scenario

In the Avoiding Biden Blackouts scenario, AOER increased the estimated compound annual growth rate in peak electricity demand to 2 percent, compared to the EPA's estimates of 1.2 to 1.7 percent, to better reflect the latest estimates for data center demand growth from MISO.[30]

AOER also increased the amount of installed capacity on the MISO system to prevent blackouts from occurring while also achieving a carbon dioxide emissions rate of 0.8 metric tons per MWh

[30] Midcontinent Independent System Operator, "Long-Term Load Forecast," December 2024, https://cdn.misoenergy.org/MISO%20Long-Term%20Load%20Forecast%20Whitepaper_December%202024667166.pdf.

of electricity generated, which is the same emissions rate AOER determined would occur under the Biden Final CPS Rules in the IPM output files.[31]

Building enough additional wind, solar, battery storage, and natural gas capacity to prevent blackouts would require 196 GW of additional capacity, consisting of an additional 49.9 GW of wind, 20 GW of solar, 86.3 GW of four-hour battery storage, and 40.5 GW of natural gas, compared to the Biden Final CPS Rules in the IPM output files (See Figure 8).

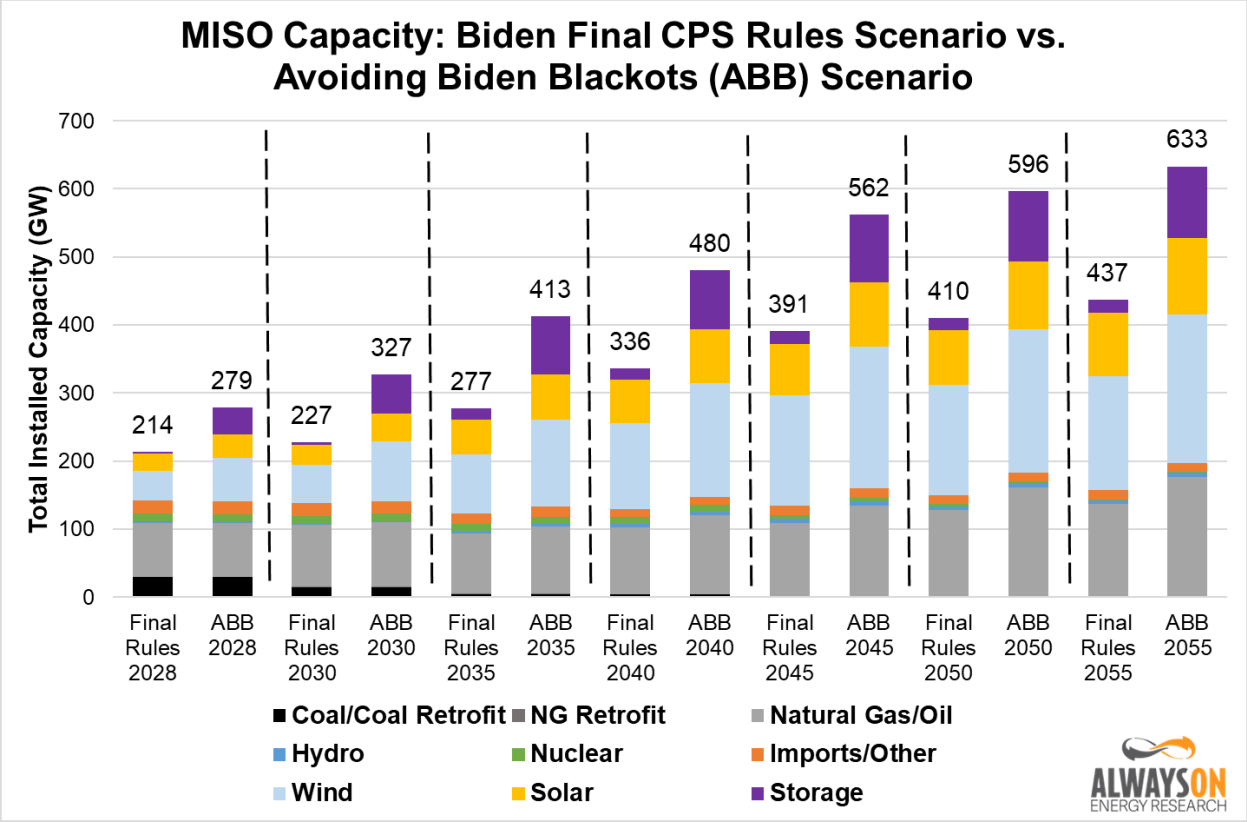

Figure 8. The Avoiding Biden Blackouts requires nearly 45 percent more capacity than the modeled MISO grid in the Biden Final CPS Rules output files to maintain reliability. This extra capacity is a major driver of cost.

The additional capacity needed to reliably meet electricity demand for every hour of the modeled years will result in $867.9 billion in compliance costs for MISO ratepayers, compared to the current grid, and this expense can be considered the true cost of the Biden Final CPS Rules (See Figure 9.

[31] Author calculation. AOER determined the increased capacity for this scenario by cost optimizing using natural gas, wind, solar, and battery storage to meet the same per megawatt-hour (MWh) emissions rate of .8 per MWh based on EPA emissions rates.

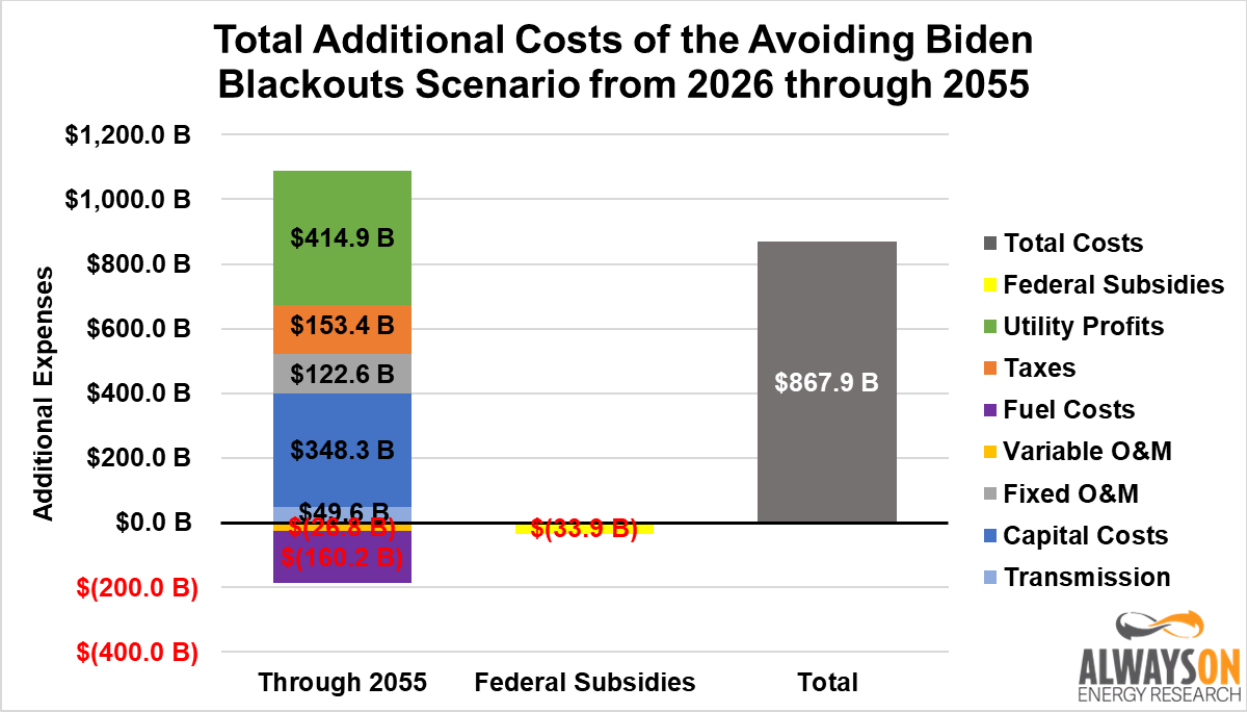

Figure 9. The true cost of the regulations is $867.9 billion, compared to the current electric grid, after fuel savings and subsidy costs are subtracted from the additional expenses.

A detailed explanation of how these costs were calculated is available in the Appendix.

Section 4: Creating a Trump Proposal Policy Scenario

The entire purpose of the Trump administration's repeal of the Biden administration's regulations on greenhouse gas emissions on existing coal plants and new natural gas plants, and the repeal of the Clean Air Act Section 111b standards for new coal plants, is to give utilities and power plant owners the freedom to continue using these reliable, affordable assets for the foreseeable future and to have the confidence needed to build new power plants to meet America's rising need for electricity in the coming decades.

Therefore, it does not make sense to evaluate the economic and reliability benefits of the rule by simply calculating the difference between the Biden Base Case, which assumed nearly all of the remaining coal plants in MISO would close due to the IRA and other factors, and the Biden Final CPS Rules. Fortunately, the Trump administration has an opportunity to clearly communicate the benefits of its proposed rules by conducting its own modeling that accounts for these important changes.

AOER has developed an illustrative Trump Proposal Policy Scenario for the MISO region that creates a more balanced and reliable resource portfolio in the region that we believe can serve as a useful framework for the administration as it develops its final rules.

The Trump Proposal Scenario

The modeled MISO grid in the Trump Proposal Policy Scenario more closely resembles the existing MISO grid because the rules are, in large part, intended to preserve the reliable, low-cost power plants that currently keep the lights on in the region and remove impediments to the construction of new natural gas plants to meet rising electricity demand.

Figure 10. shows the capacity of the Trump Proposal on the MISO system in each of the EPA's model years and the updated projected peak demand figures AOER used in the "Avoiding Biden Blackouts" scenario, which assumes a 2 percent annual compound growth rate instead of the rate of growth assumed in the Biden Final CPS Rules output files.[32]

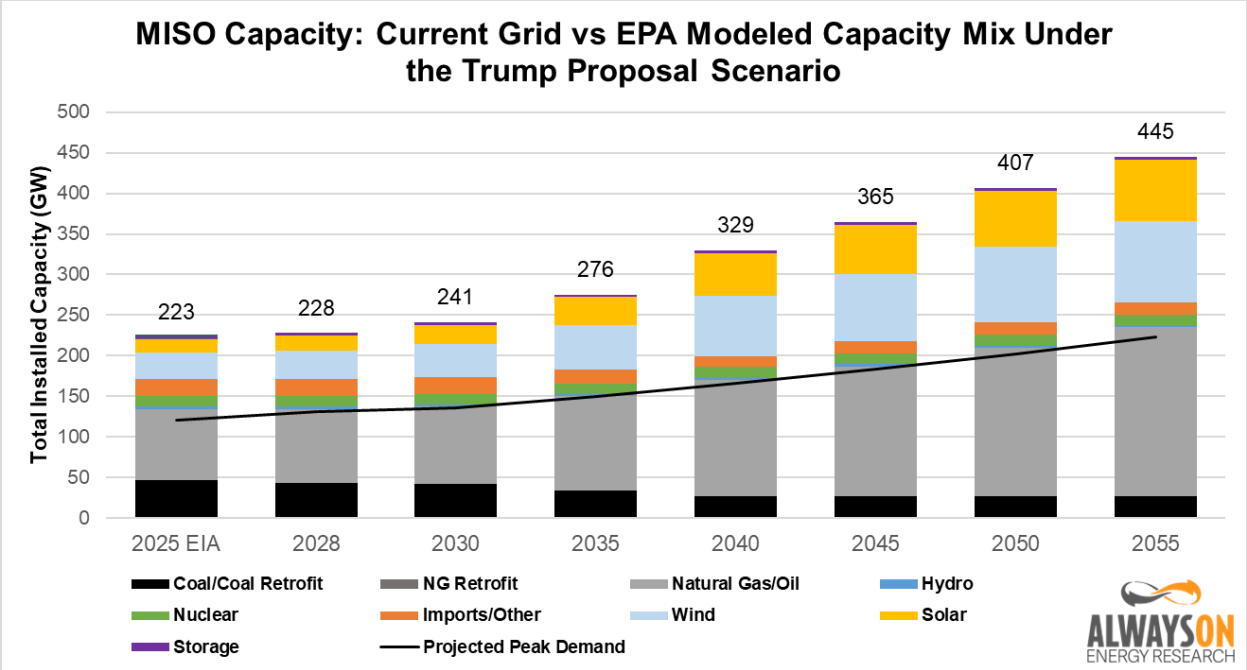

Figure 10. The Trump Proposal continues to utilize existing coal and nuclear power plants and builds new natural gas power plants to meet rising demand.

From 2025 to 2055, the total installed capacity on the modeled MISO system grows from 223 GW to 445 GW to meet the growth in demand from 121 GW to 224 GW in 2055. The growth in capacity largely consists of natural gas, solar, wind, and battery storage, with retirements consisting of coal plants and some older natural gas and oil facilities.

There are still 19.5 GW of coal retirements in the Trump Proposal as some of these generators reach 60 years of age, and others are retired due to state decarbonization mandates and renewable portfolio standards (RPS). Significant quantities of solar, wind, and battery storage capacity are also added in the Trump Proposal to ensure the region has enough wind and solar generation to

[32] Midcontinent Independent System Operator, "Long-Term Load Forecast," December 2024, https://cdn.misoenergy.org/MISO%20Long-Term%20Load%20Forecast%20Whitepaper_December%202024667166.pdf.

meet the carbon-free electricity mandates in Illinois, Michigan, and Minnesota on an annual basis, and to meet the less onerous RPS mandates in other MISO states.[33,34,35]

While these state-level mandates increase the cost of the modeled MISO grid in the Trump Proposal relative to the costs of the current MISO grid, thus reducing their benefits relative to the Biden Final CPS Rules, they represent the state of current policies and were therefore included in this analysis, similar to the methodology employed by EPA when constructing the Biden Base Case and Biden Final CPS Rules.

Lastly, the Trump Proposal provides superior reliability because it retains many of the remaining coal plants and all of the existing nuclear power plants on the system. It also builds enough new reliable power plant capacity to ensure there are no blackouts in any of the HCYs examined in AOER's modeling.

Modeling the Trump Proposal Reliability

The Trump Proposal retains a more significant portion of the existing MISO coal and nuclear fleets than the modeled MISO grid in the Biden Final CPS Rules output files and adds new combined cycle natural gas to operate in a baseload capacity to meet rising demand.

Wind, solar, and battery storage resources are still added, but under the Trump Proposal, these states do not *rely* on wind, solar, or battery storage to meet peak and net peak electricity demand. Instead, enough dispatchable capacity is built to ensure that demand can be met in every hour of the HCYs examined, plus a 15 percent reserve margin. This margin of safety increases the cost of the Trump Proposal Policy Scenario but eliminates blackouts in AOER's reliability modeling.

For example, Figure 11 shows the same hypothetical stretch from July 5 through July 8, 2040, when the modeled MISO grid in the Biden Final CPS Rules experienced a 31 GW blackout due to low wind and solar output and insufficient battery storage capacity to maintain reliability in the 2020 HCY.

Rather than suffering from a substantial blackout, the Trump Proposal maintains reliability with a healthy reserve margin as coal and nuclear provide the baseload power required, and natural gas is used as a peaking resource as wind and solar provide varying levels of energy.

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[33] AOER determined the share of annual electricity consumption in these jurisdictions to determine the amount of wind and solar generated electricity that would need to be generated in the MISO footprint to generate sufficient Renewable Energy Certificates (RECs) in the region to meet the mandates established by these states. This is a conservative assumption that increases the costs of the Trump Proposal by not allowing these states to purchase RECS from other RTOs.

[34] National Council of State Legislators, "State Renewable Portfolio Standards and Goals," Brief, Accessed August 4, 2025, https://www.ncsl.org/energy/state-renewable-portfolio-standards-and-goals.

[35] Center for Climate and Energy Solutions, "U.S. State Electricity Portfolio Standards," August 2024, https://www.c2es.org/document/renewable-and-alternate-energy-portfolio-standards/.

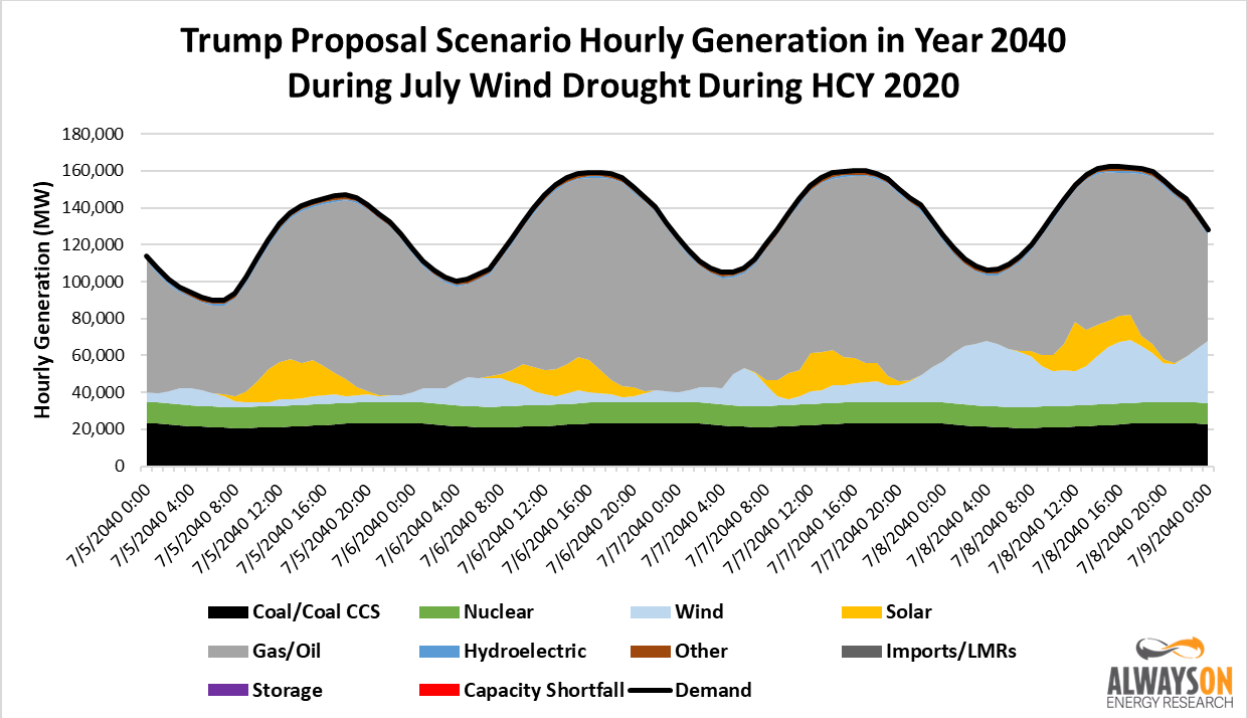

Figure 11. The Trump Proposal results in a MISO grid that is able to generate electricity without capacity shortfalls due to its reliance on dispatchable and highly reliable generators.

Allowing affordable, dispatchable power plants to remain operational comes with massive reliability and economic benefits. Providing reliable power without capacity shortfalls eliminates the Social Cost of Blackouts, and retaining existing generation sources and focusing on building new dispatchable power plants saves MISO ratepayers hundreds of billions of dollars compared to the Avoiding Biden Blackouts.

The Economic Impact of the Trump Proposal Scenario

AOER modeled the economic impacts of the modeled MISO grid under the illustrative Trump Proposal and determined that building this installed capacity to meet the projected demand growth would cost an additional $307.2 billion by 2055, compared to the current grid.

While MISO ratepayers will incur significant expenses to meet future power demand estimates under the Trump Proposal, it will save these families and businesses at least $560.7 billion through 2055, compared to the cost of the Avoiding Biden Blackouts scenario, with potential benefits up to $801.4 billion if the impacts of state policies are excluded from the analysis.

The primary benefit of the Trump Proposal is that it will grant power plant owners, especially coal plant owners, a welcome reprieve from the onerous Section 111(d) requirements in the Biden Final CPS Rules, allowing these coal plant owners to run their facilities for the foreseeable future. It will also remove regulatory obstacles to building the new natural gas plants needed to meet rising demand.

Our modeling indicates existing coal plants will provide significant value to MISO electric ratepayers. FERC Form 1 data compiled by AOER show existing coal plants in the region

provide some of the lowest cost electricity on the system, producing power for just $37.46 per MWh (See Figure 12).[36]

MISO's existing nuclear power plants provide the lowest-cost electricity, with the average facility generating electricity for $28.38 per MWh. In comparison, existing natural gas plants generate electricity at a cost of $38.14 per MWh.[37]

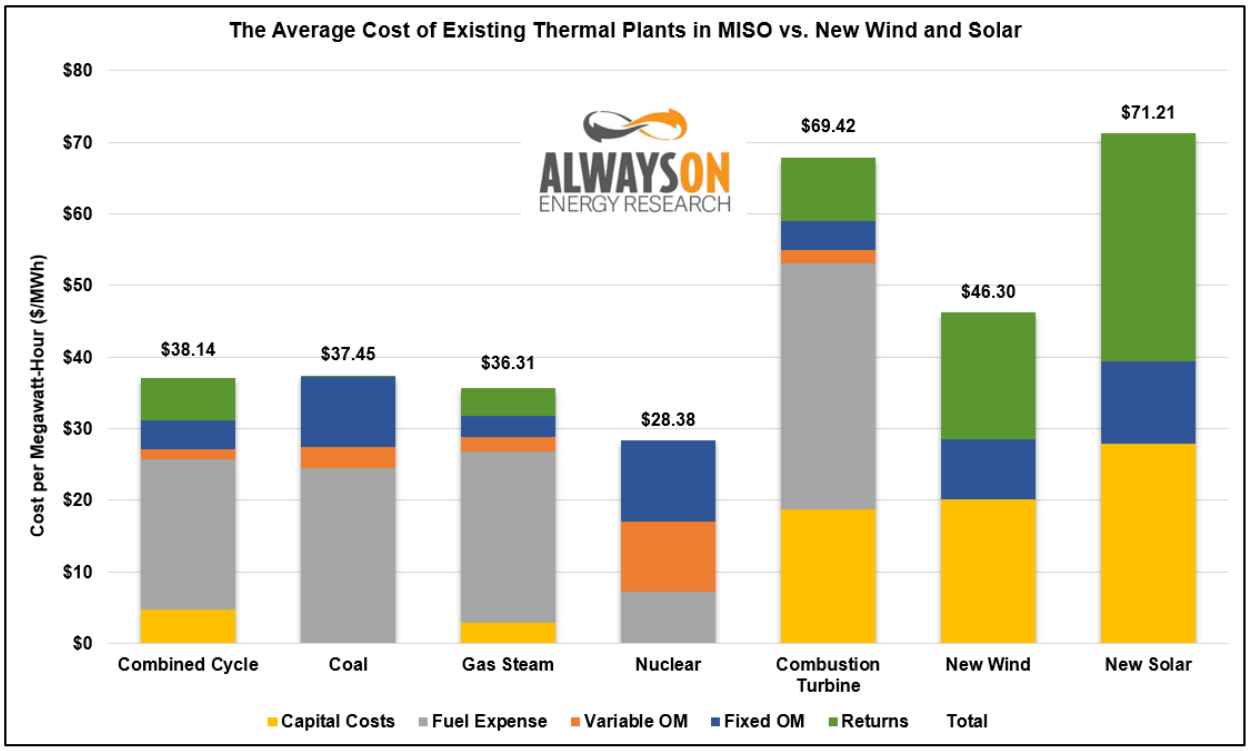

Figure 12. Existing resources on the MISO grid produce electricity for a far lower cost than new wind and solar resources. Additionally, these estimates do not account for the cost of battery storage or natural gas backup that is rightfully attributable to wind and solar.

In contrast, AOER calculates the unsubsidized cost of new solar and wind to be $71.21 per MWh and $46.30 per MWh, respectively, based on AEO 2025 EMM inputs.[38] These resources reduce the fuel costs associated with coal, natural gas, and nuclear plants, but do so by adding higher fixed costs to the system, causing electricity prices to increase when they are added.

Figure 13 shows that the cost of building and operating the modeled MISO grid in the Trump Proposal is an additional $307.2 billion through 2055, compared to operating the existing MISO grid, after federal subsidies.

[36] AOER compiled FERC Form 1 data for every power plant from the top ten utilities in MISO by sales volume. These utilities accounted for 63 percent of total sales in the region in XYEAR, providing a representative sample size.

[37] See "Capital Costs, and Fixed and Variable Operation and Maintenance Costs" of the Appendix for more information.

[38] See "Capital Costs, and Fixed and Variable Operation and Maintenance Costs" "in the Appendix.

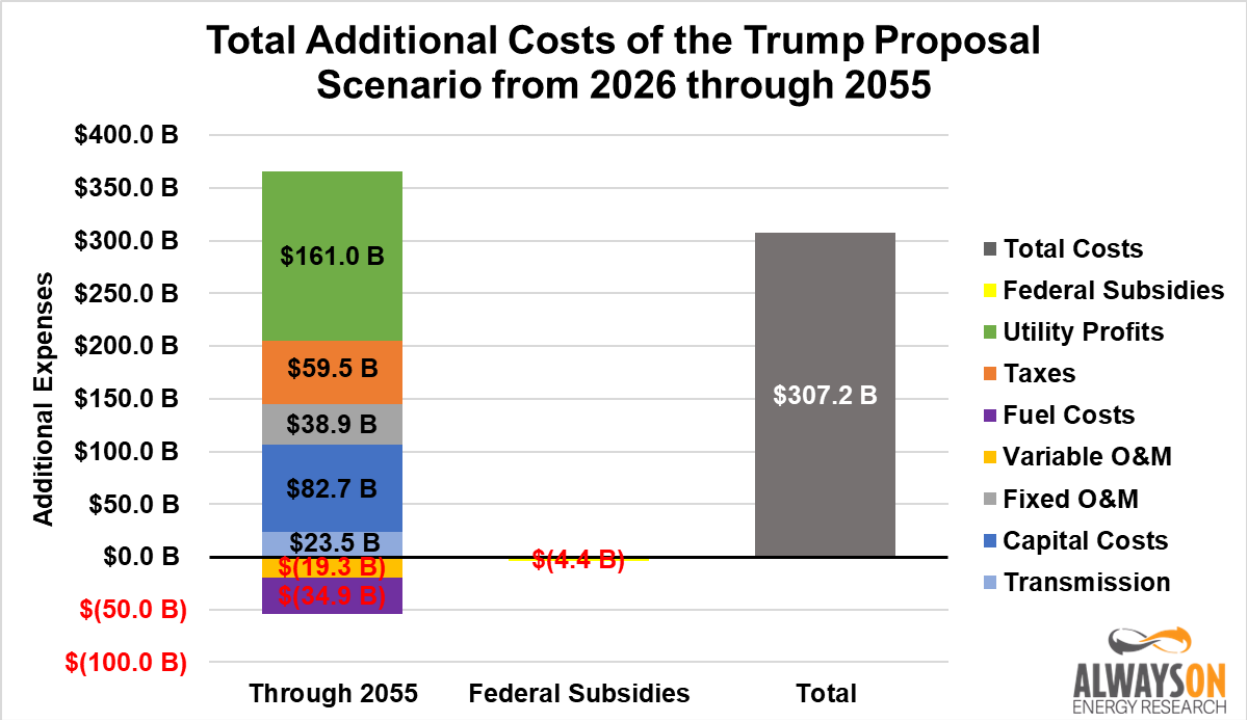

Figure 13. The cost of the Trump Proposal is $307.2 billion through 2055.

At a price tag of $307.2 billion more than operating the current MISO grid, the Trump Proposal is far less costly than the Biden Baseline ($362.1 billion), the Biden Final CPS Rules ($404.1 billion), and the Avoiding Biden Blackouts (867.9 billion) (See Figure 14).

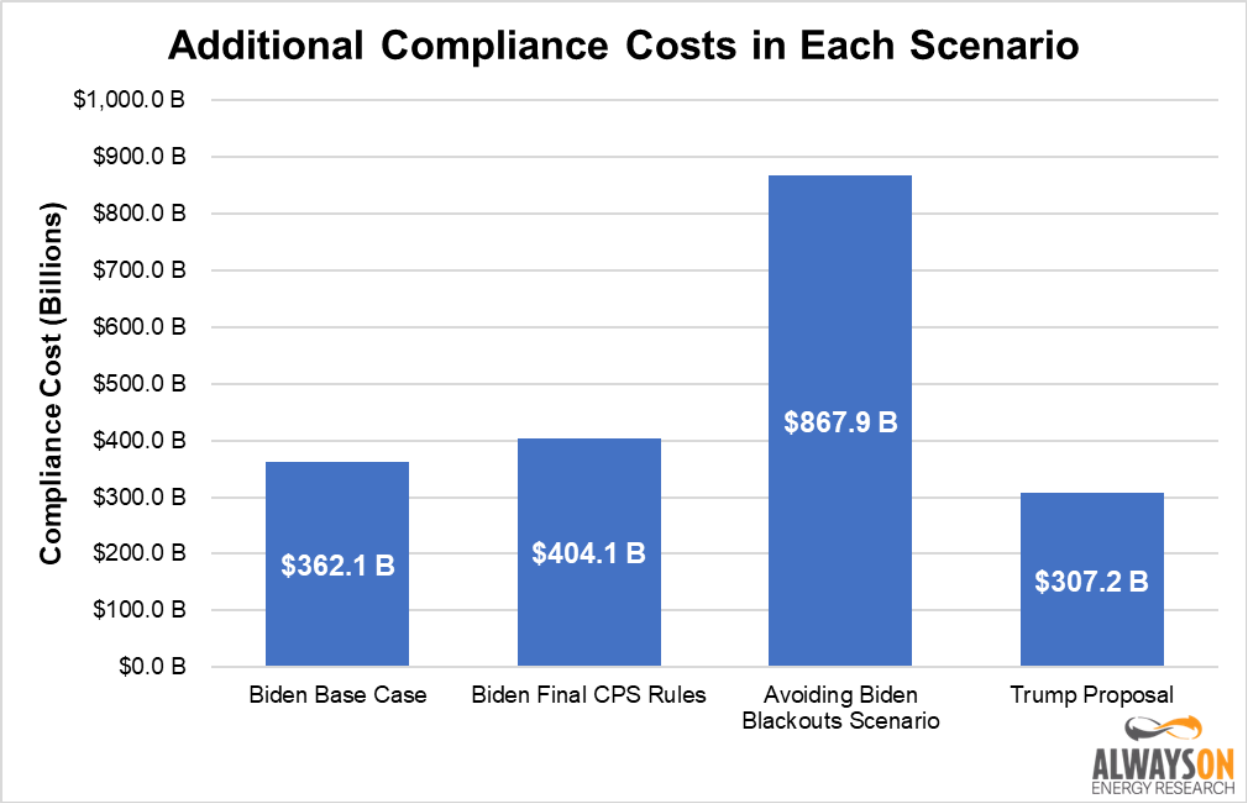

Figure 14. The Trump Proposal will save $560.7 billion through 2055 compared to the cost of the Avoiding Biden Blackouts in the MISO region.

The $41.9 billion delta between the Biden Base Case and the Biden Final CSP Rules represents the compliance costs modeled by the Biden administration in its RIA, and the $362.1 billion difference between the Biden Base Case and the current MISO grid represents the costs that were hidden in the Biden Base Case. The delta between the Trump Proposal and the Avoiding Biden Blackouts represents the total cost savings of the Trump Proposal.

Costs are far lower in the Trump Proposal Policy Scenario than the Avoiding Biden Blackouts for three reasons:

1) Most of the MISO region's existing, low-cost coal and all of its existing nuclear power plants are expected to remain online, reducing the need for new capital spending and utility returns.
2) Low-cost natural gas plants are built to meet rising electricity demand and replace coal plants that are shuttered in response to state policies or due to age.[39]
3) The system is built using mostly dispatchable capacity, which reduces the need for $52.7 billion in expensive large-scale transmission lines to carry power from distant wind and solar facilities to the populations that use the power, and limits the need for overbuilding

[39] AOER retired older coal, natural gas, and oil plants after they reach 60 years of age and replaced them with natural gas facilities as needed.

and curtailment of unreliable wind and solar resources to ensure adequate power supplies during periods of low wind and solar generation.

AOER also determined that the Trump Proposal could generate even more savings if not for state mandates forcing the premature closure of coal-fired power plants and the adoption of unreliable wind and solar generators. Figure 15 shows that MISO ratepayers could save as much as $801.4 billion if states with carbon-free mandates were to repeal these policies and continue to utilize the existing coal, natural gas, and nuclear plants on their systems while only building wind, solar, or storage resources if it made financial sense to do so.

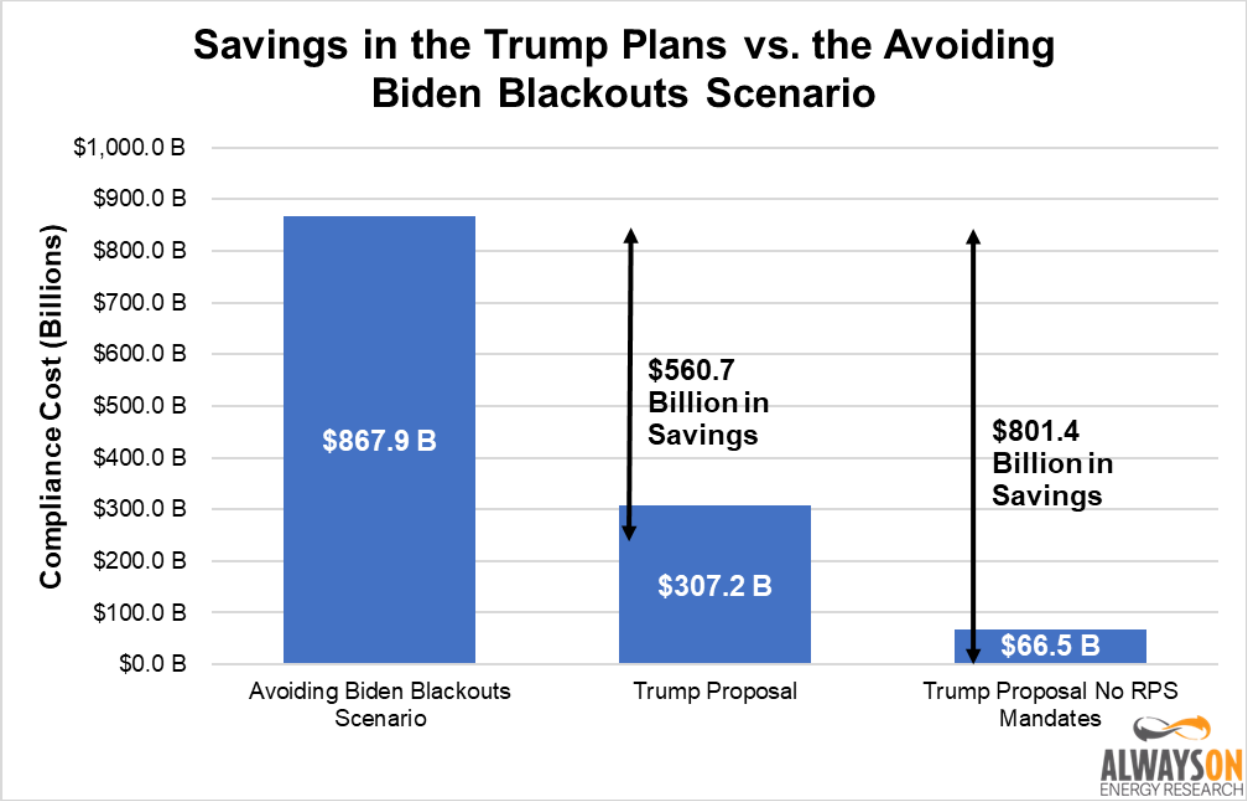

Figure 15. The Trump Proposal could save MISO ratepayers as much as $801.4 billion in savings through 2055, if not for state mandates requiring the use of wind and solar.

Not only does the Trump Proposal save MISO ratepayers $560.7 billion in compliance costs, it also saves them up to $53.6 billion by avoiding massive rolling blackouts.[40]

Trump Proposal Emissions and Net Benefits Calculations

The cost/benefit analysis of the Biden Final CPS Rules relied heavily on the calculation of co-benefits from reducing emissions of PM2.5, NOx, and SOx, as well as climate benefits from reducing greenhouse gases to make their regulations pencil out. There are serious shortcomings to this approach.

[40] Both figures are calculated at a 3.76 percent discount rate.

Improvements in emissions reduction technology on existing power plants mean they emit very few pollutants. EPA data show the vast majority of states, particularly those in the MISO region, are already in compliance with the National Ambient Air Quality Standards (NAAQS) established for these emissions, which are designed to protect even the most vulnerable populations, such as children and the elderly.[41,42]

Furthermore, according to the Minnesota Pollution Control Agency, the worst air quality days in Minnesota for 2024, a state within MISO, were "associated with several intrusions of wildfire smoke from Canada. The Air Quality Index (AQIs) reached Red during smoke intrusions in mid-May and mid-September and reached Orange on a few days between mid-August and early September."[43]

While AOER recommends that the agency explore alternatives to using Linear No Threshold cost estimates for criteria pollutants, our analysis found that even when the additional costs of more PM2.5, NOx, and SOx emissions were accounted for in the Trump Proposal, it still delivered $314.6 billion in net benefits in the MISO region in avoided compliance costs when discounted at a 3.76 percent discount rate.

Criteria Pollutants

Emissions of criteria pollutants will rise in the Trump Proposal relative to the Biden Final CPS Rules and Avoiding Biden Blackouts scenarios. Using average emissions rates for U.S. coal and natural gas power plants from the U.S. EIA, AOER applied an average tons per MWh emissions factor to each MWh of electricity generated in the MISO region under the Trump Proposal to calculate the increase in emissions and their associated cost of the emissions, relative to the Avoiding Biden Blackouts.[44]

Coal plant emissions fall over time as plants are retired as a result of state mandates and due to age in both scenarios, but emissions in the Trump Proposal scenario remain elevated relative to the Avoiding Biden Blackouts scenario throughout the duration of the model.

Table 4 shows the increase in criteria pollutants in the Trump Proposal, relative to the Avoiding Biden Blackouts through 2055. It also shows the cost per ton estimate established by EPA, and shows the final discounted cost of these emissions in the Trump Proposal.[45]

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[41] U.S. Environmental Protection Agency, "PM-2.5 Non-Attainment Areas (2012 Standard)," Accessed July 31, 2025, https://www3.epa.gov/airquality/greenbook/mappm25_2012.html.
[42] U.S. Environmental Protection Agency, "NAAQS Table," Accessed July 28, 2025, https://www.epa.gov/criteria-air-pollutants/naaqs-table.
[43] Minnesota Pollution Control Agency, "2024 Minnesota Air Monitoring Data Report," May 2025, https://www.pca.state.mn.us/sites/default/files/aq10-26e.pdf.
[44] NOx and SOx emissions were calculated using the State Energy Data Profile for the United States from the U.S. Energy Information Administration. Total emissions of NOx and SOx from coal and natural gas plants were divided by total U.S. generation to produce a tons per MWh emissions rate.
[45] See "Criteria Pollutant Emissions," in the Appendix.

Additional Criteria Pollutant Costs Through 2055 in Trump Proposal Policy Scenario						
	Coal			Natural Gas		
	NOx	SOx	PM2.5	NOx	SOx	PM2.5
Total Additional Emissions Tons	2,476,014	3,560,228	77,140	1,206,611	11,418	47,651
Cost ($/Ton)	$7,710	$57,000	$113,000	$7,710	$57,000	$113,000
Total Social Cost	$19,090,070,734.59	$202,933,022,441.85	$8,716,864,248.28	$9,302,968,998.20	$650,805,030.47	$5,384,600,617.48
Total	$230,739,957,424.72			$15,338,374,646.15		

Table 4. The Trump Proposal will cost an additional $246.1 billion in criteria pollutants, according to EPA's cost estimates for these emissions.

The $246.1 billion cost of emissions in the Trump Proposal are subtracted from the $560.7 compliance cost savings to produce a net benefit calculation of $314.6 through 2055 in just the MISO region of the country (See Figure 16).

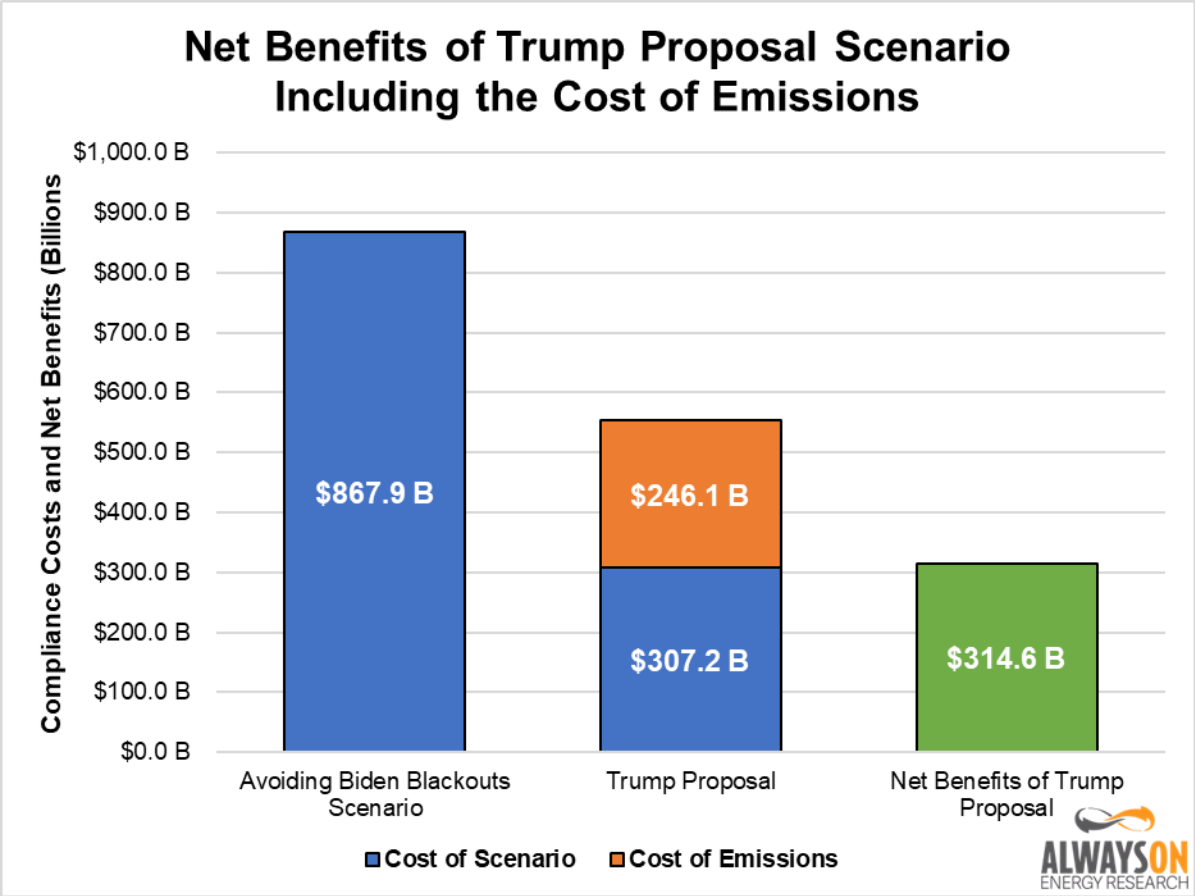

Figure 16. The net benefits of the Trump Proposal are $314.6 billion, after accounting for the additional emissions costs associated with criteria pollutants.

Social Cost of Carbon

The repeal of the Biden Administration's greenhouse gas standards for new and existing coal plants will inevitably lead to an increase in total greenhouse gas emissions, as planned and premature coal-fired power plant retirements are reversed and new natural gas-fired turbines are built to meet America's growing demand for affordable energy. Therefore, repealing the rule means that the social benefits associated with improved air quality and reduced climate damage published in the original rule are now costs EPA will need to address when repealing and revising its emission standards.

During the Biden Administration, EPA used a global social cost of carbon (SC-CO_2). The SC-CO_2 is an estimator that captures the monetary value of future marginal damages associated with emitting one metric ton of carbon dioxide today, or at a point in the future. Regulators have tried to estimate the value of the SC-CO_2 decades, and even centuries, into the future using complex integrated models.

However, the resulting estimates of the SC-CO_2 are only as good as the underlying assumptions used when regulators run the models. Between 2009 – 2017, and 2021 – 2025, the Interagency Working Group (IWG) on Climate Change and EPA flaunted established regulatory impact analysis (RIA) procedures set by the Office of Management and Budget's Circular A-4 when estimating SC-CO_2 values. In 2010, 2013, 2015, 2016, and 2021, IWG published 3 technical support documents, none of which provided an SC-CO_2 estimate using a 7 percent discount rate. This left agencies unable to produce a climate benefit stream, overstating the value of public investment in the regulations.

When EPA estimated a new domestic value of the SC-CO_2 at the appropriate 3 and 7 percent discount rates for the repeal of the Clean Power Plan and promulgation of the Affordable Clean Energy (ACE) rule, the estimator was significantly lower than what was estimated under the Obama and Biden Administration's EPAs. TableX:SC-CO_2estimates uses the change in carbon emissions estimated by AOER and monetizes the emissions using several estimators for the SC-CO2 published by the EPA of the three previous administrations.

Table 5: Estimated Social Cost of Repealing Biden EPA's Climate Rule for MISO Region 2026 – 2050* (in billions $2024)

Administration/SC-CO2 Discount Rate	3 percent	3.76 percent	7 Percent
Obama EPA 2016	$276.78	$251.62	$172.97
Trump EPA 2019 - 3%	$36.46	$33.11	$22.65
Trump EPA 2019 - 7%	$7.77	$7.07	$4.85
Biden EPA 2023	$729.63	$653.35	$426.29

Table 5: SC-CO_2 estimates monetizes the difference in CO2 emissions under a repeal of the Biden Administration EPA's standards for stationary sources of greenhouse gas emissions. The source of variation across SC-CO_2 estimators stems from the Obama and Biden Administration's publication of a global SC-CO_2 and non-compliance with RIA guidelines established by the 2003 OMB circular A-4. Note, estimates for Obama and Trump EPA stopped at 2050. Benefits for Biden EPA span 2026 – 2055.

For monetizing the difference in emissions, AOER suggests using the Trump EPA 2019 SC-CO2 estimates. These estimates are the only SC-CO2 estimates produced within the appropriate regulatory guidelines during their time and likely reflect climate damages impacting American citizens exclusively. Subtracting these values from the total net benefits of the Trump Proposal would result in $281.5 billion in total savings.

History of Flawed SC-CO_2 Estimates

In 2009, the Interagency Working Group developed and standardized the first sequence of SC-CO_2 estimates for use in agencies RIAs.[46] IWG published their guide for regulators in 2010. IWG would update the SC-CO_2 using the same models, but with more recent climate data in 2016. IWG's decadal estimates for SC-CO_2 are provided in Table 6.

[46] Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis, Interagency Working Group on Social Cost of Greenhouse Gases, August 2016; https://www.epa.gov/sites/default/files/2016-12/documents/sc_co2_tsd_august_2016.pdf ; Social Cost of Carbon for Regulatory Impact Analysis, Interagency Working Group on Social Cost of Carbon, February 2010; https://www.epa.gov/sites/default/files/2016-12/documents/scc_tsd_2010.pdf

Table 6: IWG's estimates for the Social Cost of Carbon 2010 and 2016 (in 2007$)

	TSD - 2010				TSD - 2016			
	5% Avg	3% Avg	2.5% Avg	3% 95th	5%	3%	2.5%	3% 95th
2010	$4.7	$21.4	$35.1	$64.9	$10.0	$31.0	$50.0	$86.0
2015	$5.7	$23.8	$38.4	$72.8	$11.0	$36.0	$56.0	$105.0
2020	$6.8	$26.3	$41.7	$80.7	$12.0	$42.0	$62.0	$123.0
2025	$8.2	$29.6	$45.9	$90.4	$14.0	$46.0	$68.0	$138.0
2030	$9.7	$32.8	$50.0	$100.0	$16.0	$50.0	$73.0	$152.0
2035	$11.2	$36.0	$54.2	$109.7	$18.0	$55.0	$78.0	$168.0
2040	$12.7	$39.2	$58.4	$119.3	$21.0	$60.0	$84.0	$183.0
2045	$14.2	$42.1	$61.7	$127.8	$23.0	$64.0	$89.0	$197.0
2050	$15.7	$44.9	$65.0	$136.2	$26.0	$69.0	$95.0	$212.0

Table 6: Shows the IWG's estimated values for the SC-CO_2. IWG obtained these estimates from the DICE, PAGE, and FUND models using discount rates of 5%, 3%, 2.5% and 3% at the 95th percentile. The last estimate was presented to reflect the most extreme climate scenarios – rapid ice-pack loss and unstoppable sea-level rise.

When estimating the SC-CO_2 IWG utilized three integrated assessment models – DICE, PAGE, and FUND. IWG chose to run these models at discount rates of 5 percent, 3 percent, 2.5 percent, and the 95th percentile of damages at the 3% discount rate, reflecting the most extreme climate change scenarios. However, IWG never published a scenario modeling the social cost of carbon at 7 percent. During the publication of IWG's 2010, 2016 guiding documents, OMB's Circular A-4 (2003) required agencies to model costs at discount rates of 3 and 7 percent.[47] Economically, these rates reflected the risk-free rate of return on capital and the private rate of return accrued to capital invested in businesses or the stock market.[48]

[47] MB Circular A-4, Regulatory Analysis, September 17, 2003; https://www.transportation.gov/sites/dot.gov/files/docs/OMB%20Circular%20No.%20A-4_0.pdf ; Social Cost of Carbon for Regulatory Impact Analysis, Interagency Working Group on Social Cost of Carbon, February 2010; https://www.epa.gov/sites/default/files/2016-12/documents/scc_tsd_2010.pdf ; Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis, Interagency Working Group on Social Cost of Greenhouse Gases, August 2016; https://www.epa.gov/sites/default/files/2016-12/documents/sc_co2_tsd_august_2016.pdf

[48] OMB Circular A-4, Regulatory Analysis, September 17, 2003; https://www.transportation.gov/sites/dot.gov/files/docs/OMB%20Circular%20No.%20A-4_0.pdf ; Circular A-94, Economic Analysis of Federal Regulations Under Executive Order 12866; https://obamawhitehouse.archives.gov/sites/default/files/omb/assets/a94/a094.pdf ; David Kreutzer, Discounting

Dayaratna et al. (2017) reviewed the DICE and FUND models and found that a 7 percent discount rate significantly reduced the SC-CO_2, producing negative estimates in some cases. [49] Table 7 and Table 8 show how changes in the model drastically revised down estimates for SC-CO_2.

Discount rates	Mean SCC–DICE model							
	Using simulated ECS				Using empirical ECS			
	2.50%	3.00%	5.00%	7.00%	2.50%	3.00%	5.00%	7.00%
2010	$46.58	$30.04	$8.81	$4.02	$23.62	$15.62	$5.03	$2.48
2020	$56.92	$37.79	$12.10	$5.87	$28.92	$19.66	$6.86	$3.57
2030	$66.53	$45.15	$15.33	$7.70	$33.95	$23.56	$8.67	$4.65
2040	$76.96	$53.26	$19.02	$9.85	$39.47	$27.88	$10.74	$5.91
2050	$87.70	$61.72	$23.06	$12.25	$45.34	$32.51	$13.03	$7.32
% Chg at 2020					−49.2%	−48.0%	−43.3%	−39.2%

Table 7. This table shows the average SC-CO_2 estimates published in Dayaratna 2017 for the DICE model. Estimates for the SC-CO2 at the 7 percent discount rate are in the single digits, and do not exceed $10 per metric ton until 2050.[50] At higher discount rates, the DICE model would inevitably produce a negative social cost of carbon.

Discount rates	Mean SCC–FUND model							
	Using simulated ECS				Using empirical ECS			
	2.50%	3.00%	5.00%	7.00%	2.50%	3.00%	5.00%	7.00%
2010	$29.69	$16.98	$1.87	−$0.53	$5.25	$2.78	−$0.65	−$1.12
2020	$32.90	$19.33	$2.54	−$0.37	$5.86	$3.33	−$0.47	−$1.10
2030	$36.16	$21.78	$3.31	−$0.13	$6.45	$3.90	−$0.19	−$1.01
2040	$39.53	$24.36	$4.21	$0.19	$7.02	$4.49	−$0.18	−$0.82
2050	$42.98	$27.06	$5.25	$0.63	$7.53	$5.09	$0.64	−$0.53
% Chg at 2020					−82.2%	−82.8%	−118.5%	−197.3%[a]

Climate Costs, The Heritage Foundation, June 16, 2016; https://www.heritage.org/environment/report/discounting-climate-costs

[49] Kevin Dayaratna et al., 017, Empirically carbon. Constrained Climate Sensitivity And The Social Cost Of Carbon: Climate change economics, v. 8, no. 2, p. 1750006.

[50] Kevin Dayaratna, K., R. Mckitrick, and D. Kreutzer, 2017 et al., 017, Empirically constrained climate sensitivity and the social cost of carbon. Constrained Climate Sensitivity And The Social Cost Of Carbon: Climate change economics, v. 8, no. 2, p. 1750006.

Table 8. This table shows the average SC-CO_2 estimates published in Dayaratna 2017 for the FUND model. At a 5% discount rate, the social cost of carbon does not reach $6 by 2050. Given a 7% discount rate, the model produced negative values for the SC-CO2 between 2010 – 2030, and never exceeded $1 by 2050.[51] At higher discount rates, the DICE model would inevitably produce a negative social cost of carbon.

In addition to updating and providing estimates for the SC-CO2 at the 7 percent discount rate, Dayaratna et al. (2017) also discovered that the models EPA used to estimate the SC-CO2 frequently produced negative values for the SC-CO2 – implying that increasing CO2 emissions generated societal benefits. Figure 9 shows that at the 7 percent discount rate, the FUND model began producing negative estimates for the SC-CO2. And this negative SC-CO2 estimate was not generated by an anomalous run of the model. Dayaratna et al. (2017) encountered negative SC-CO2 values for nearly three out of four model runs at the 7 percent discount rate (see Table 9).

Table 6. Probability of a negative SCC under four discount rates in the FUND model.

Discount rates	Probability of negative SCC – FUND model							
	Using simulated ECS				Using empirical ECS			
	2.50%	3.00%	5.00%	7.00%	2.50%	3.00%	5.00%	7.00%
2010	0.087	0.121	0.372	0.642	0.416	0.450	0.601	0.730
2020	0.084	0.115	0.344	0.601	0.402	0.432	0.570	0.690
2030	0.080	0.108	0.312	0.555	0.388	0.414	0.536	0.646
2040	0.075	0.101	0.282	0.507	0.371	0.394	0.496	0.597
2050	0.071	0.093	0.251	0.455	0.354	0.372	0.456	0.542

Table 9. This table was pulled directly from Dayaratna et al. (2017) and shows the probability that EPAs FUND model would return a negative SC-CO2 value. E.G. when the fund model was run using empirical ECS and parameterized with a 7 percent discount rate, the model would produce a negative SC-CO2 value in three out of every four runs. By 2050, 1 out of every 2 runs would return a positive SCC. Negative SC-CO2 values were also observed at similar frequencies using simulated ECS data.

Many of the criticisms laid out in Dayaratna et al. (2017) were redressed by the Trump administration. In 2017, Trump signed Executive Order 13783, Promoting Energy Independence and Economic Growth. E.O. 13785 Sec. 5(c) directed federal agencies to revise estimates for SC-CO2 by applying the discount rates outlined in Circular A-4 (2003) to the models used to

[51] Kevin Dayaratna, K., R. Mckitrick, and D. Kreutzer, 2017 et al., 017, Empirically constrained climate sensitivity and the social cost of carbon. Constrained Climate Sensitivity And The Social Cost Of Carbon: Climate change economics, v. 8, no. 2, p. 1750006.

estimate the SC-CO_2.[52] In 2019, as part of the Affordable Clean Energy Rule, EPA published the domestic SC-CO2 estimators presented in Table 10.

Table 10: EPA's 2019 estimates for the Domestic Social Cost of Carbon

	Discount Rate	
	3% Average	7% Average
2015	$6	$1
2020	$7	$1
2025	$7	$1
2030	$8	$2
2035	$9	$2
2040	$9	$2
2045	$10	$2
2050	$11	$2

Table 10. This table presents EPA's published SC-CO2 estimates used to quantify the benefits of the repeal of the Clean Power Plan.

The Trump administration's revision of the SC-CO2 refrained from analyzing the global effect of emitting one metric ton of carbon, restricting its analysis to within the US borders. This kept the SC-CO2 consistent with Circular A-4 2003, which required regulatory impact analyses to refrain from monetizing benefits that accrued to foreign nations and their denizens.[53]

In 2021, a series of executive orders from President Biden reinstated the IWG on the Social Cost of greenhouse gases, updated the SC-CO2, and ordered OMB to review and revise Circular A-4. In February 2021, IWG published revised SC-CO2 estimates. In November 2023, OMB finalized Circular A-4 (2023), which eliminated the three and seven-percent discount rates entirely. In the same month, EPA also released "Supplementary Material for the Regulatory Impact Analysis for the Final Rulemaking, 'Standards for Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review," - hereinafter cited as EPA (2023) - which included the agency's most extreme estimates for the SC-CO2 to date. The highest discount rate used in the updated analysis was 2.5 percent.

When selecting which scenario to highlight, AOER chooses to maintain compliance with the existing rules. Executive Order 14192: Unleashing Prosperity Through Deregulation ordered the

[52] Promoting Energy Independence and Economic Growth, E.O. 13783 Sec. 5(C); https://www.federalregister.gov/documents/2017/03/31/2017-06576/promoting-energy-independence-and-economic-growth

[53] OMB Circular A-4, Regulatory Analysis, September 17, 2003; https://www.transportation.gov/sites/dot.gov/files/docs/OMB%20Circular%20No.%20A-4_0.pdf ; David C. Tryon, Alex M. Certo, Zachary D. Cady, and Trevor W. Lewis, Comment on Proposed OMB Circular A-4, The Buckeye Institute, June 6, 2023; 2023-06-06-Comment-on-Proposed-OMB-Circular-A-4.pdf

director of OMB to revoke Circular A-4 (2023) and restore Circular A-4 (2003).[54] Consequently, estimates for the SC-CO2 from TSD (2010), (2013), (2015), (2016), (2021), and EPA (2023) are invalid. EPA 2019 provides the only SC-CO2 estimator that comports with OMB's requirements.

Monetizing the Benefits of a Repeal of the Biden Administration's Climate Rule

Using the same methodology agencies use to monetize emissions for benefit-cost analysis, AOER estimated foregone social benefits of SC-CO_2 by multiplying the change in emissions each year by the corresponding estimate for the SC-CO_2 for that year.[55]

AOER's analysis found emissions from fossil fuel-fired generation will increase over the next 25 years under the Trump Proposal. The largest increase in emissions and potential damages comes from CO2. Repealing EPA (2023) will result in an additional 5.488 billion metric tons of CO_2 emissions. Using the SC-CO2 estimator provided in EPA 2019, total foregone benefits are $22.65 - $36.46 billion in the 3 percent discount rate case and $4.85 billion – $7.77 billion in the 7 percent discount rate case. Using non-compliant SC-CO2 estimates from previous TSDs and rule makings causes foregone benefits to range from $110.89 to $729.63 billion over the next 25 – 30 years.

Table 11: Total Foregone Benefits (In Billions 2024$)

Total Benefits	TSD-2010 3%	TSD-2016 3%	TSD 2021 - 3%	EPA 2019 3%	EPA 2019 7%	EPA 2.5%
3% Discount Rate	$178.16	$276.78	$265.10	$36.46	$7.77	$729.63
3.76% Discount Rate	$161.83	$251.62	$240.94	$33.11	$7.07	$653.35
7% Discount Rate	$110.89	$172.97	$165.46	$22.65	$4.85	$426.29

Table 11. This table shows the total climate benefits foregone under an array of social cost of carbon estimates. The SC-CO2 values for TSD-2010, TSD-2016, and TSD-2021 were chosen because they reflected the middle scenario of these models. EPA 2023's 2.5 percent discount rate represented the highest discount rate used to estimate the SC-CO2. The 3 and 7 percent discount rate scenarios used to model the Affordable Clean Energy Rule are presented here and should serve as the model for adhering to the prudent fiscal guidance provided by Circular A-4 (2003). The SC-CO2 in EPA 2019 properly restricted its analysis to damages occurring within U.S.

[54] E.O. 14192 Sec. 6(b) https://www.federalregister.gov/documents/2025/02/06/2025-02345/unleashing-prosperity-through-deregulation.

[55] Social Cost of Carbon for Regulatory Impact Analysis, Interagency Working Group on Social Cost of Carbon, February 2010; https://www.epa.gov/sites/default/files/2016-12/documents/scc_tsd_2010.pdf

borders, and properly discounted at the required 3 and 7 percent discount rates, reflecting the risk-free rate of return and average rate of return on private capital, respectively.[56]

Conclusions

The Trump Proposal will save Americans living in the MISO region $560.7 billion on their electric bills through 2055 by allowing the continued use of reliable, existing coal plants and removing impediments to new natural gas power plants entering service. Even after the externality costs of additional criteria pollutants are accounted for, the Trump Proposal delivers net benefits of $314.6 billion through 2055 in the MISO region alone.

These benefits are more than 16 times higher than the $19 billion in benefits, under a 3 percent discount rate from 2026 through 2047, estimated by the Trump administration by reversing the compliance costs of the Biden Final CPS Rules and counting those avoided costs as benefits in the Trump Proposal.

AOER encourages the administration to conduct a nationwide cost and reliability assessment of the impact of the Trump Proposal on the electric grid and broader economy to ensure they are accurately quantifying the massive benefits that these rules will accrue to all Americans by allowing the continued use of existing reliable power generators.

To do so, the administration would be wise to instruct EPA to update its Power Sector Modeling to include an illustrative Trump Proposal Policy Scenario that reflects the vast differences in cost and reliability between the Trump Proposal and the Biden Final CPS Rules.

[56] OMB Circular A-4, Regulatory Analysis, September 17, 2003; https://www.transportation.gov/sites/dot.gov/files/docs/OMB%20Circular%20No.%20A-4_0.pdf ; David C. Tryon, Alex M. Certo, Zachary D. Cady, and Trevor W. Lewis, Comment on Proposed OMB Circular A-4, The Buckeye Institute, June 6, 2023; 2023-06-06-Comment-on-Proposed-OMB-Circular-A-4.pdf

APPENDIX

Electricity Consumption and Peak Demand Assumptions

Annual electricity consumption assumptions in the Biden Base Case and Biden Final CPS Rules scenarios use the Biden EPA's peak demand and load growth assumptions in the Biden Final CPS Rules IPM output data in each scenario. The Avoiding Biden Blackouts and Trump Proposal scenarios increase the compound rate of growth for peak electricity demand from 1.2 to 1.7 percent to 2 percent annually.

Time Horizon Studied

This analysis studies the impact of the studied proposals from 2025 through 2055 to capture the long-term cost of the regulations and to compare these costs to those generated by EPA, consistent with the model years selected by the Biden EPA in its RIA for the Final Biden CPS Rules.

This timeline downwardly biases the cost of compliance with the regulations because power plants are long-term investments, often paid off over a 30-year time period. This means the changes to the resource portfolio in MISO resulting from each of these rules will affect electricity rates for decades beyond 2055.

Hourly Load and Capacity Factors

Hourly load shapes and wind and solar generation were determined using data for the entire MISO region obtained from EIA's Hourly Grid Monitor. Load shapes were obtained for 2020, 2021, 2022, 2023, and 2024. [57]

Capacity factors used for new wind and solar facilities were adjusted upward to match EPA assumptions that new wind and solar facilities will have capacity factors as high as 45 percent and 26 percent, respectively. This is a generous assumption because the current MISO-wide capacity factor of existing wind turbines is only 36 percent, and solar is 20 percent.

These upward adjustments are significantly higher than observed capacity factors reported from Lawrence Berkeley National Labs, which demonstrates that new wind turbines entering operation since 2015 have never achieved annual capacity factors of 43.7 percent (See Figure 17).[58]

These inputs were entered into the model to assess hourly load shapes, capacity shortfalls, and calculate storage capacity needs.

[57] Energy Information Administration, "Hourly Electric Grid Monitor," Accessed August 12, 2022, https://www.eia.gov/ electricity/gridmonitor/dashboard/electric_overview/balancing_authority/MISO
[58] Lawrence Berkely National Labs, "Wind Power Performance," Land Based Wind Report, Accessed July 27, 2023, https://emp.lbl.gov/wind-power-performance.

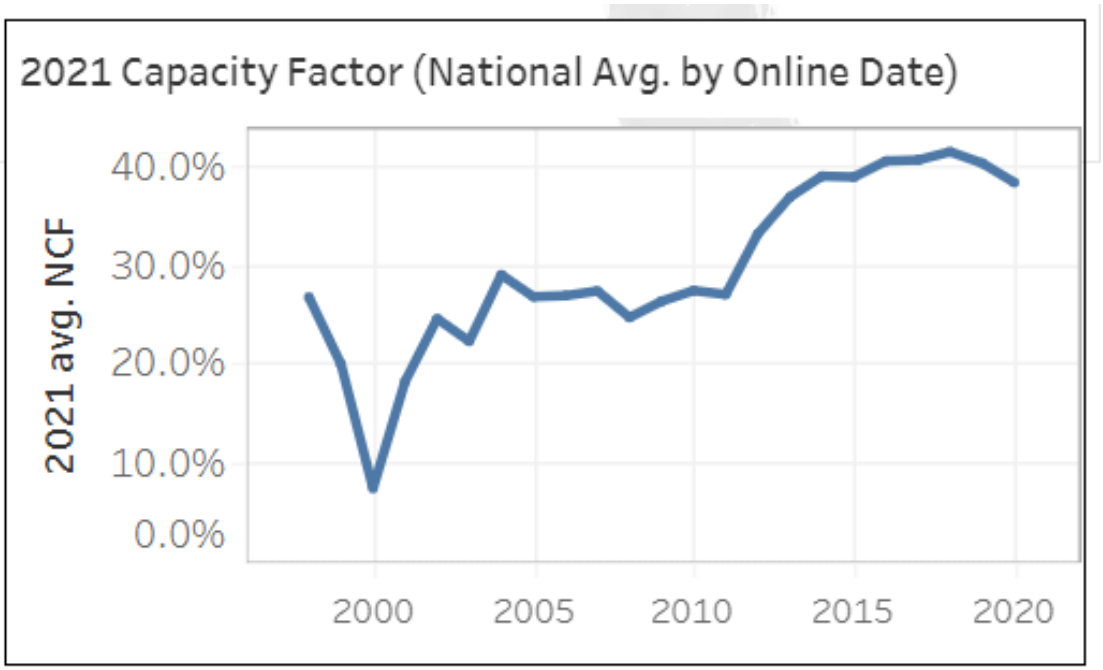

Figure 17. This figure shows capacity factors for U.S. onshore wind turbines by the year they entered service. In no year do these turbines reach EPA's assumed 45 percent capacity factor on an annual basis.

Natural gas combined cycle plants (CC) are assumed to operate below 49 percent capacity factors in the Biden Scenarios, thus allowing these plants to avoid using carbon capture and sequestration or co-firing with hydrogen. In our modeling of the Biden Scenarios, natural gas CC plants operate far below this threshold, running 22.5 percent of the time by 2055, to meet EPA's modeled emissions targets. Natural gas combustion turbine (CT) plants operate at 0.7 percent capacity factors, in line with EPA's assumptions for these resources.

In the Trump Proposal, there are no artificial capacity factor limits imposed on dispatchable power plants, as they are run as often as needed to serve demand.

Line Losses

Line losses are assumed to be 5 percent of the electricity transmitted and distributed in the United States based on U.S. EIA data from 2017 through 2021.[59]

Plant Retirement Schedules and Plant Construction By Type

Our modeling does not make decisions about which individual plants will retire in the Biden Base Case, Biden Final CPS Rules, or Avoiding Biden Blackouts scenarios. Rather, coal, natural gas, and nuclear plant capacity is retired to match the changes modeled by EPA in the IPM files

[59] Energy Information Administration, "How Much Electricity is Lost in Electricity Transmission and Distribution in the United States," Frequently Asked Questions, https://www.eia.gov/tools/faqs/faq.php?id=105&t=3

for these scenarios. The Avoiding Biden Blackouts use the same retirement schedule as the Biden Final CPS Rules.

Capacity additions in the Biden Base Case and Biden Final CPS Rules scenarios are added in accordance with the IPM output files. For additions in the Avoiding Biden Blackouts scenario, enough new wind, solar, battery, and natural gas capacity is added to eliminate blackouts and achieve a carbon dioxide emissions rate of 0.8 metric tons per MWh.

For the Trump Proposal, AOER assumes coal plants will close in accordance with state carbon-free electricity mandates. For example, Minnesota's 100 percent carbon-free by 2040 electricity mandate resulted in AOER shutting these facilities down in accordance with the laws. However, existing natural gas capacity in these states is retained but infrequently operated to maintain reliability. AOER also shuts down coal, natural gas, and oil plants after 60 years in operation.

New natural gas plants are built to replace the retiring capacity on the system and to meet rising peak demand. Enough new wind and solar facilities are added to meet state mandates for these energy resources.

Load Modifying Resources, Demand Response, and Imports

Our model allows for the use of 7,875 MW of Load Modifying Resources (LMRs) and 3,900 MW external resources (imports) in determining how much reliable capacity will be needed within MISO to meet peak electricity demand under the Avoiding Biden Blackouts scenario.

Utility Returns

Most of the load serving entities in MISO are vertically integrated utilities operating under the Cost-of-Service model. The amount of profit a utility makes on capital assets is called the Rate of Return (RoR) on the Rate Base. For the purposes of our study, the assumed rate of return is 9.9 percent with debt/equity split of 48.92/51.08 based on the rate of return and debt/equity split of the ten-largest investor-owned utilities in MISO.

Transmission

This analysis assumes the transmission capacity on the MISO system will need to increase by 27,354 miles, constituting a 40 percent increase in the amount of transmission installed in MISO's U.S. footprint.

According to MISO's Renewable Integration Impact Analysis (RIIA) study, most of the required increases in transmission capacity would occur in high-voltage transmission lines, meaning those over 230 kilovolts (kV), with the largest increases needed for lines over 345 kV.[60]

MISO has approximately 68,000 circuit-miles of transferred functional control transmission lines serving as the backbone of the footprint (Figure 18) in the United States, with approximately

[60] Midcontinent Independent Systems Operator, "Renewable Integration Impact Analysis," Summary Report, February 2021, https://www.misoenergy.org/planning/policy-studies/Renewable-integration-impact-assessment/.

10,409-line miles of 230 kV transmission lines, 12,435-line miles of 345 kV, 2,250-line miles of 500 kV, and 148-line miles of 765 kV.[61]

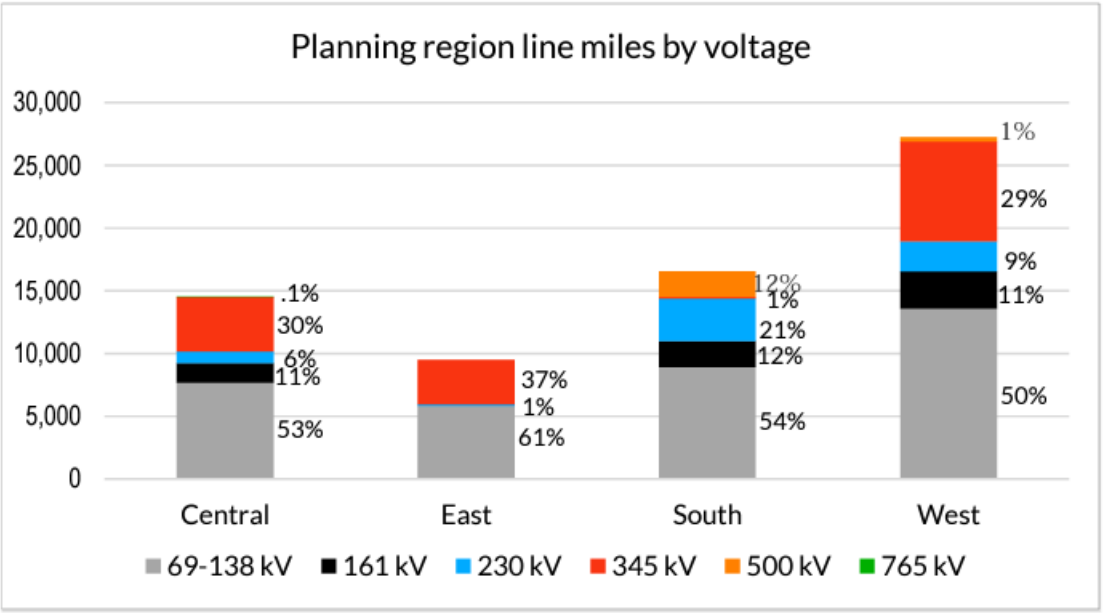

Figure 18. MISO has approximately 68,000 miles of transmission lines in its U.S. footprint. The values for specific line voltages represent the authors' best interpretation of the figure.

Interconnection costs were estimated to be approximately $48,000 per MW of wind or solar installed, the average cost of active projects at the point of interconnect.[62]

This buildout of transmission lines is estimated to cost $102.9 billion. Costs were calculated using the distance per mile costs from the 2021 Midcontinent Independent Systems Operator Transmission Cost Estimation Guide.[63] We assume all transmission expenses are paid by MISO ratepayers.

These transmission cost assumptions are more conservative than the estimated transmission needs in the Net-Zero America study Reference Case, which suggests the nation will need to expand transmission capacity by 47 percent at a cost of $954 billion.[64]

Taxes and Subsidies

[61] Line miles are estimated based on the author's best interpretation of Figure 1.1-4 in the Midcontinent Independent Systems Operator, "MISO Transmission Expansion Plan 2022," Accessed July 27, 2023, https://cdn.misoenergy.org/MTEP22%20Chapter%201%20-%20MTEP%20Overview627346.pdf.
[62] Lawrence Berkeley Labs, "Data from MISO Show Rapidly Growing Interconnection Costs," Electricity Markets and Policy, October 7, 2022, https://emp.lbl.gov/news/data-miso-show-rapidly-growing.
[63] Midcontinent Independent Systems Operator, "Transmission Cost Estimation Guide for MTEP21," April 27, 2021, https://bit. ly/3AZu59l.
[64] Andrew Pascale et al., "Princeton's Net-Zero America study Annex F: Integrated Transmission Line Mapping and Costing," Princeton University, August 1, 2021, https://netzeroamerica.princeton.edu/img/NZA%20Annex%20F%20-%20HV%20Transmission.pdf.

Additional tax payments for utilities were calculated to be 1.3 percent of the rate base. The state income tax rate of 7.3 percent was estimated by averaging the states within the MISO region. The Federal income tax rate is 21 percent. The value of the Production Tax Credit (PTC) is $27.50. Coal 45-Q Subsidy of $85 per ton CO2 sequestered.

Battery Storage

Battery storage assumes a 5 percent efficiency loss on both ends (charging and discharging), resulting in a round-trip efficiency of 90 percent.

Maximum discharge rates for the MISO system model runs were held at the max capacity of the storage fleet, less efficiency losses. Battery storage is assumed to be 4-hour storage, while pumped storage is assumed to be 8-hour storage.

Wind and Solar Degradation

According to the Lawrence Berkeley National Laboratory, output from a typical U.S. wind farm shrinks by about 13 percent over 17 years, with most of this decline taking place after the project turns ten years old. According to the National Renewable Energy Laboratory, solar panels lose one percent of their generation capacity each year and last roughly 25 years, which causes the cost per megawatt hour (MWh) of electricity to increase each year.[65] However, our study does not take wind or solar degradation into account.

Capital Costs, and Fixed and Variable Operation and Maintenance Costs

AOER calculated the cost of the Biden Base Case and Biden Final CPS Rules by inserting the new power plant capacity in the Power Sector IPM output files into its cost-of-service model to estimate the cost of building and operating this modeled MISO grid.

Overnight capital cost, fixed operations and maintenance cost, variable operations and maintenance cost, and heat rate data for each technology were obtained from the U.S. Energy Information Administration's Assumptions to the Annual Energy Outlook 2025: Electricity Market Module 2025, and these costs we held constant throughout the model run.[66] Capacity factor data for intermittent generators was scaled up to match the values estimated by EPA in the Biden Final CPS Rules output files.

These costs were compared to the cost of operating the existing MISO fleet as of May 2025. Existing coal, nuclear, and natural gas plant costs were obtained using FERC Form 1 data for the ten largest Investor-Owned Utilities (IOUs) in the MISO region, which constitute over 60 percent of the load served in MISO. Existing wind and solar costs were calculated using the entire MISO region. The average costs of coal, natural gas, and nuclear generators were applied

[65] Liam Stoker, "Built Solar Assets Are' Chronically Underperforming,' and Modules Degrading Faster than Expected, Research Finds," PV Tech, June 8, 2021, https://www.pv-tech.org/built-solar-assets-are-chronically-underperforming-andmodules-degrading-faster-than-expected-research-finds/.

[66] U.S. Energy Information Administration's Assumptions to the Annual Energy Outlook 2025: Electricity Market Module, April 2025, https://www.eia.gov/outlooks/aeo/assumptions/pdf/EMM_Assumptions.pdf.

to all generation from these respective resources to estimate the current cost of the existing MISO grid.

The cost of the representative generators is shown in Table 12 below.

	Plant Type	Capacity Factor	Capital Cost	Fuel Cost	Fixed OM	Variable OM	Returns	Total
Big Cajun 2 Unit 3	Coal	3%	$0.00	$44.97	$27.89	$17.00	$0.00	$89.85
Roy S. Nelson 6	Coal	11%	$0.00	$29.68	$9.60	$5.73	$0.00	$45.01
Belle River	Coal	45%	$0.00	$25.95	$4.63	$2.03	$0.00	$32.61
Monroe	Coal	46%	$0.00	$29.86	$5.27	$1.45	$0.00	$36.58
Campbell 3	Coal	70%	$0.00	$29.76	$2.80	$2.51	$0.00	$35.06
Karn 3 & 4	Coal	1%	$0.00	$150.51	$86.30	$82.24	$0.00	$319.04
Labadie	Coal	68%	$0.00	$16.37	$2.63	$1.30	$0.00	$20.30
Rush Island	Coal	4%	$0.00	$35.13	$17.33	$14.59	$0.00	$67.05
Sioux	Coal	35%	$0.00	$24.98	$8.02	$4.69	$0.00	$37.70
A S King	Coal	10%	$0.00	$36.01	$12.48	$14.27	$0.00	$62.76
Sherburne County	Coal	43%	$0.00	$27.67	$5.22	$3.63	$0.00	$36.52
Wilmarth	Coal	49%	$0.00	$37.65	$36.86	$31.63	$0.00	$106.14
Cayuga	Coal	44%	$0.00	$30.57	$3.95	$4.71	$0.00	$39.23
Gibson	Coal	36%	$0.00	$33.11	$5.37	$4.72	$0.00	$43.19
Elm Road	Coal	61%	$0.21	$24.98	$61.24	$2.20	$0.13	$88.76
South Oak Creek	Coal	21%	$0.00	$25.32	$7.82	$8.19	$0.00	$41.33
Independence	Coal	31%	$0.00	$26.02	$5.49	$0.58	$0.00	$32.10
White Bluff	Coal	13%	$0.00	$31.92	$8.09	$5.61	$0.00	$45.63
Acadia	Combined Cycle	49%	$2.53	$20.34	$2.36	$0.69	$0.71	$26.63
J. Wayne Leonard	Combined Cycle	46%	$5.05	$24.30	$1.05	$1.57	$4.28	$36.25
Lake Charles	Combined Cycle	53%	$4.46	$21.83	$0.85	$1.51	$4.10	$32.75
Ninemile 6	Combined Cycle	66%	$5.51	$19.36	$2.45	$0.94	$3.70	$31.95
Ouachita 3	Combined Cycle	62%	$3.19	$19.37	$1.26	$1.62	$0.90	$26.35
Perryville	Combined Cycle	53%	$3.34	$19.11	$1.75	$1.23	$0.83	$26.25
Union 3 & 4	Combined Cycle	56%	$3.78	$20.77	$1.51	$1.83	$1.07	$28.96
Jackson Gas Plant	Combined Cycle	35%	$7.69	$21.39	$4.72	$1.53	$2.17	$37.51
Black Dog 2, 5, & 6	Combined Cycle	47%	$6.18	$23.73	$1.64	$1.38	$5.23	$38.16
High Bridge 7,8,9	Combined Cycle	54%	$5.00	$20.71	$1.62	$1.10	$2.47	$30.91
Riverside	Combined Cycle	54%	$4.07	$22.33	$1.65	$1.25	$2.16	$31.46
Edwardsport	Combined Cycle	38%	$35.32	$27.71	$21.34	$7.06	$23.70	$115.13
Noblesville	Combined Cycle	73%	$6.06	$18.68	$4.41	$1.74	$1.93	$32.82
Port Washington	Combined Cycle	70%	$0.07	$20.56	$18.30	$0.84	$0.04	$39.81
West Riverside	Combined Cycle	63%	$6.52	$19.88	$1.57	$1.35	$5.76	$35.08
Whitewater	Combined Cycle	30%	$11.42	$18.98	$3.99	$6.19	$1.21	$41.80
Hot Spring	Combined Cycle	33%	$5.87	$21.83	$2.71	$1.87	$1.45	$33.74
Ouachita 1 & 2	Combined Cycle	71%	$2.89	$15.91	$1.62	$1.21	$0.82	$22.45
Union Power Station	Combined Cycle	48%	$4.74	$20.04	$1.18	$2.13	$1.34	$29.43
Calcasieu	Combustion Turbine	3%	$48.02	$67.12	$10.02	$11.05	$11.87	$148.08
Audrain	Combustion Turbine	2%	$38.91	$47.92	$4.02	$1.33	$8.24	$100.41
Peno Creek	Combustion Turbine	6%	$37.60	$66.16	$10.32	$1.13	$10.62	$125.84
Pickneyville	Combustion Turbine	2%	$76.24	$41.70	$15.35	$4.82	$16.15	$154.27
Venice	Combustion Turbine	1%	$258.90	$112.98	$46.24	$19.99	$91.43	$529.54
Blue Lake	Combustion Turbine	6%	$13.55	$34.61	$6.19	$1.61	$4.79	$60.74
Cadiz	Combustion Turbine	22%	$9.62	$29.22	$7.34	$2.14	$2.04	$50.36
Cayuga	Combustion Turbine	1%	$0.00	$52.92	$37.62	$18.46	$0.00	$109.00
Cayuga Peaking	Combustion Turbine	0.2%	$0.00	$307.03	$0.00	$0.00	$0.00	$307.03
Madison	Combustion Turbine	17%	$11.56	$34.56	$1.93	$2.45	$2.45	$52.95
Vermillion	Combustion Turbine	8%	$12.31	$31.05	$2.11	$1.75	$2.61	$49.83
Wheatland	Combustion Turbine	3%	$33.01	$42.01	$14.17	$10.96	$5.83	$105.98
Concord	Combustion Turbine	5%	$0.00	$40.03	$5.28	$0.70	$0.00	$46.02
Germantown	Combustion Turbine	1%	$128.22	$52.23	$38.28	$4.83	$22.64	$246.19
Weston RICE	Combustion Turbine	15%	$35.73	$25.87	$8.46	$2.66	$36.59	$109.30
Little Gypsy 2 & 3	Gas Steam	14%	$0.00	$30.64	$4.76	$3.20	$0.00	$38.59
Ninemile Point 4& 5	Gas Steam	33%	$0.00	$28.65	$1.55	$1.26	$0.00	$31.46
Washington Parish	Gas Steam	8%	$25.64	$30.99	$5.97	$3.43	$22.64	$88.66
Waterford 1 & 2	Gas Steam	4%	$0.00	$50.07	$9.18	$9.56	$0.00	$68.80
Greenwood EC	Gas Steam	18%	$0.00	$27.09	$4.64	$4.86	$0.00	$36.59
Covert	Gas Steam	63%	$3.15	$16.15	$1.80	$0.41	$1.11	$22.61
Zeeland	Gas Steam	67%	$2.49	$17.18	$1.33	$0.82	$0.70	$22.52
Maryland Heights LF	Gas Steam	42%	$34.20	$35.86	$26.74	$6.77	$20.53	$124.10
Angus Anson	Gas Steam	7%	$22.68	$31.10	$10.57	$3.07	$8.81	$76.24
Inver Hills	Gas Steam	3%	$0.00	$55.00	$30.81	$6.08	$0.00	$91.89
Rothschild	Gas Steam	30%	$65.37	$81.33	$30.83	$3.87	$43.86	$225.26
Valley	Gas Steam	18%	$0.00	$74.70	$16.44	$35.98	$0.00	$127.11
Lake Catherine	Gas Steam	6%	$0.00	$60.67	$17.29	$10.74	$0.00	$88.70
River Bend	Nuclear	94%	$0.00	$6.30	$13.10	$8.84	$0.00	$28.24
Waterford 3	Nuclear	59%	$0.00	$8.63	$18.18	$14.25	$0.00	$41.06
Fermi 2	Nuclear	77%	$0.00	$6.69	$10.96	$10.22	$0.00	$27.87
Callaway	Nuclear	97%	$0.00	$7.64	$9.18	$4.63	$0.00	$21.45
Monticello	Nuclear	92%	$0.00	$7.95	$8.09	$15.35	$0.00	$31.40
Prairie Island	Nuclear	62%	$0.00	$9.60	$11.23	$19.13	$0.00	$39.96
Arkansas Nuclear One	Nuclear	91%	$0.00	$5.69	$10.37	$6.16	$0.00	$22.22

Table 12. The cost of existing thermal resources was obtained using FERC Form 1 data and shows these resources are among the most affordable on the grid.

Unit Lifespans

Different power plant types have different useful lifespans. Our analysis takes these lifespans into account. Wind turbines are assumed to last for 20 years, solar panels are assumed to last 25 years, and battery storage for 15 years. Natural gas plants are assumed to last for 30 years.

Repowering

Our model assumes wind turbines, solar panels, and battery storage facilities are repowered after they reach the end of their useful lives. Our model also excludes economic repowering, a growing trend whereby wind turbines are repowered after just 10 to 12 years to recapture the wind Production Tax Credit (PTC).

EPA does not appear to take repowering into consideration because the amount of existing wind on its systems never changes. If our understanding of EPA's methodology is accurate, this a significant oversight that must be corrected in future dockets.

Fuel Cost Assumptions

Fuel cost estimates for new and existing power facilities were taken from EPA's RIA for the Biden Final CPS Rules output files.

Inflation Reduction Act (IRA) Subsidies

Our analysis assumes all wind and solar projects will elect the Production Tax Credit, valued at $27.50 per MWh, through the phase-out period in the One Big Beautiful Bill Act (OBBBA). Carbon Capture and Sequestration projects receive the 45Q subsidies of $85 per ton of carbon dioxide sequestered.

Criteria Pollutant Emissions

Monetizing the health benefits foregone from increased NOx, SO2, and PM2.5 emissions is more challenging. Unlike the SC-CO_2, EPA has not published a comprehensive TSD guiding regulators for monetizing climate damages from NOx, SO2, and PM2.5. Oftentimes, total benefits are estimated by using the increase in premature deaths and illness that result directly from increased pollutants. To monetize the benefits, AOER used EPA's Sector-based PM2.5 and Ozone Benefits per Ton Estimates.[67]

[67] Sector-based PM2.5 and Ozone Benefit Per Ton Estimates, EPA, March 26, 2025; https://www.epa.gov/benmap/sector-based-pm25-and-ozone-benefit-ton-estimates.

Table 13 (Values in millions 2024$)

Emission Rates(tons/MWh)	SO2	NOx	PM2.5
Coal	0.00099689	0.00069330	0.00002160
Natural Gas	0.00000264	0.00027905	0.00001102
Social Benefit/Ton	$57,000	$7,710	$113,000

Table 13. This table estimates the annual foregone benefits associated with emissions from each plant type currently operating in the MISO region. Plant totals are as follows: 40 bituminous coal plants, 2 lignite coal plants, 49 sub-bituminous coal plants, and 526 natural gas plants. The annual total social cost associated with these plants is $23.107 billion. All values are monetized using EPA's Sector-based Benefit per Ton Estimates and adjusted for inflation using CPI.[68]

Table 14 Emissions Benefits and Costs (in billions 2024$)

	Benefits	Discounted		
Emissions				
Coal	Undiscounted	3%	3.76%	7%
SO2	$202.93	$135.41	$123.29	$85.51
NOx	$19.09	$12.74	$11.60	$8.04
PM2.5	$8.72	$5.82	$5.30	$3.67
Total	$230.74	$153.97	$140.18	$97.22
Natural Gas				
SO2	$0.65	$0.32	$0.26	$0.12
NOx	$9.30	$4.51	$3.75	$1.71
PM2.5	$5.38	$2.61	$2.17	$0.99
Total	$15.34	$7.43	$6.19	$2.82
Total SB (coal + ng)	$246.08	$161.39	$146.37	$100.04

Table 14 This table applies the 3 and 7 percent discount rates to the benefit streams associated with SO2, NOx, and PM2.5 emissions presented in Table 13. Total undiscounted benefits are $683 billion by 2055.

[68] Sector-based PM2.5 and Ozone Benefit Per Ton Estimates, EPA, March 26, 2025; https://www.epa.gov/benmap/sector-based-pm25-and-ozone-benefit-ton-estimates ; U.S. Bureau of Labor Statistics, Consumer Price Index for All Urban Consumers: All Items in U.S. City Average [CPIAUCSL], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/CPIAUCSL, August 4, 2025 ; https://fred.stlouisfed.org/series/CPIAUCSL

While the annual damages from SO2 and NOx are significant, the agency must consider in the final ruling that these costs are not static and emission reduction solutions aimed at keeping coal-plants operating are the best path forward. Technologies, such as chemical reagents, can be applied to thermal coal before it's used to generate power.

If a reagent can reduce sulfur emissions by 20 percent, a significant portion of the benefits are clawed back. Between 2026 and 2055, the MISO region would save over $40 billion in undiscounted benefits. Table 15 shows how applying a chemical reagent to thermal coal improves the foregone benefit stream compared to Table 14.

Table 15 (in billions 2024$)

	Benefits	Discounted		
Emissions				
Coal	Undiscounted	3%	3.76%	7%
SO2	$162.35	$108.33	$98.63	$68.41
NOx	$19.09	$12.74	$11.60	$8.04
PM2.5	$8.72	$5.82	$5.30	$3.67
Total	$190.15	$126.88	$115.52	$80.12
Natural Gas				
SO2	$0.65	$0.32	$0.26	$0.12
NOx	$9.30	$4.51	$3.75	$1.71
PM2.5	$5.38	$2.61	$2.17	$0.99
Total	$15.34	$7.43	$6.19	$2.82
Total SB (coal + ng)	$205.49	$134.31	$121.71	$82.94

Table 15. This table applies a 20 percent reduction in sulfur emissions associated with a chemical reagent capable of removing 20% of sulfur from thermal coal prior to burning.