UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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 No. EPA–HQ–OAR–2023–0072** *Via Regulations.gov* *August 8, 2023*

The Environmental Defense Fund (EDF) appreciates the opportunity to provide the following comments on the Environmental Protection Agency's (EPA) proposed *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*, 88 Fed. Reg. 33,240 (May 23, 2023) **(**Rule) to establish performance standards for carbon pollution from electric utility generating units (EGUs), one of the single largest sources of climate-destabilizing pollution in the U.S. and in the world. EDF is a non-profit, non-governmental and non-partisan environmental organization with millions of members and offices and staff across the U.S. who are carrying out the organization's mission to build a vital earth for everyone. Our key priorities are to stabilize the climate and strengthen people's ability to thrive in a changing climate. We do this by using science, economics, law, and uncommon partnerships to find practical and lasting solutions to the most serious environmental problems.

Climate change poses an urgent and critical threat to public health and welfare. Emissions of carbon dioxide (CO_2) from fossil fuel-fired EGUs account for 30.6 percent (1,541 MMT CO_2e) of the United States' carbon pollution.[1] Accordingly, we strongly support EPA's initiative to establish nation-wide limits on carbon pollution from fossil fuel-fired EGUs, as required by the Clean Air Act. Specifically, our comments:

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[1] This is according to EPA's latest U.S. GHG Inventory, completed in 2021. U.S. Env't Prot. Agency (EPA), *U.S. Inventory of Greenhouse Gas Emissions and Sinks: 1990-2021*, https://cfpub.epa.gov/ghgdata (last visited Aug. 2, 2023).

- Support EPA's finding that greenhouse gas pollution threatens the health and welfare of millions across the United of States and that emissions reductions are vitally important;
- Highlight current trends in the power sector responsible for significant greenhouse gas emission reductions and which make efforts to achieve necessary further reductions both feasible and affordable;
- Support EPA's authority for the subcategories included in the Rule, including subcategories based on utilization factors and operating horizon;
- Recommend that EPA strengthen its standards for gas sources by expanding the intermediate load subcategory for new gas facilities and basing the standard on combined-cycle units; ensuring that each subcategory is based on state-of-the-art thermal efficiency; and expanding the baseload subcategory for existing gas.
- Recommend that EPA strengthen the Remaining Useful Life and Other Factors framework to guide states and limit inappropriate applications.
- Recommend that EPA strengthen the meaningful engagement standard to ensure robust protections for vulnerable communities in state planning initiatives concerning existing sources;
- Highlight EPA's newly reinforced authority under the Inflation Reduction Act to adopt robust carbon reduction standards;
- Support EPA's incorporation of a rigorous life-cycle emissions analysis and low-GHG hydrogen in relation to any EPA reliance on hydrogen technology;
- Recommend that EPA consult with environmental justice communities and prioritize concerns regarding carbon capture and storage and hydrogen technologies.
- Recommend that EPA issue guidance pertaining to the requirements of the alternatives analysis under Section 165(a)(2) and BACT analyses for GHG Emissions.

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I. <u>Climate Change Is a Clear, Present Threat Caused by Harmful Greenhouse Gases and U.S. Fossil Fuel Power Plant Pollution Is a Significant Contributor</u>

a. Anthropogenic Combustion of Fossil Fuels is the Largest Contributor to Global Climate Change

The global scientific consensus is that human activities—primarily, the burning of fossil fuels—have unequivocally caused exponential planetary warming. When combusted, fossil fuels such as coal, natural gas, and oil emit greenhouse gases into the atmosphere and trap heat. Earth's natural greenhouse effect maintains a livable global surface temperature above freezing; however, excess anthropogenic emissions from fossil fuel combustion result in an enhanced greenhouse effect that creates a radiation imbalance, altering the global climate for hundreds to thousands of years.[2] This not only destabilizes the earth's climate but also weakens the ability of people and nature to thrive and significantly threatens public health.

CO2, the primary greenhouse gas emitted through human activities, accounts for 79% of all United States' greenhouse emissions and is predominately released through fossil fuel combustion.[3] 2022 saw a new record high of average atmospheric carbon dioxide at 417.06 parts per million, 50% higher than it was prior to the industrial revolution.[4] Additionally, CO2 was responsible for approximately two-thirds of the total heating influence of all anthropogenic greenhouse gases.[5] Other key greenhouse gases emitted by human activities that contribute to the greenhouse effect include methane (CH4), nitrous oxide (N2O), and chlorofluorocarbons (CFCs).[6] Additional chemically-reactive gases include carbon monoxide (CO), nitrogen oxides (NOx), water vapor, among others.[7]

The United States Is the highest per capita and historical emitter of greenhouse gases, having contributed more carbon dioxide to the atmosphere than any other country.[8] With 400 billion tons emitted since 1751, it is responsible for a quarter of all global historical emissions.[9] This is twice as much as China, the second-highest historical emitting nation.[10]

Recognizing this global concern, 195 countries committed to limiting their greenhouse gas emissions via the Paris Agreement, with a goal of capping global warming at 2°C at most, and

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[2] Nat'l Oceanic and Atmospheric Admin. (NOAA), *Global Monitoring Laboratory, Carbon Toolkit: Basics of the Carbon Cycle and the Greenhouse Effect*, https://gml.noaa.gov/outreach/carbon_toolkit/ (last visited July 17, 2023).
[3] EPA, *Overview of Greenhouse Gases*, https://www.epa.gov/ghgemissions/overview-greenhouse-gases (last visited July 17, 2023).
[4] NOAA, *Greenhouse Gases Continued to Increase Rapidly in 2022* (Apr. 5, 2023), https://www.noaa.gov/news-release/greenhouse-gases-continued-to-increase-rapidly-in-2022.
[5] *Id.*
[6] Nat'l Aeronautics and Space Admin. (NASA), *The Causes of Climate Change* (July 13, 2023), https://climate.nasa.gov/causes/.
[7] *Id.*
[8] Hannah Ritchie, *Who has contributed most to global CO2 emissions?* (Oct. 1, 2019), https://ourworldindata.org/contributed-most-global-co2.
[9] *Id.*
[10] *Id.*

1.5°C ideally.[11] This Agreement is a landmark multilateral climate change document that further underscores the urgent need to address the climate crisis.

b. Climate Change Impacts Affect All Sectors of Society and Disproportionately Harm Certain Communities in the United States and Globally

Climate change impacts are real, observable changes whose effects on the Earth are already visible and attributable to increased greenhouse gas emissions.[12] Impacts include hotter temperatures, more severe storms, increased drought, rising sea levels, biodiversity loss, food shortages, increased health risks, poverty, and displacement.[13] Many climate change impacts have disproportionate harms on vulnerable populations, including communities of color, low-income communities, children, indigenous populations, the elderly, people with chronic medical conditions, people with disabilities, and pregnant women.

There are many negative impacts on human health and wellness resulting from climate change. As the average global temperature continues rising each year, the number of heat-related deaths and illnesses has dramatically increased. Heat is the leading weather-related killer in the U.S., with over 11,000 Americans having died as a direct result of heat stroke or other heat-related illnesses, and even greater deaths when heat itself is considered a contributing factor as well.[14] From 2001 to 2010 alone, nearly 30,000 Americans were hospitalized across 20 states.[15] June and July of 2023 have observed record-setting heat waves in parts of the Northeast, Mid-Atlantic, and Great Lakes, with Arizona witnessing a record 19+ straight days with temperatures at or over 110°F.[16] Other public health impacts resulting from climate change impacts include increased susceptibility to vector-borne diseases, viruses, and allergy-induced asthma attacks.[17]

In the United States alone, future effects of climate change include sea level rise of up to 6.6 feet by 2100 from melting land ice and seawater expansion, increased duration and/or intensity of Western wildfire seasons, and a dramatic change in precipitation patterns that will yield more

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[11] In the Paris Agreement, countries establish Nationally Determined Contributions (NDCs), country-specific climate plans that provide each country's ambitious strategy to cut greenhouse gas emissions and build resilience to adapt to the impacts of climate change. Paris Agreement to the United Nations Framework Convention on Climate Change, Dec. 12, 2015, T.I.A.S. No. 16-1104. The United States' NDC is an economy-wide net reduction target of 50-52% below 2005 levels by 2030. *Id.*

[12] EPA, *Climate Change Impacts by Sector* (Dec. 13, 2022), https://www.epa.gov/climateimpacts/climate-change-impacts-sector.

[13] United Nations (UN), *Causes and Effects of Climate Change*, https://www.un.org/en/climatechange/science/causes-effects-climate-change (last visited July 17, 2023).

[14] EPA, *Climate Change Indicators: Heat-Related Deaths* (Aug. 2, 2022), https://www.epa.gov/climate-indicators/heat-related-deaths.

[15] *Id.*

[16] NOAA, Nat'l Ctr. for Env't Info. (NCEI), *Assessing the U.S. Climate in June 2023: Record-breaking heat waves hit portion of the U.S. during June* (July 11, 2023) https://www.ncei.noaa.gov/news/national-climate-202306; Jacey Fortin & Mary Beth Gahan, *Phoenix Breaks Heat Record Set in 1974*, N.Y. Times (July 18, 2023), https://www.nytimes.com/2023/07/18/us/phoenix-heat-record.html.

[17] EPA, *Climate Change Indicators: Ragweed Pollen Season* (Aug. 2, 2022), https://www.epa.gov/climate-indicators/climate-change-indicators-ragweed-pollen-season.

severe precipitation events causing flooding in the northern United States while simultaneously causing increased drought in the Southwest.[18]

However, climate change-induced disasters are already happening today and costing the U.S. billions of dollars. Since 1980, the U.S. has witnessed 360 climate and weather disasters where overall costs and damages were $1 billion or more, costing over $2,570 trillion cumulatively. [19] In the first half of 2023 alone, there have already been 12 confirmed U.S. extreme weather events and climate disasters whose damages each exceeded $1 billion.[20] In 2021 alone, 20 distinct billion-dollar disasters from winter storms to wildfires and flooding caused almost $150 billion in total losses.[21]

c. Recent Executive Orders Stress the Exigency for Emissions Reductions to Prevent Further Environmental Injustices

Executive orders signed by President Biden in the past two years emphasize the requisite to mitigate climate change to prioritize environmental justice. In the U.S., frontline communities—primarily composed of Black, Indigenous, and People of Color (BIPOC) and/or low-income communities—bear the brunt of climate change impacts while having contributed least to the problem. Each of these orders builds off the foundational Executive Order 12898 (*Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations)* of February 11, 1994 that initially called on federal agencies to make environmental justice part of their missions by identifying and addressing the "disproportionately high and adverse human health or environmental effects of [their] programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions."[22] Key actions that emphasize the need for emissions reductions to stabilize the climate, protect public health, and center environmental justice include:

> Executive Order 13990 *(Protecting Public Health and the Environment and Restoring Science To Tackle the Climate Crisis)* of January 20, 2021, which declares that it is the policy of all executive departments and agencies to take action to "listen to the science; to improve public health and protect our environment; to ensure access to clean air and water; to limit exposure to dangerous chemicals and pesticides; to hold polluters accountable, including those who disproportionately harm communities of color and low-income communities; to reduce greenhouse gas emissions; to bolster resilience to the impacts of climate change; to restore and expand our national treasures and monuments; and to

[18] NASA, *The Effects of Climate Change* (Jul. 13, 2023), https://climate.nasa.gov/effects/.
[19] NOAA, NCEI, *U.S. Billion-Dollar Weather and Climate Disasters*
(2023), https://www.ncei.noaa.gov/access/billions/.
[20] *Id.*
[21] Nat'l Conference of State Legislatures, *2021-2022 Energy Security State Legislative Review: Disaster Planning and Ensuring Reliable Service*, https://www.ncsl.org/energy/disaster-planning-and-ensuring-reliable-service (last updated Nov. 22, 2022).
[22] Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 59 Fed. Reg. 7,629 (Feb. 16, 1994) https://www.archives.gov/files/federal-register/executive-orders/pdf/12898.pdf.

prioritize both environmental justice and the creation of the well-paying union jobs necessary to deliver on these goals."[23] Section 5 requires agencies to account for the benefits of reducing climate pollution to support the international leadership of the United States on climate issues and capture the full costs of greenhouse gas emissions as accurately as possible. This includes providing an accurate social cost of various greenhouse gases (carbon, nitrous oxide, and methane) to be used as estimated of monetized damages from increases in greenhouse gas emissions.[24]

Executive Order 14008 *(Tackling the Climate Crisis at Home and Abroad)* of January 27, 2021, which places the climate crisis at the center of U.S. foreign policy and national security interests while taking a government-wide approach to address the climate crisis. This includes rejoining the Paris Agreement and implementing pathways towards low greenhouse gas emissions and a more climate-resilient world. It calls on the Federal Government to "drive assessment, disclosure, and mitigation of climate pollution and climate-related risks in every sector of our economy, marshaling the creativity, courage, and capital necessary to make our Nation resilient in the face of this threat. Together, we must combat the climate crisis with bold, progressive action that combines the full capacity of the Federal Government with efforts from every corner of our Nation, every level of government, and every sector of our economy."[25]

Executive Order 14096 *(Revitalizing Our Nation's Commitment to Environmental Justice for All)* of April 21, 2023, which states that the Federal Government must fulfill the Nation's promises of justice, liberty, and equality through ensuring all people have "clean air to breathe; clean water to drink; safe and healthy foods to eat; and an environment that is healthy, sustainable, climate-resilient, and free from harmful pollution and chemical exposure."[26] It requires that environmental justice be advanced through the implementation and enforcement of national environmental and civil rights laws to prevent pollution and address climate change and its effects.[27]

Other related executive orders address racial equity and its intersection with environmental justice (Executive Order 13985 (*Advancing Racial Equity and Support for Underserved Communities Through the Federal Government*) of January 20, 2021,[28] and Executive Order 14091 (*Further Advancing Racial Equity and Support for Underserved Communities Through*

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[23] Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis, 86 Fed. Reg. 7,037 (Jan. 25, 2021).
[24] *Id.*
[25] Tackling the Climate Crisis at Home and Abroad, 86 Fed. Reg. 7,619 (Feb. 1, 2021).
[26] Revitalizing Our Nation's Commitment to Environmental Justice for All, 88 Fed. Reg. 25,251 (Apr. 26, 2023).
[27] *Id.*
[28] Advancing Racial Equity and Support for Underserved Communities Through the Federal Government, 86 Fed. Reg. 7,009 (Jan. 25, 2021).

the Federal Government) of February 16, 2023); the implementation of recent legislation focused on climate change mitigation and greenhouse gas emission reductions (Executive Order 14052 (*Implementation of the Infrastructure Investment and Jobs Act)* of November 15, 2021,[29] Executive Order 14082 *(Implementation of the Energy and Infrastructure Provisions of the Inflation Reduction Act of 2022*) of September 12, 2022),[30] and Executive Order 14057 (*Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability*) of December 8, 2021.[31]

d. Pollution Reductions from Fossil Fuel-Fired Electric Generating Units in the Electric Power Sector are Necessary to Avert the Worst Effects of Climate Change and Protect Public Health

The Intergovernmental Panel on Climate Change's modeled mitigation pathways to limit warming to 1.5°C and 2°C require deep, rapid, and sustained greenhouse gas emission reductions in all sectors.[32] A reduction in overall fossil fuel use, increased deployment of low-emission energy sources, and increased energy efficiency are necessary to reduce energy sector emissions specifically. If unabated fossil fuel infrastructure continues to be installed, it will 'lock-in' greenhouse gas emissions, increasing the rate of global warming.[33]

Electric power generation is the largest source of carbon dioxide emissions globally. Approximately 34% of global net anthropogenic greenhouse gas emissions originated from the energy supply sector, 10% more than the second-highest emitting sector (industry) at 24%. The electricity and heat generation sector underwent the largest sectoral increase in global CO2 emissions in 2022, an increase of 1.8% or 261 Mt from 2021.[34] In the United States, the electric power sector accounted for one quarter of total greenhouse gas emissions in 2021, the second largest sector after transportation.[35] 30.7% of all U.S. energy from fossil fuels was used by electric generators.

In 2022, 60% of all net electricity generation at utility-scale facilities in the United States came from fossil fuels, equivalent to 2,554 billion kWh out of the total 4,243 billion kWh generated from all sources. Natural gas comprised 39.8% of generation (2,554 billion kWh), coal comprised 19.5% of generation (828 billion kWh), and petroleum comprised 0.6% of generation (23 billion kWh).[36] The remaining 40% (1,689 billion kWh) of electricity generation came from nuclear energy at 18.2% of generation (772 billion kWh), renewable sources at 21.5% of

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[29] Implementation of the Infrastructure Investment and Jobs Act, 86 Fed. Reg. 64,335 (Nov. 18, 2021).
[30] *Id.*
[31] Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability, 86 Fed. Reg. 70,935 (Dec. 13, 2021).
[32] Intergovernmental Panel on Climate Change, Climate Change 2022: Mitigation of Climate Change 28 (2022), https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_SPM.pdf.
[33] *Id.* at 32.
[34] Int'l Energy Agency (IEA), CO2 Emissions in 2022 9 (2023), https://www.iea.org/reports/co2-emissions-in-2022.
[35] EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021 (2023), https://www.epa.gov/system/files/documents/2023-04/US-GHG-Inventory-2023-Main-Text.pdf.
[36] Energy Info. Admin. (EIA), *What is U.S. Electricity Generation by Energy Source?*, https://www.eia.gov/tools/faqs/faq.php?id=427&t=3 (last updated Mar. 2, 2023).

generation (913 billion kWh), and other sources at 0.3% of generation (11 billion kWh). Within the renewables category, 10.2% (435 billion kWh) is attributed to wind energy, 6.2% (262 billion kWh) is attributed to hydropower, and 3.4% (146 billion kWh) is attributed to solar energy.[37] An additional 58 billion kWh of electricity generation is estimated to have come from small-scale solar photovoltaic systems with less than one megawatt of electric generating capacity.[38]

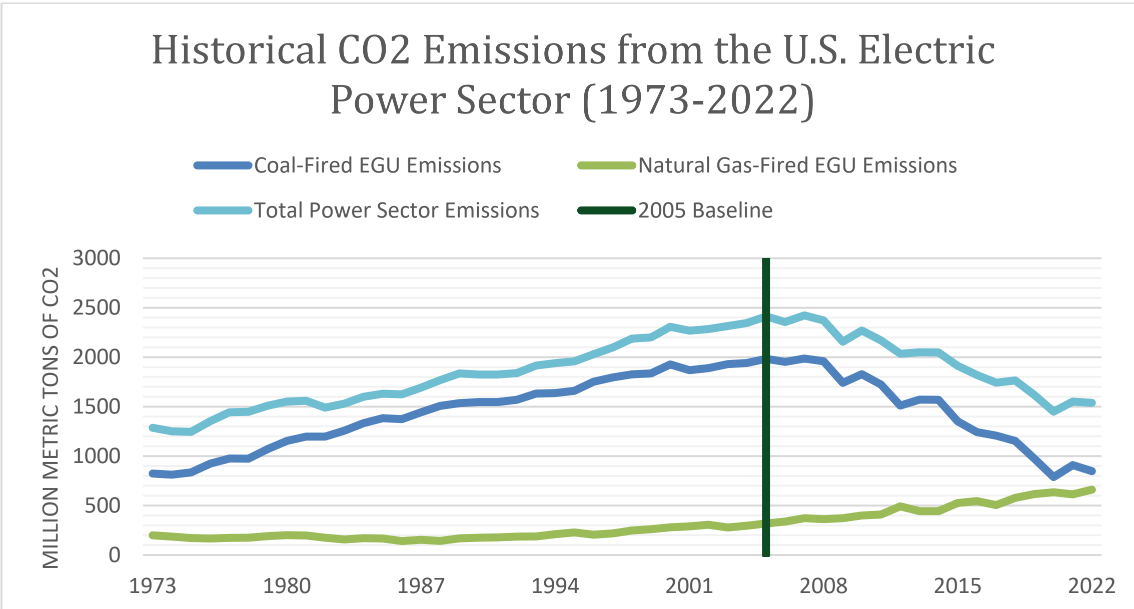

Figure 1: Historical CO2 Emissions from the U.S. Power Sector. The 2005 baseline is highlighted to show U.S. progress in achieving a 50% reduction by 2030. Data: EIA.

97.8% of all United States coal consumption in 2022 is attributable to the electric power sector, with 350,574 thousand tons used by electric utilities and 119,364 thousand tons consumed by independent power producers.[39] This is a 51.54% reduction from emissions at the start of the century for overall coal consumption and a 54.99% reduction from 2005 levels.[40] In 2022, coal combustion at EGUs resulted in 847 million metric tons of CO2 emissions, 55% of the total US power sector; while natural gas combustion released 661 million metric tons, 43% of the U.S.'

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[37] *Id.*
[38] *Id.*
[39] EIA, *Electricity Data Browser: Total consumption for coal, annual*, https://www.eia.gov/electricity/data/browser/#/topic/2?agg=1,0,2&fuel=8&geo=g&sec=o3g&linechart=ELEC.CONS_TOT.COW-US-99.A~ELEC.CONS_TOT.COW-US-1.A~ELEC.CONS_TOT.COW-US-94.A&columnchart=ELEC.CONS_TOT.COW-US-99.A&map=ELEC.CONS_TOT.COW-US-99.A&freq=A&start=2001&end=2022&ctype=linechart&ltype=pin&rtype=s&maptype=0&rse=0&pin= (last visited July 17, 2023).
[40] EIA, *Electricity Data Browser: Consumption for electricity generation for coal, annual*, https://www.eia.gov/electricity/data/browser/#/topic/3?agg=1,0,2&fuel=8&geo=g&sec=o3g&linechart=ELEC.CONS_EG.COW-US-99.A&columnchart=ELEC.CONS_EG.COW-US-99.A&map=ELEC.CONS_EG.COW-US-99.A&freq=A&start=2005&end=2022&chartindexed=0&ctype=columnchart&ltype=pin&columnendpoints=0&columnvalues=1&rtype=s&maptype=0&rse=0&pin= (last visited July 13, 2023).

share.[41] While coal usage has been declining since 2005, natural gas usage has been increasing to replace its capacity (see Figure 1).

Natural gas overtook coal as the highest generating electric power fuel source in the U.S. in March of 2019,[42] accounting for 37% of U.S. electric power generation in 2021.[43] In the next 5 years, there are 124 utility-scale natural gas-fired plants planned for construction in the U.S. across 28 states.[44] The United States is the largest natural gas producer in the world, having produced 36 quadrillion Btu in 2021. This is over 25% more than Russia, the second highest natural gas producer, and over 74% more than Iran, the third highest producer.[45]

Pollution from this increased natural gas buildout have associated negative impacts on human health and the environment. In addition to emissions of greenhouse gases like carbon dioxide and methane, natural gas extraction, storage, transmission and burning releases nitrogen oxides, which forms lethal particulate aerosol nitrates and is a main component of the tropospheric ozone smog that exacerbates severe lung and heart diseases; carbon monoxide, which reduces the blood's ability to carry oxygen and can prove fatal if inhaled; particulate matter such as respirable soot, which can be inhaled and trapped in the lungs and/or bloodstream; and additional hazardous air pollutants such as benzene which have the potential to cause cancer, birth defects, or other serious harms.[46]

The recently observed shift away from coal and towards natural gas increases the volume of pollution from extraction, storage and transmission as well as natural gas-fired electric generating units, harming already overburdened communities who experience disproportionate environmental harms and risks.[47] Inhabitants of overburdened communities often have higher risk of pre-existing diseases and limited access to medical treatments which can further exacerbate the negative harms associated with power plant pollution. According to a July 2022 report, nearly 10 percent of Americans live within just three miles of peaker power plants, which the report defined as plants with a maximum 15 percent capacity factor, and on average, a 5

[41] EIA, *How much of U.S. carbon dioxide emissions are associated with electricity generation?*, https://www.eia.gov/tools/faqs/faq.php?id=77&t=11 (last updated May 1, 2023).
[42] EIA, *Electricity Data Browser: Net generation, United States, electric utility, monthly*, https://www.eia.gov/electricity/data/browser/#/topic/0?agg=2,0,1&fuel=vvg&geo=g&sec=8&linechart=ELEC.GEN.ALL-US-1.M~ELEC.GEN.COW-US-1.M~ELEC.GEN.NG-US-1.M~ELEC.GEN.NUC-US-1.M~ELEC.GEN.HYC-US-1.M&columnchart=ELEC.GEN.ALL-US-1.M~ELEC.GEN.COW-US-1.M~ELEC.GEN.NG-US-1.M~ELEC.GEN.NUC-US-1.M~ELEC.GEN.HYC-US-1.M&map=ELEC.GEN.ALL-US-1.M&freq=M&start=200101&end=202212&ctype=linechart&ltype=pin&rtype=s&maptype=0&rse=0&pin= (last visited Aug. 2, 2023).
[43] EPA, *Sources of Greenhouse Gas Emissions*, https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions (last updated Apr. 28, 2023).
[44] EIA, *Preliminary Monthly Electric Generator Inventory (based on Form EIA-860M as a Supplement to Form EIA-860)* (June 27, 2023), www.eia.gov/electricity/data/eia860m/.
[45] EIA, *Total energy production from natural gas 2021*, https://www.eia.gov/international/rankings/country/USA?pid=4413&aid=1&f=A&y=01%2F01%2F2021&u=0&v=none&pa=287 (last visited Aug. 2, 2023).
[46] Am. Lung Ass'n, *What Makes Outdoor Air Unhealthy*, https://www.lung.org/clean-air/outdoors/what-makes-air-unhealthy (last visited July 17, 2023).
[47] Juan Declet-Barreto & Andrew A. Rosenberg, *Environmental justice and power plant emissions in the Regional Greenhouse Gas Initiative states*, PLOS One (July 20, 2022), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9299318/.

percent capacity factor.[48] Peaker plants are some of the dirtiest and least efficient energy sources that primarily run on gas at times of high demand, and are more likely to be in or nearby low-income neighborhoods and or communities of color; two-thirds (755/1148) of U.S. peaker plants exist near low-income communities and 41 million of these residents are located within a 3-mile radius of a plant.[49] NOx emissions from these peaker plants are more than 60% higher within populations with high percentages of people of color.[50]

II. <u>Current Power Sector Trends</u>

Current trends in the power sector make carbon reduction efforts under the proposed rule both feasible and affordable. These trends are largely economic in nature, driven by existing market effects and reinforced by investments and tax credits in the Inflation Reduction Act.

a. Coal Trends

A recent study by Analysis Group illustrates that the decline in coal generation can largely be attributed to (1) the sustained and widening economic advantages of producing electricity from lower cost and lower emitting sources of generation; and (2) policies by states and commitments by companies related to the climate and clean energy.[51] These factors have driven trends in the power sector, while federal environmental regulations have had lesser influence in comparison.[52] For example, even absent the EPA's Clean Power Plan—which never went into effect due to the February 2016 U.S. Supreme Court stay and would have reduced CO2 emissions by 32 percent by 2030—the power sector has reduced its CO2 emissions as of 2022 by 34 percent.[53]

Numerous coal industry leaders have cited environmental regulations, like the Clean Power Plan, and the "war on coal" to explain widespread coal retirement and the industry's declining profitability.[54] However, based on previous and ongoing power sector trends, the coal industry's declining profitability is more appropriately attributed to changing market trends and this is reflected in the industries' own legal filings in bankruptcy proceedings.[55]

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[48] Clean Energy Group & Strategen, *The Peaker Problem* 17 (July 2022), https://www.cleanegroup.org/wp-content/uploads/The-Peaker-Problem.pdf
[49] *Id.* at 8.
[50] *Id.* at 9.
[51] Susan F. Tierney, Analysis Group, *U.S. Coal-Fired Power Generation: Market Fundamentals as of 2023 and Transitions Ahead* 4 (Aug. 2023) (submitted with these comments as Attachment 1A), also available at https://www.analysisgroup.com/globalassets/insights/publishing/2023-tierney-coal-generation-report.pdf
[52] *Id.* at 29.
[53] *Id.* at 5.
[54] *See, e.g.*, Peabody Energy Corp.'s Motion for Stay, *West Virginia v. EPA*, Case No. 15-1363 (filed Nov. 5, 2015) (noting that the Clean Power Plan will cause loss in revenue, profits, jobs); Coal Indus. Reply in Support of Application for Immediate Stay of Final Agency Action Pending Jud. Review, 1, *Murray Energy Corp. v. EPA*, No. 15A-778 (2016) (Filed Jan. 27, 2016) (Peabody Energy and Murray Energy arguing that the Clean Power Plan would cause it irreparable damage, including the shutdown of coal-fuel generation and loss of revenue, profits and jobs).
[55] Peabody Energy—who filed for a stay of the Clean Power Plan, noting that it would lead to an irreparable loss in revenues—filed for bankruptcy two months after the Court issued a stay of the rule, citing market effects. Declaration of Amy B. Schwetz, *In re: Peabody Energy Corporation, et al.*, Case No. 16-42529 (B.A.P E.D. Mo.

Coal-fired EGUs are less efficient, and these aging facilities are more expensive to operate than other energy sources. Ninety-nine percent of all U.S. coal-fired plants (209 out of 210 studied) are more expensive to run compared to replacing their capacity with renewables.[56] With the increasing expense of running coal plants, more affordable renewable generation surpassed coal generation in the U.S. in 2022.[57] Coal-fired electricity generation has declined substantially since 2000, dropping 54% from 2000 to 2021, from 1,943 thousand GWh in 2000 to 893 thousand GWh in 2021.[58] In 2000, 53% of electric generation was from coal-fired plants, but that figure dropped to 23% by 2021.[59] As an indication of the significant decline in the use of coal-fired EGUs, there have been no new units built in the last ten years.[60] From 2000 to 2021, only 21 GW of new coal-fired EGUs were installed, which is 8.5 times less than the amount built from 1970 to 1990; comparatively, 200 GW of renewable capacity was installed during this period.[61] In the United States, the last large coal power plant to open began operation in 2013.[62] Over the past decade, virtually all new capacity additions were from natural gas, wind, solar, or water, and energy storage facilities.[63]

These trends are largely driven by economics, with coal-fired power plants more expensive to build, run, and maintain than other resource options available today. Renewable energy technologies now have the lowest mean levelized costs of energy, with the mean cost of utility-scale onshore wind $50/MWh and utility-scale solar PV $60/MWh, compared to coal at $117/MWh.[64] With zero new coal-fired EGUs entering the market in more than a decade, most of those remaining in use are now decades old.[65]

2016) (filed Apr. 13, 2016). In addition, Murray Energy Corp., who similarly filed a stay of the Clean Power Plan, filed for Chapter 11 bankruptcy protection absent the Clean Power Plan. Clifford Krauss, *Murray Energy is 8th Coal Company in a Year to Seek Bankruptcy*, N.Y. Times (Oct. 29. 2019), https://www.nytimes.com/2019/10/29/business/energy-environment/murray-energy-bankruptcy.html.

[56] Energy Innovation Technology LLC, *The Coal Cost Crossover 3.0.* (Jan. 28, 2023), https://energyinnovation.org/publication/the-coal-cost-crossover-3-0/.

[57] Katherine Antonio, *Renewable Generation Surpassed Coal and Nuclear in the U.S. Electric Power Sector in 2022*, EIA (Mar. 27, 2023), https://www.eia.gov/todayinenergy/detail.php?id=55960.

[58] EPA, *Power Sector Trends, Technical Support Document,* Docket ID No. EPA-HQ-OAR-2023-0072, at 3 (Apr. 2023), https://www.epa.gov/system/files/documents/2023-05/Power%20Sector%20Trends%20TSD.pdf.

[59] *Id.*

[60] New Source Performance Standards for Greenhouse Gas Emissions for 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, 88 Fed. Reg. 33240, 33256 (May 23, 2023) (to be codified at 40 C.F.R. pt. 60) [hereinafter Proposal].

[61] EIA, *Preliminary Monthly Electric Generator Inventory (based on Form EIA-860M as a Supplement to Form EIA-860)* (June 27, 2023), www.eia.gov/electricity/data/eia860m/.

[62] Tierney, *supra* note 51, at 4.

[63] *Id*. at 5.

[64] *See, e.g.,* Lazard, *Lazard's Levelized Cost of Energy Analysis - Version 16.0*, at 9 (Apr. 2023), https://www.lazard.com/media/2ozoovyg/lazards-lcoeplus-april-2023.pdf.

[65] *See* Tierney, *supra* note 51, at 4, 6; Proposal at 33256; EIA, *supra* note 44 (documenting that 71% of remaining coal EGU capacity is over 40 years old).

The majority of the remaining coal-fired plants were built in the 1970s and 1980s and are therefore over 40 or 50 years old—which is close to the average retirement age for coal plants.[66] This is one reason why coal-fired EGU retirements have been increasing overtime.[67]

As of 2022, no new coal-fired EGUs are scheduled to be built, while utilities have announced their intention to retire 118 GW of coal-fired capacity between 2021 and 2040—over half of the remaining coal-fired capacity.[68] In addition to these units reaching retirement age, the significant retirements of coal-fired capacity are also due in large part to the inefficiency and expense of operating this aging fleet.[69]

The current fleet of aging coal-fired EGUs is inefficient because older EGUs tend to operate less frequently and, therefore, less efficiently.[70] Capacity factor trends for coal-fired EGUs reflect the decreasing utilization of coal plants: in 2005, capacity factors for coal-fired EGUs averaged 67% but fell to 41% by 2020.[71] As coal-fired plants are used less often, the plants need to cycle (startup and shutdown) more frequently than EGUs operating in baseload.[72] This cycling creates greater emissions and is less efficient.[73]

Older coal-fired plants are also substantially less efficient because they require much more energy to produce electricity, yielding higher heat rates. From 2014 to 2021, coal plants between 60 to 70 years old operated at average heat rates of 11,410 MMBtu/MWh, while plants between 10 to 20 years old operated at 10,159 MMBtu/MWh.[74] These less efficient heat rates have contributed to why running coal plants is less economical than dispatching more efficient resources.[75]

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[66] *See* Tierney, *supra* note 51, at 6; EPA, *supra* note 58, at 7; Proposal at 33257 (citing eGRID 2020 (January 2022 release from EPA eGRID website).
[67] *See* Tierney, *supra* note 51, at 5, 32. *See also* Tierney, *supra* note 51, at 31, fig. 24; EPA, *supra* note 58, at 7.
[68] *See* EPA, *supra* note 58, at 9.
[69] *See* Tierney, supra note 51, at 12.
[70] *See* EPA, *supra* note 58, at 12. *See also* Tierney, *supra* note 51, at 38-40 (comparing announced coal retirements before and after IIJA and IRA)
[71] *See* EIA, *Electric Power Monthly*, *Table 6.07.A. Capacity Factors for Utility Scale Generators Primarily Using Fossil Fuels* (Sept. 2022), www.eia.gov/electricity/monthly/ [hereinafter EIA, *Electric Power Monthly*]; EIA, *Annual Electric Generators Report, Form EIA-860* (Sept. 2022), http://www.eia.gov/electricity/data/eia860/ [hereinafter EIA, *Annual Electric Generators Report*]; EIA, *Annual Power Plant Operations Report, Form EIA-923* (Oct. 2022), http://www.eia.gov/electricity/data/eia923/ [hereinafter EIA, *Annual Power Plant Operations Report*]. *See also* EPA, *supra* note 58, at 11.
[72] EIA, *Electric Power Monthly*, *supra* note 71; EIA, *Annual Electric Generator Report*, *supra* note 71; EIA, *Annual Power Plant Operations Report*, *supra* note 71. *See also See* EPA, *supra* note 58, at 11.
[73] EIA, *Electric Power Monthly*, *supra* note 71; EIA, *Annual Electric Generators Report*, *supra* note 71; EIA, *Annual Power Plant Operations Report*, *supra* note 71. *See also* EPA, *supra* note 58, at 11.
[74] EIA, *Form EIA-923 Detailed Data with Previous Form Data (EIA-906/920)* (June 29, 2023), https://www.eia.gov/electricity/data/eia923/.
[75] Tierney, *supra* note 51, at 12-13. *See also id.* at 40 ("As new generating capacity and storage facilities with no or low variable costs enter service (in part supported by financial incentives provided under federal law) and is dispatched ahead of fossil generating units (like coal) with higher variable costs, the capacity factor of many coal plants will continue to deteriorate, rendering many of these now-operating coal plants less economic to operate and maintain and less financially viable in the future.").

Maintenance of coal-fired EGUs is also expensive, becoming increasingly costly as unit efficiency declines due to equipment degradation.[76] However, EPA's data suggests that owners are refusing to pay for this expensive maintenance.[77] The concurrent decline in investment in plants with declining efficiency is likely due to owners' shifting priorities and refusal to invest in the maintenance required to keep these EGUs operating efficiently.[78] Owners' decision not to invest further capital into plants with unprofitable outlooks illustrates how keeping coal plants operational is uneconomical.

The market price of coal has fluctuated significantly in the recent past, burdening coal plant operators with greater costs and operational uncertainty, as seen in figure 2. The higher variable costs of coal units, as compared to renewables, makes them less economical to deploy to the grid, contributing with the several other economic factors to the declining use of these generation sources in recent years.[79]

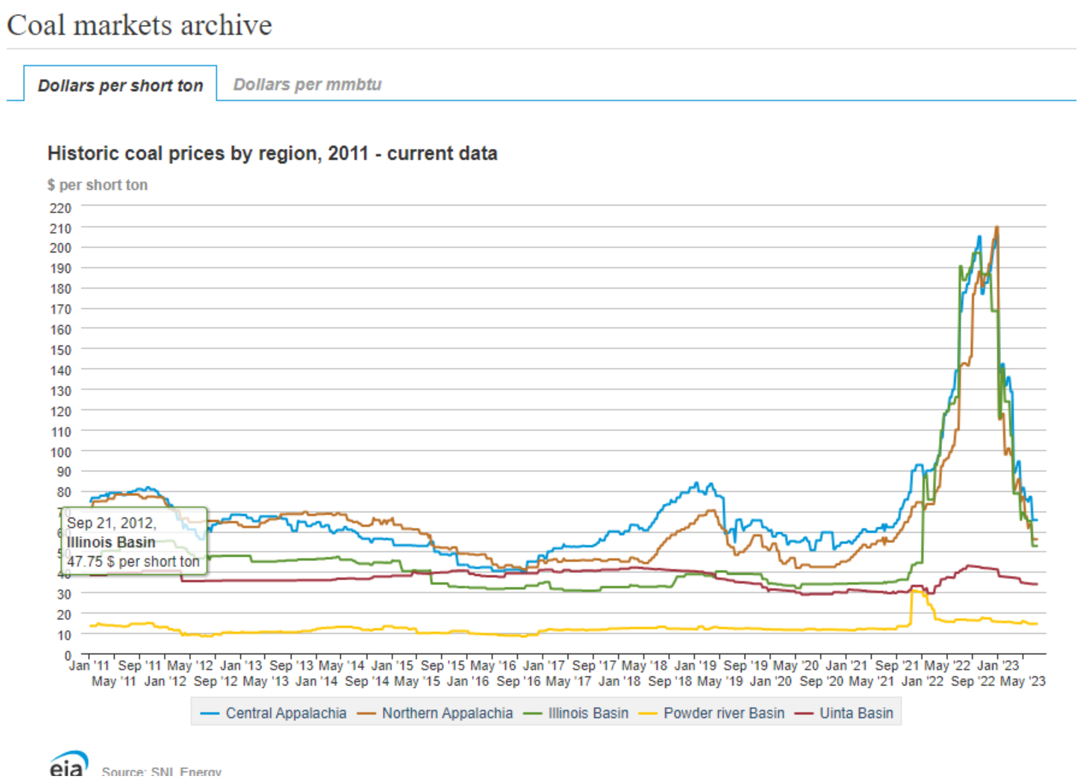

Figure 2: Coal price volatility is yet another reason why coal is uneconomical for electricity generation.[80]

[76] *Id.* at 24.
[77] *See* EPA, *supra* note 58, at 12.
[78] *Id.*
[79] Tierney, *supra* note 51, at 6.
[80] EIA, *Coal Markets Archive* (July 10, 2023), https://www.eia.gov/coal/markets/.

b. Natural Gas Trends

Natural gas prices have remained fairly low since the 2010s, making natural gas power production the dominant energy resource over the last decade instead of relatively inefficient coal-fired production.[81] Gas futures contracts, as an indicator supporting continued investment in natural gas-fired generation, have remained below $5.00 for much of the period since 2010, exceptions include the spike in prices caused by the Russian invasion of Ukraine in 2022.[82]

In addition to lower prices, heat rates as a measure of plant efficiency also influence operator decisions on power generation dispatch. Combined cycle gas turbine (CCGT) plants have lower, and thus more efficient, heat rates than coal plants.[83] Consequently, market dynamics prioritize the dispatch of more efficient CCGT plants over coal plants, and even peaking plants, because these plants have less efficient heat rates.[84]

Another way of understanding how these market dynamics influence operators' decisions to invest in and run certain types of plants is to analyze the amount of revenue that plants generate. The industry uses the term "dark spread" to denote the revenue coal plants make versus "spark spread" for natural gas plant revenue.[85] The PJM Western Hub daily wholesale electricity prices for January 2016 through July 2017 illustrate this trend. (See figure 3.) During this period, coal plant revenue, the "dark spread," was considerably less than that for natural gas plants, the "spark spread." In fact, coal revenue was frequently negative after October of 2016. This is due, in part, to the significantly higher fuel prices for coal plants than for natural gas plants – prices that regularly exceeded the wholesale electricity price, and thus were revenue losses for the owners. This lack of profitability puts financial pressure on existing coal plant owners to retire, while making natural gas a much more attractive option.[86]

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[81] Tierney, *supra* note 51, at 10.
[82] *Id. But see* Naureen Malik, *America's Biggest Power Source Wasn't Built for Extreme Weather*, Bloomberg (June 27, 2023), https://www.bloomberg.com/graphics/2023-natural-gas-biggest-us-power-source-also-most-vulnerable/ (discussing December 2022 winter storm, when some natural gas plants in the PJM service area that "could have ordered and received gas in time chose not to because gas prices heading into the storm were too high to justify the low prices they'd earn selling power").
[83] Tierney, *supra* note 51, at 12.
[84] *Id.* at 12.
[85] *Id.*
[86] *Id.* at 13.

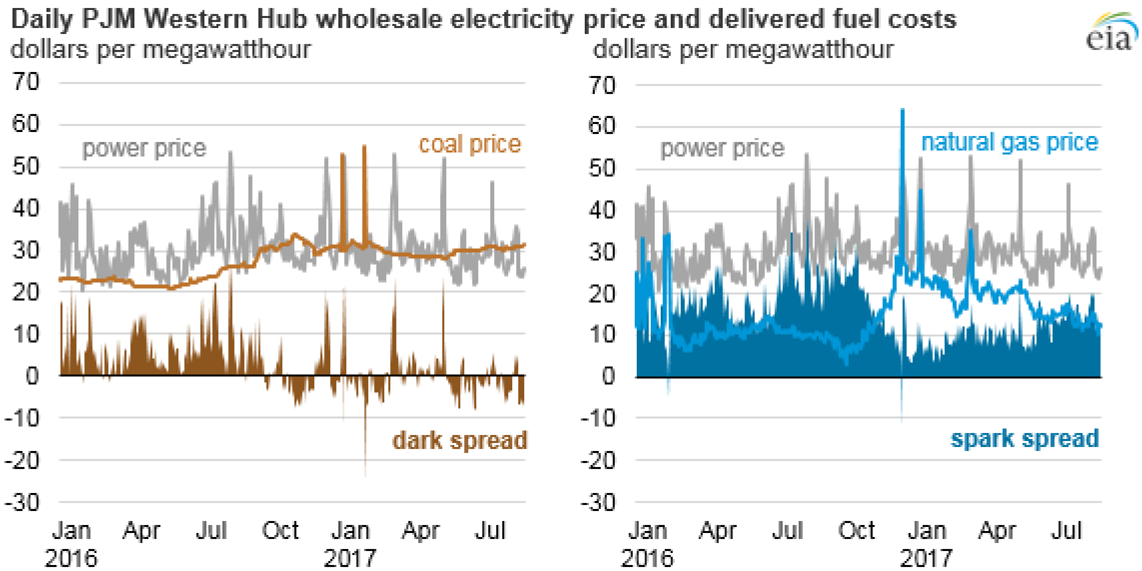

Figure 3: The "dark spread," shown at left with the dark brown solid area, indicates revenues for coal plant owners. The solid brown line indicates coal price, while the gray line indicates the wholesale electricity price. Similarly, at right, the "spark spread" illustrates the greater comparative revenues of natural gas plants during the same period, from January 2016 to July 2017.[87]

c. Renewable Energy Trends

Within the power sector, renewables—especially wind and solar energy—have grown substantially. The historical growth of renewables is reflective of underlying economics, with the construction of new clean energy resources increasingly the most economic decision for resource owners – a trend that is documented in the current penetration of renewables within the electricity market. The use of renewable energy in the power sector has grown significantly since 2000, with the most substantial growth in wind and solar in particular. Between 2012 and 2022, nearly 160 GW of new wind and utility-scale solar was added.[88] In 2022, renewable generation surpassed coal generation, and in 2021, renewables surpassed nuclear generation.[89] Wind generation surpassed hydroelectricity in 2019 as the largest source of renewable energy.[90]

The generation from all renewable energy sources combined has more than doubled since the turn of the 21st century—climbing from 315,000 GWh in 2000 to 790,000 GWh in 2021.[91]

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[87] *See* EIA, *Spark and Dark Spreads Indicate Profitability of Gas, Coal Power Plants,* Today in Energy (Oct. 13, 2017), https://www.eia.gov/todayinenergy/detail.php?id=33312; Tierney, *supra* note 51, at 13, fig. 9.
[88] Tierney, *supra* note 51, at 5, 28.
[89] Katherine Antonio, *Renewable Generation Surpassed Coal and Nuclear in the U.S. Electric Power Sector in 2022*, EIA (Mar. 27, 2023), https://www.eia.gov/todayinenergy/detail.php?id=55960 [hereinafter *EIA Renewables Surpass Coal, 3/27/2023*].
[90] Owen Comstock & Elesia Fasching, *Nonfossil Fuel Energy Sources Accounted for 21% of U.S. Energy Consumption in 2022*, EIA (June 29, 2023), https://www.eia.gov/todayinenergy/detail.php?id=56980, [hereinafter *EIA Nonfossil Fuel Consumption 6/29/2023*].
[91] *See* EPA, *supra* note 58, at 4.

Utility-scale solar power generation has increased particularly exponentially, from generating 1,212 GWh in 2010 to generating 145,598 GWh in 2022.[92] These figures demonstrate the sizable growth of renewables supporting the U.S. electricity market.

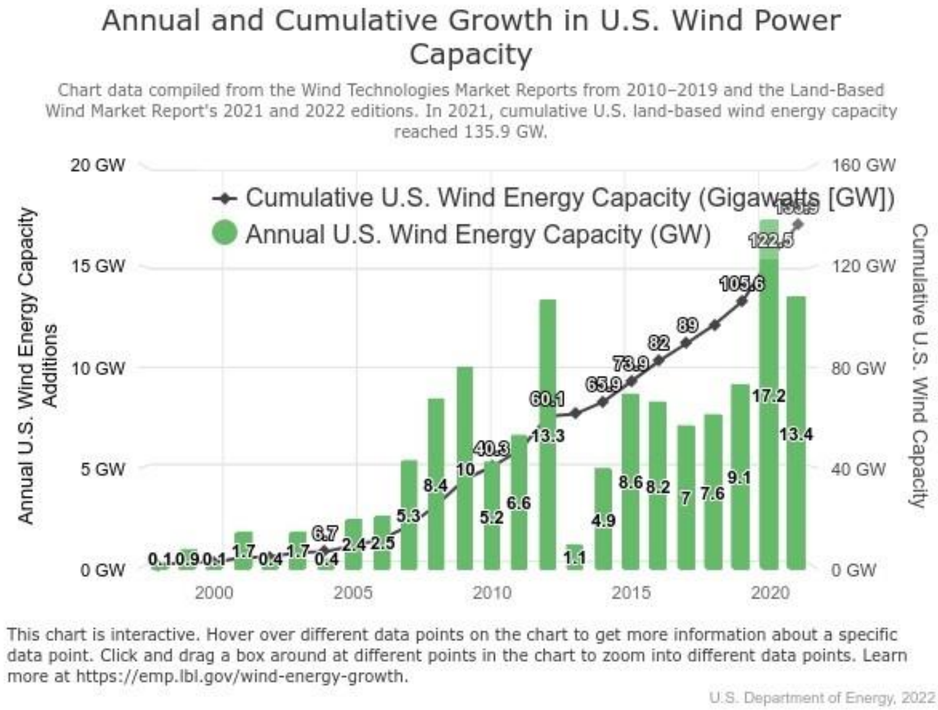

Figure 4: Since 2000, wind energy capacity has been on a steep upward trend.[93]

Renewable energy generation currently provides significant value to energy markets, meeting regulatory requirements associated with maintaining and ensuring grid reliability and resource adequacy during a period of rapid electrification. In 2022, 21% of U.S. electric consumption was from non-fossil fuel sources.[94] This increase in renewable consumption is primarily due to the rise in wind and solar generation, as discussed above. Wind energy generation provides 10.2% of the utility-scale electric power generation in the United States, and solar accounts for 3.4%.[95] Overall, renewables contributed 22% of the utility-scale electric generation to the power grid in 2022.[96]

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[92] EIA, *Table 10.6 Solar Electricity Net Generation*, https://www.eia.gov/totalenergy/data/browser/index.php?tbl=T10.06#/?f=A&start=1949&end=2022&charted=0-10-6-7-8-9 (last visited July 19, 2023).
[93] DOE, Wind Energy Technologies Office, *Wind Market Reports: 2022 Edition* (2022), https://www.energy.gov/eere/wind/wind-market-reports-2022-edition#:~:text=Wind%20turbines%20continued%20to%20grow,its%20levelized%20cost%20of%20energy.
[94] Owen Comstock & Elesia Fasching, *supra* note 90.
[95] EIA, *supra* note 36.
[96] *Id.*

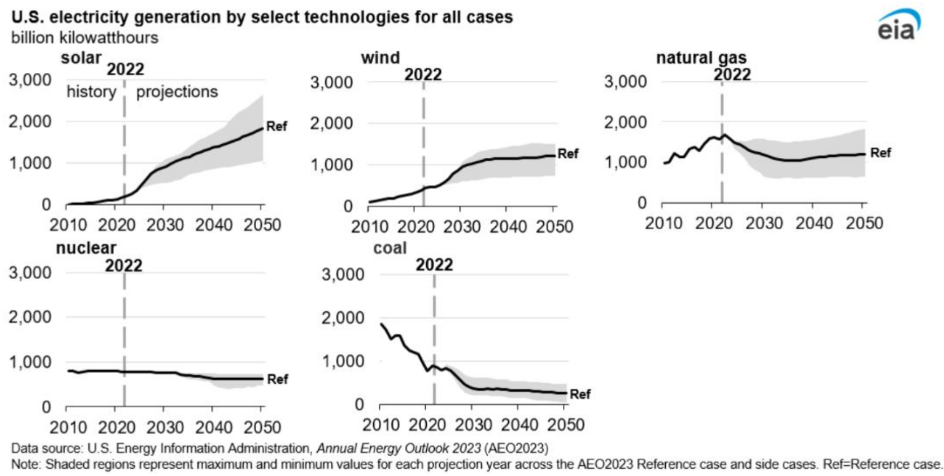
As the costs for renewables decline further and they become even more affordable as compared to fossil resources, the total electricity generation from renewables will continue to increase. While the mean levelized cost of energy (LCOE) for coal is currently $117 per MWh, and $168 per MWh for peaking natural gas, utility-scale solar and onshore wind are $60 and $50 per MWh, respectively.[97] Since 2009, the mean (LCOE) for utility-scale solar, for example, has decreased from $359 to $60 per MWh, a cost decrease of 83% over just the last 14 years.[98]

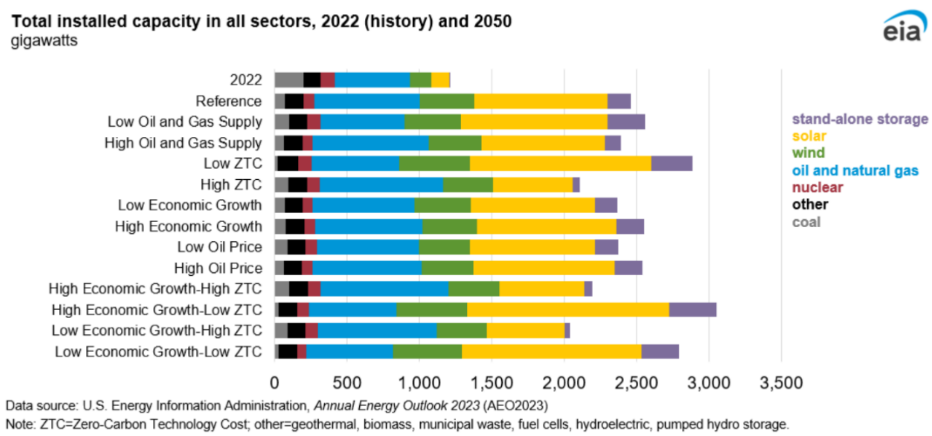
Renewables are forecasted to continue playing an important role in sustaining grid reliability and ensuring resource adequacy by providing significant electricity to the U.S. power grid in the upcoming years. At the end of 2022, over two million MW of capacity, with the vast majority of the capacity being renewable resources, was waiting in the interconnection queue to get connected to the grid.[99] That is nearly double the total capacity of the current U.S. electrical grid.[100] The enormous amount of renewable capacity that is waiting to come online in the interconnection queue further confirms current power sector economic trends.

In 2023, solar, wind, and battery storage are anticipated to account for 82% of the new utility-scale generating capacity planned to be brought online in the United States.[101] Specifically, utility-scale solar capacity is expected to be over 50% of the new generation added to the grid in 2023, the highest solar capacity added in a single year.[102] By the end of 2024, utility-scale solar capacity is expected to grow by an additional 63 GW above 2022 capacity – an increase of 85% over two years – due to falling construction costs and tax credits associated with renewable generation.[103] By 2050, the Energy Information Administration (EIA) projects that wind and solar will generate most of the electricity produced in the United States.[104] A massive increase in renewable capacity—which EIA projects to be between a 380% and 600% increase from 2022 to 2050—is largely due to declining capital costs in the development of such energy resources,

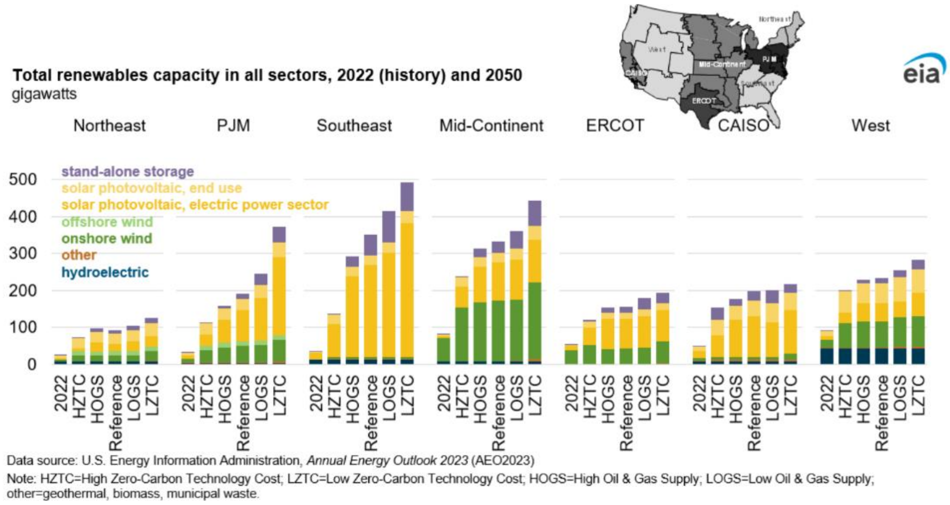
[97] *See, e.g.*, Lazard, *supra* note 64; Tierney, *supra* note 51, at 24-25 ("During the past few years, the going-forward levelized costs of new onshore wind and utility-scale solar dropped below those of gas-fired combined cycle projects. . . . By 2022, new onshore wind and utility-scale solar technologies had lower costs than all other technologies.").
[98] *See, e.g.*, Lazard, *supra* note 64, at 9.
[99] *See* Lawrence Berkeley Nat'l Lab. (LBNL), *Generation, Storage, and Hybrid Capacity in Interconnection Queues* (2022), https://emp.lbl.gov/generation-storage-and-hybrid-capacity (documenting 2,039,711 MW total capacity in interconnection queues at the end of 2022, including 490,835 MW solar; 430,908 MW battery and solar; 312,232 battery (standalone); 357,792 MW battery (hybrid); 164,566 MW wind; 111,787 MW offshore wind; 17,935 MW wind and battery; 12,038 MW solar, wind, and battery; and 4,076 MW solar and wind).
[100] EIA, *Electricity Explained, Electricity Generation, Capacity, and Sales in the United States* (June 30, 2023), https://www.eia.gov/energyexplained/electricity/electricity-in-the-us-generation-capacity-and-sales.php (documenting 1,160,169 MW of total utility-scale and 39,486 MW of small-scale solar PV electricity-generation capacity at the end of 2022).
[101] EIA, *supra* note 61.
[102] Stephanie Tsao, *Annual Energy Outlook 2023 – Issues in Focus: Inflation Reduction Act Cases in the AEO2023*, EIA (Mar. 16, 2023), https://www.eia.gov/outlooks/aeo/IIF_IRA/.
[103] Tyler Hodge, *Increasing Renewables Likely to Reduce Coal and Natural Gas Generation Over Next Two Years*, EIA (Jan. 19, 2023), https://www.eia.gov/todayinenergy/detail.php?id=55239.
[104] EIA, *Annual Energy Outlook 2023*, *Executive Summary*, para. 4 (Mar. 16, 2023), https://www.eia.gov/outlooks/aeo/.

including solar panels, wind turbines, and battery storage.[105] In addition, EIA forecasts this massive expansion of renewables to occur concurrently with a doubling of total power grid capacity by 2050, allowing the electric system to meet increased demand due to electrification.[106]





[105] EIA, *Annual Energy Outlook 2023*, *The Elec. Mix in the U.S. Shifts from Fossil Fuels to Renewables*, para. 1 (Mar. 16, 2023), https://www.eia.gov/outlooks/aeo/.
[106] *Id.* at para. 3.



Figures 5, 6, and 7: Highlighting the historic growth and further predicted growth of renewables in every transmission region through 2050.[107]

These declining costs, paired with the incentives from the Inflation Reduction Act (IRA) make renewables increasingly cost effective.[108] Consequently, EIA projects coal generation to continue to decline in usage, paving the way for this burst of renewable energy generation.[109]

Cleaner energy sources are a most affordable option for energy generation both currently and in energy market forecasts for the coming decades. Market-driven declining capital costs for solar panels, wind turbines, and battery storage, in addition to further price declines due to incentives provided in the IRA, make the shift to renewable energy extremely cost-competitive with other forms of generation capacity.[110] In particular, wind and solar have driven this economic shift, with marked decreases in capital costs for these renewables in recent decades.[111] From 1988-1999, the unsubsidized average capital cost of wind energy was $106 per MWh, but it declined 70% by 2021 to $32 per MWh.[112] The average levelized cost for utility-scale solar photovoltaics dropped 85% in just the last decade, from $227 per MWh in 2010 to $33 per MWh in 2021.[113]

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[107] EIA, *Annual Energy Outlook 2023* (Mar. 16, 2023), https://www.eia.gov/outlooks/aeo/.
[108] *Id.* at para. 1 ("Declining capital costs for solar panels, wind turbines, and battery storage, as well as government subsidies such as those included in the IRA, result in renewables becoming increasingly cost effective compared with the alternatives when building new power capacity.").
[109] *Id.* at para. 2; EIA, *Annual Energy Outlook 2023*, *The Electricity Mix in the United States Shifts from Fossil Fuels to Renewables*, para. 6 (Mar. 16, 2023), https://www.eia.gov/outlooks/aeo/narrative/index.php#TheElectricityMixinth.
[110] *Id.* ("The IRA provides additional incentives to wind and solar power generation, which accelerates the near-term decline of electric power sector coal-fired generating capacity and hastens the timeline for retirement in the U.S. coal fleet.").
[111] *See* EPA, *supra* note 58, at 16.
[112] Dep't of Energy (DOE), *Land-Based Wind Market Report: 2022 Edition* (Aug. 16, 2022), https://www.energy.gov/eere/wind/articles/land-based-wind-market-report-2022-edition [hereinafter *Wind Market 2022*].
[113] LBNL, *Utility-Scale Solar Technical Brief* (Sept. 2022), https://emp.lbl.gov/utility-scale-solar.

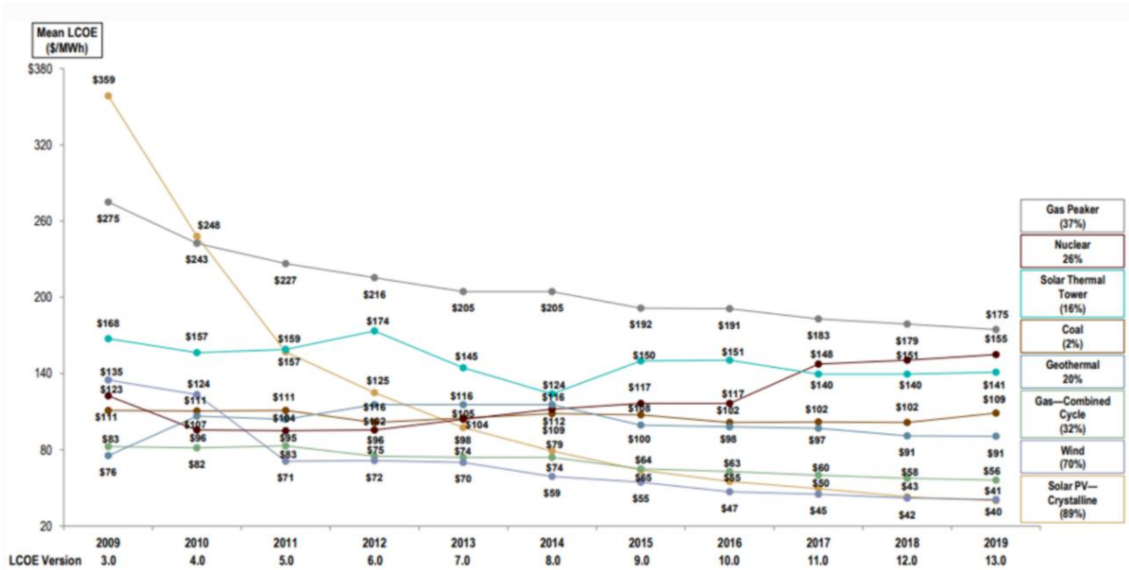

Figure 8: Showcasing the historic trends of mean LCOE prices for each energy source and demonstrating the dramatic decline in solar PV and wind energy LCOE compared to coal.[114]

Solar photovoltaic system construction costs have also sharply decreased in recent years. From 2019 to 2020, solar construction costs fell 8% to $1,655 per kW due to a 17% drop in the construction costs for cadmium tracking panels, which was the lowest capacity-weighted average cost of the panels since 2014.[115] Solar electric generating capacity will expand another 84% by the end of 2024 due to falling costs associated with construction and tax credits rendering it cheaper than fossil fuels.[116] Wind construction costs decreased as well. The average construction cost of onshore wind in the U.S. decreased 27% from 2013-2019.[117]

Energy produced from renewable wind and solar generation is so competitive in part because, unlike fossil fuel-fired EGUs, renewables have zero fuel costs.[118] This is one reason why renewable generation outcompetes other generation types in system dispatch.[119] It also provides resource owners greater cost certainty in O&M costs, as fossil fuels can experience large price swings that must be accounted for in energy market pricing in order for generation to remain

[114] *See* Lazard, *Lazard's Levelized Cost of Energy Analysis - Version 13.0*, at 7 (2019), https://www.lazard.com/media/o3ln2wve/lazards-levelized-cost-of-energy-version-130-vf.pdf; Silvio Marcacci, *Renewable Energy Prices Hit Record Lows: How Can Utilities Benefit From Unstoppable Solar and Wind?*, Forbes (Jan. 21, 2020), https://www.forbes.com/sites/energyinnovation/2020/01/21/renewable-energy-prices-hit-record-lows-how-can-utilities-benefit-from-unstoppable-solar-and-wind/?sh=64bbc26a2c84.
[115] Alex Mey, *Average U.S. Construction Costs Drop for Solar, Rise for Wind and Natural Gas Generators*, EIA (Nov. 3, 2022), https://www.eia.gov/todayinenergy/detail.php?id=54519.
[116] Tyler Hodge, *supra* note 103.
[117] Sara Hoff & Alexander Mey, *Average U.S. Construction Cost for Onshore Wind Generation Decreased by 27% Since 2013*, EIA (Aug. 17, 2021), https://www.eia.gov/todayinenergy/detail.php?id=49176.
[118] EIA, *supra* note 104 ("Once built and when the resource is available, wind and solar are the least cost resources to operate to meet electricity demand because they have zero fuel costs.").
[119] EIA, *supra* note 109, at para. 5.

profitable.[120] Operational expenses for land-based wind plants have been significantly declining over the past 35+ years and are now approximately $40/kW-yr.[121] Utility-scale solar PV O&M costs have also declined "precipitously" recently in recent years to $5-8/kWDC-yr. on average by 2019.[122]

Because much of the country uses market economics to dispatch power, the relative affordability of renewables means they are dispatched ahead of fossil fuel sources, such as coal-fired EGUs. These same market fundamentals are the key driver of why resource owners increasingly opt to build renewable energy resources.[123]

d. State Climate and Clean Energy Policies and Corporate Commitments

State climate and clean energy policies and corporate commitments are also driving power sector trends, further increasing generation from renewable sources. Many states have adopted a variety of climate and clean energy policies and many have adopted or updated their clean energy standards over past decade.[124] For example, some states have policies regarding the percentages of power that electricity suppliers must source from renewable energy, also known as renewable portfolio standards ("RPS") (or clean energy performance standards ("CEPS" or "CES").[125] Other states have policies that limit GHG emissions from the power sector.[126] And several states have both a RPS/CEPS and a GHG-reduction policy.[127]

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[120] EIA, *Historic Coal Prices by Region, 2011 – Current Data* (July 24, 2023), https://www.eia.gov/coal/markets/ (within *Archive* on webpage) (sourced from SNL Energy).
[121] Nat'l Renewable Energy Lab. (NREL), *2021 Cost of Wind Energy* (Dec. 2022), https://www.nrel.gov/docs/fy23osti/84774.pdf [hereinafter *NREL Report*].
[122] Ryan Wiser et al., LBNL, *Benchmarking Utility-Scale PV Operational Expenses and Project Lifetimes: Results from a Survey of U.S. Solar Industry Professionals* (June 2020), https://eta-publications.lbl.gov/sites/default/files/solar_life_and_opex_report.pdf.
[123] NREL Report, *supra* note 121.
[124] Tierney, *supra* note 51, at 15.
[125] *Id.*
[126] *Id.*
[127] *Id.*

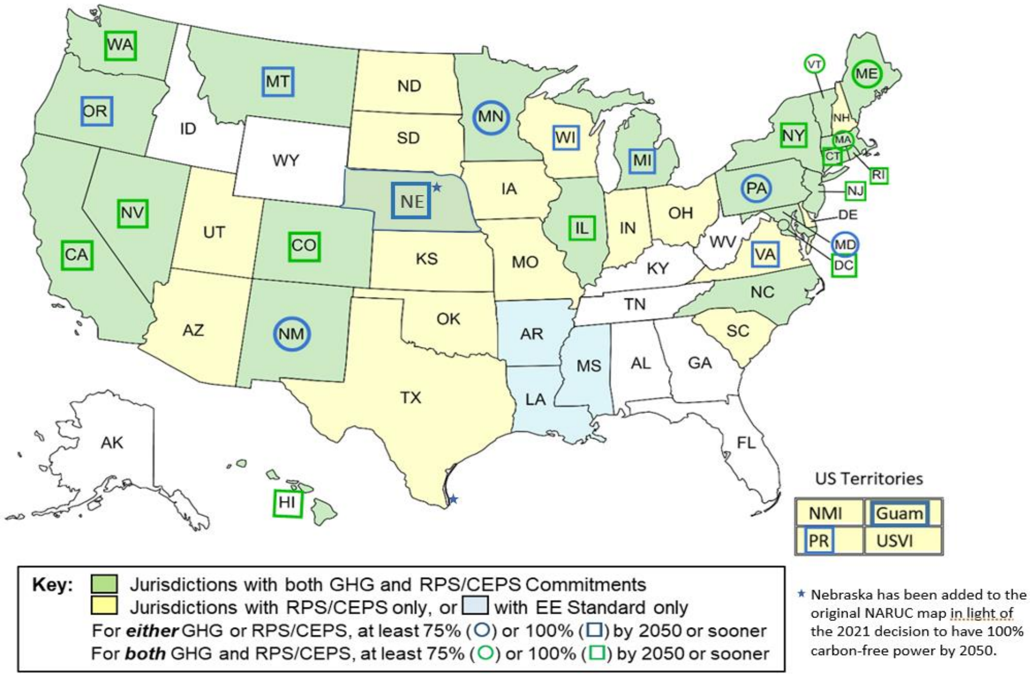

Figure 9: *Showing the widespread state adoption of renewable portfolio standards (RPS), clean energy portfolio standards (CEPS), greenhouse gas goals (GHG), and energy efficiency (EE) standards.*[128]

Other policies that have led to a decrease in dependence on fossil fired sources include: net metering policies, which compensate electricity consumers for installing onsite generation sources (such as solar power); policies providing financial support for nuclear plants; and energy efficiency resource standards, which require utilities to meet certain energy savings goals.[129]

In addition to state policies, the private sector—including large companies and utilities—have also made climate and clean energy commitments. Data shows that large corporate electricity customers have made commitments totaling 68 GW of clean energy as of 2022, with another 3.2 GW announced in the first quarter of 2023.[130]

And utilities that have made carbon-reduction commitments supply electricity to nearly four-fifths of electricity customers in the United States.[131] These entities include 42 utilities that have adopted a voluntary 100% carbon-reduction target and 497 individual utilities preparing to meet state goals of 100% carbon reduction. In the case of investor-owned utilities, their public commitments have been reported in financial disclosure statements and reflect the decisions of

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128 *See* Nat'l Ass'n of Regulatory Util. Comm'r (NARUC), *State Clean Energy Policy Tracker*, https://www.naruc.org/nrri/nrri-activities/clean-energy-tracker/ (last visited Aug. 7, 2023); Tierney, *supra* note 51, at 16, fig. 11.
129 Tierney, *supra* note 51, at 16-18.
130 *Id.* at 18-20.
131 *Id.* at 20-22.

the companies' leadership that such carbon-reduction targets are in the best interest of their investors and customers.[132]

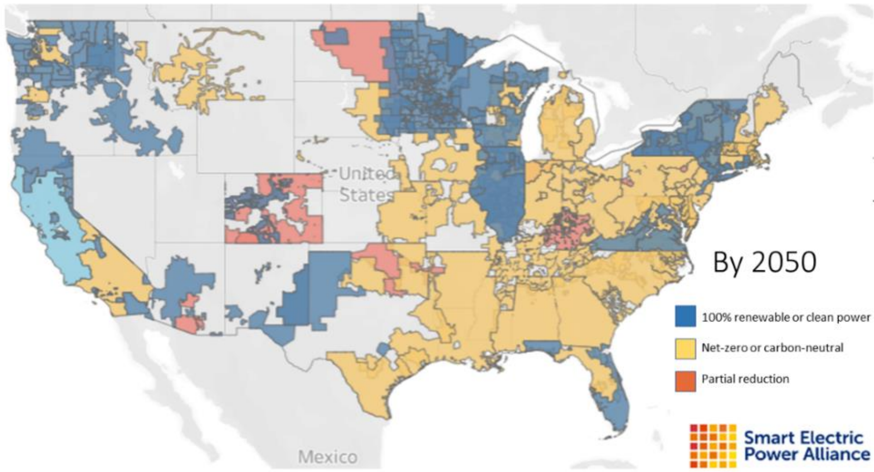

Figure 10: *Carbon-reduction targets adopted by utilities, including 100% renewable clean energy targets in dark blue.*[133]

e. Funding from the IRA Further Bolsters the Affordability of Clean Energy Sources.

The Inflation Reduction Act (IRA), signed into law on August 16, 2022, invests a historic $369 billion in clean energy investments over the next ten years to accelerate the shift away from fossil fuels.[134] This figure could underestimate the incentives, as some analysts model IRA incentives of over $1 trillion due to the uncapped nature of the tax credits.[135] A cross-model comparison study predicts that the IRA can scale low-emitting generation, including renewables, nuclear, and CCS, to supply 49-82% of all electricity by 2030, with a 68% average, relative to a 46-65% baseline without the IRA (54% average).[136] That is an increase of between 11 and 33 percentage points above the pre-IRA baseline.[137] Rhodium estimates the Inflation Reduction Act investments will cut power sector CO2 by 69-80% below 2005 levels by 2030.[138] Four major

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[132] *Id.* at 21.
[133] *See* Smart Elec. Power All. (SEPA), *Utility Carbon Reduction Tracker*, https://sepapower.org/utility-transformation-challenge/utility-carbon-reduction-tracker/ (last visited Aug. 7, 2023); Tierney, *supra* note 51, at 22, fig. 15.
[134] Cong. Budget Office (CBO), *Estimated Budgetary Effects of H.R. 5376, the Inflation Reduction Act of 2022* (Aug. 3, 2022), https://www.cbo.gov/publication/58366.
[135] Goldman Sachs, *The U.S. is Poised for an Energy Revolution* (Apr. 17, 2023), https://www.goldmansachs.com/intelligence/pages/the-us-is-poised-for-an-energy-revolution.html.
[136] *See* John Bistine, et al., *Emissions and Energy Impacts of the Inflation Reduction Act: Economy-Wide Emissions Drop 43 to 48% Below 2005 Levels by 2035 with Accelerated Clean Energy Deployment,* 380 Science 1324, 1325 (June 29, 2023), https://www.science.org/stoken/author-tokens/ST-1277/full. *See also* John Larsen et al., *A Turning Point for U.S. Climate Progress: Assessing the Climate and Clean Energy Provisions in the Inflation Reduction Act*, Rhodium Group (Aug. 12, 2022), https://rhg.com/research/climate-clean-energy-inflation-reduction-act/.
[137] John Bistine, et al., *supra* note 136.
[138] John Larsen et al., *supra* note 136.

modeling assessments of the Inflation Reduction Act – Rhodium, Princeton's REPEAT Project, Energy Innovation, and Resources for the Future – find the U.S. may achieve 73 to 76% clean electricity by 2030 and reduce electricity sector greenhouse gas emissions 67 to 78% by 2030 from 2005 levels.[139] Modeling also predicts a 32-45% reduction in U.S. greenhouse gas emissions below 2005 levels by 2030, 6-11% lower than the baseline.[140] And by 2035, greenhouse gas emission reductions are modelled to be 13-16% lower than the baseline due to the IRA.[141]

The IRA is not the only recent legislation accelerating the shift to renewables and zero emitting electricity generation. The Infrastructure Investment and Jobs Act (IIJA), signed into law on November 15, 2021, allocated more than $70 billion (via grants, contracts, cooperative agreements, credit allocations, etc.) to upgrade and develop infrastructure to facilitate renewable energy access, including upgrades to the electric transmission system.[142] These two statutes have the potential to vastly accelerate the market trends already underway in the U.S. electric sector to clean energy generation.[143] The IIJA also invests $6 billion in a Civilian Nuclear Credit program to support the continued operation of nuclear reactors.[144] By April of 2023, eight months after the IRA's passage in August of 2022, but one month before the release of EPA's proposed carbon rule, the number of planned coal plant retirements increased by 166% above 2021 figures.[145] This increase in retirements illustrates how the incentives from this historic climate legislation are speeding up the baseline economic trends.

The IRA contains over 20 clean energy tax provisions, including clean energy production tax credits (PTC) for renewable energy generators, investment tax credits (ITC) for renewable project development, and low-income community bonus credits for small-scale solar and wind installations on tribal lands or in environmental justice communities.[146] PTC and ITC tax credits financially incentivize new zero-emitting generation resources to enter the energy market. These tax credits are available for renewable energy-generating technologies until 2032, or, when there

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[139] Mike O'Boyle et al., *Implementing the Inflation Reduction Act: A Roadmap for State Electricity Policy*, Energy Innovation Policy & Tech. LLC at 19 (Oct. 2022), https://energyinnovation.org/wp-content/uploads/2022/10/Implementing-the-Inflation-Reduction-Act-A-Roadmap-For-State-Policy.pdf.
[140] John Bistline et al., *Economic Implications of the Climate Provisions of the Inflation Reduction Act* 2 (Nat'l Bureau of Econ. Research, Working Paper No. 31267, 2023), https://www.nber.org/system/files/working_papers/w31267/w31267.pdf.
[141] John Bistine, et al., *supra* note 136, at 1324 (June 29, 2023) (modeling GHG emissions reductions of 43-48% by 2035, as compared to a 27-35% baseline).
[142] *See* EPA, *supra* note 58, at 16.
[143] *See* Tierney, *supra* note 51, at 34-38.
[144] DOE, *DOE Establishes $6 Billion Program to Preserve America's Clean Nuclear Energy Infrastructure* (Feb. 11, 2022), https://www.energy.gov/articles/doe-establishes-6-billion-program-preserve-americas-clean-nuclear-energy-infrastructure.
[145] *See* Tierney, *supra* note 51, at 38-39 ("Cumulative planned retirements for the 2024-2050 period grew by 166% from January 2021, when the amount was 30.9 GW, to May 2023, when the amount was 51.2 GW.").
[146] White House, *Clean Energy Tax Provisions in the Inflation Reduction Act*, https://www.whitehouse.gov/cleanenergy/clean-energy-tax-provisions/ (last visited July 10, 2023).

is a 75% reduction in GHG emissions from the entire power sector from 2022 levels (whichever is later).[147]

The IRA Is projected to support roughly two-thirds of the needed progress, following the IIJA, to achieving the U.S.'s 2030 climate goals.[148] Financial incentives for implementing clean energy and climate solutions provide a bolstered foundation for executive agencies, state and local governments, and private sector leaders to work towards achieving these goals.[149]

Combined with additional grants and financial incentives, the PTC and ITC only amplify and broaden existing cost trends, with clean fuels predicted to become only more cost-effective compared to conventional fossil fuel options within the next decade – to the point where the U.S. is estimated to have the lowest levelized cost of clean energy in the world.[150] These credits could catalyze and amplify the $70 billion in clean-energy technology and demonstration projects funded under the IIJA, with the two statutes combined providing approximately $370 billion in federal funding in just the next 5 to 10 years.[151]

The IRA increases investment in solar PV and wind power, which almost doubles to $334 billion by 2030 opposed to $181 billion today.[152] Stacked benefits from tax credits are forecasted to make U.S. solar and wind the most affordable in the world between 2025 and 2030, with the subsidized cost of a solar module being about 20% to 40% of the unsubsidized cost, and a reduction in wind turbine costs of over 50%.[153] Additionally, solar manufacturing tax credits make U.S.-produced modules among the cheapest globally, which may transform the U.S. from an importer to an exporter of solar modules and wind turbines.[154]

Helping to spur this massive domestic expansion of renewable generation is the IRA's emphasis on onshoring manufacturing. Almost one million manufacturing jobs, primarily in solar PV and wind turbine component manufacturing, are estimated to be supported by IRA initiatives expanding supply chains and creating clean energy jobs.[155] An estimated 2,000 to 10,000 jobs are expected to be added in each state as a result of these clean energy investments.[156]

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[147] *See* EPA, *supra* note 58, at 6.
[148] Jesse D. Jenkins et al., Rapid Energy Policy Evaluation and Analysis Toolkit (REPEAT), *Climate Progress and the 117th Congress: The Impacts of the Inflation Reduction Act and Infrastructure Investment and Jobs Act* 39 (July 14, 2023), https://repeatproject.org/docs/REPEAT_Climate_Progress_and_the_117th_Congress.pdf.
[149] *Id.* at 111.
[150] John Larsen et al., *supra* note 136.
[151] Justin Badlam et al., *The Inflation Reduction Act: Here's What's in It*, McKinsey & Co. (Oct. 24, 2022), https://www.mckinsey.com/industries/public-sector/our-insights/the-inflation-reduction-act-heres-whats-in-it.
[152] Jenkins et al., *supra* note 148, at 15.
[153] Credit Suisse, *U.S. Inflation Reduction Act: A Catalyst for Climate Action* (Nov. 30, 2022), https://www.credit-suisse.com/about-us-news/en/articles/news-and-expertise/us-inflation-reduction-act-a-catalyst-for-climate-action-202211.html.
[154] *Id.*
[155] *See* Jenkins et al., *supra* note 148, at 124; Inflation Reduction Act of 2022, Pub. L. No. 117-169, 136 Stat. 1818, § 30001 (signed Aug. 12, 2022) (appropriating $500 million to DOE to accelerate domestic manufacturing of clean energy technologies including solar panels, electric grid components, heat pumps, electrolyzers, and fuel cells).
[156] Ashna Aggarwal et al., *The Economic Tides Just Turned for States*, Rocky Mountain Inst. (RMI) (Feb. 6, 2023), https://rmi.org/economic-tides-just-turned-for-states/.

With an increased diversity in renewable energy technologies at a commercial scale coming online due to the incentives in recent federal legislation like the IRA, more opportunities will arise for low-cost emissions reductions in the long term, making economics and these incentives important drivers of the U.S.'s net-zero emissions ambitions,[157] and fundamentally altering the cost structure of clean solutions in reducing pollution.

III. Subcategorization of New Gas Plants Based on Level of Utilization Is Supported by Statutory Authority and Regulatory Precedent.

Irrespective of any particular technology that the EPA determines to be adequately demonstrated as the BSER, EPA's decision to subcategorize new gas plants based on utilization is grounded in both statutory authority and regulatory precedent.

a. The Clean Air Act Supports Subcategorizing New Gas Plants Based on Utilization.

Section 111(b)(2) provides direct authority for EPA to "distinguish among classes, types, and sizes within categories of new sources for the purpose of establishing" new source performance standards (NSPS).[158] While the statute does not define these terms, dictionary definitions shed light on their ordinary meaning. Of particular relevance to the proposal at hand, "class" is defined as "a group, set, or kind marked by common *attributes* or a common attribute," and "type" is defined as "*qualities* common to a number of individuals that serve to distinguish them as an identifiable class or kind."[159] A subcategorization framework built on differences between unit utilization could either be understood to be based on an *attribute* or *quality* of the plants, and therefore be justified as either the statutory reference to "classes" or "types," permitting the Administrator to develop differentiated subcategories based on this characteristic.

A second statutory requirement under (b)(2) Is that the subcategorization be "for the purpose of establishing" the NSPS.[160] Section 111(a)(1) provides the definition of "standard of performance" as including the requirement that the standard reflect the "emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines have been adequately demonstrated."[161] Because the statute requires that use of subcategories to be for the purpose of establishing standards of performance, which are in turn derived through determining the best system of emission reduction (BSER), the BSER factors are of paramount importance when designing a subcategorization structure.

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[157] John Larsen et al., *supra* note 136.
[158] 42 U.S.C. § 7411(b)(2).
[159] Webster's Third New International Dictionary of the English Language, Unabridged 416, 2476 (1961, 56th printing) (emphasis added).
[160] 42 U.S.C. § 7411(b)(2).
[161] *See id.* § 7411(a)(1).

EPA has defined subcategories in past rules based on consideration of cost – one of the factors Congress explicitly required EPA to consider in identifying the BSER, among other factors.[162] Subcategories built on differences in the cost-effectiveness of control effectuate the second prong of (b)(2) because they are employed "for the purpose of establishing" the NSPS.

Utilization rates, as EPA has explained in the proposal, impact the cost-effectiveness of the BSER, and are thus an acceptable basis for subcategorization under the statute.[163] Units running at a higher capacity factor are generally more able to absorb the cost of installing new and potentially more costly controls, while units running at lower capacity factors are generally less able to do so. The capacity factor of the plant at issue therefore impacts the appropriateness of the BSER. Developing subcategories on the basis of the cost-effectiveness of different BSERs for plants running at different capacity factors is thus plainly consistent with the statutory terms, enumerated statutory factors, and framework.

A second, broader, justification for subcategorization based on utilization is that it furthers the purposes of the Act to protect against "air pollution which may reasonably be anticipated to endanger public health or welfare."[164] Subcategorization on this basis is reasonable since it could allow the EPA to determine the BSER more precisely for different types of units, potentially effectuating greater pollution reductions and thus improving public health and welfare.[165] Rather than avoiding a more stringent level of control altogether because it may be less cost-effective for certain plants, subcategorization may be beneficial for effectuating the health and welfare purposes of the Act because it allows for a differentiated framework of tailored standards appropriate for varying types of plants.[166]

The agency's design of a program of regulation including subcategories based on different applicable BSERs for different levels of utilization, which in turn reflect the cost effectiveness of different control standards, is therefore justified by the language, structure, and purpose of the Act.

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[162] *See, e.g.,* Steam Electric Reconsideration Rule, 85 Fed. Reg. 64650, 64679 (Oct. 13, 2020) (distinguishing between EGUs retiring before 2028 and those remaining in operation after that time, recognizing that more stringent controls are not cost-effective for sources with shorter operating horizons); 2015 NSPS, 80 Fed. Reg. 64510, 64602, tbl. 15 (Oct. 23, 2015) (dividing new natural gas power plants into baseload and non-baseload categories because reasonableness of control costs depends on extent of operation).

[163] Proposal at 33278.

[164] 42 U.S.C. § 7411(b)(1)(A).

[165] *See NRDC v. EPA*, 896 F.3d 459, 464 (D.C. Cir. 2018).

[166] In some circumstances subcategorization to reflect differential costs or feasibility concerns may be required. Courts may also invalidate a rule because EPA did not appropriately tailor its standards, potentially through subcategorization, so that all units can meet them. *See, e.g., Nat'l Lime Ass'n v. EPA,* 627 F.2d 416, 443-45 (D.C. Cir. 1980) (remanding rule for failure to consider the possibility that a BSER cannot be achieved by a subset of industry).

b. EPA's Prior Regulations Support the Differentiation of New Gas Plants into Subcategories Based on Utilization.

EPA has a long, robust record of utilizing subcategories in its section 111 regulations, as evidenced by the proposal's listing of *seven* past section 111 rulemakings spanning nearly five decades and defining subcategories based on numerous criteria, including, source size, fuel, equipment type, manufacturing process, activity level, geographic location, and level of utilization.[167]

Past regulations subcategorizing sources on the basis of unit utilization, specifically, also provide support for EPA's reliance on capacity factor to differentiate new gas sources. EPA's prior history of employing plant utilization to subcategorize new gas plants for GHG control under section 111(b) reflects EPA's aligned interpretation of the statute.

EPA subdivided new gas plants based on utilization in its 2015 natural gas GHG NSPS by creating baseload and non-baseload subcategories.[168] Although EPA initially considered a very similar three-part structure to the subcategories contained in this proposal – baseload, intermediate, and peaking subcategories – it ultimately decided that inadequate cost information existed at that time to support the three subcategories.[169] Since 2015, EPA conducted further modelling of control costs that the agency relies on in support of this proposal's adoption of three subcategories based on the different control costs for units operating at varied capacity factors.[170] The 2015 NSPS is an important regulatory precedent for its reliance on utilization as an approach to subcategorization for this source category.

EPA's 2013 NSPS for stationary compression ignition internal combustion engines also provides a precedent for subcategorization based on utilization. The ICE framework includes two subcategories, non-emergency engines limited to 100 hours of operation annually, as well as emergency engines which lack such a utilization limit when they are used in emergency conditions.[171] Capacity factor is analogous to the ICE regulation's annual utilization limit because it is a ratio of electricity actually produced by a unit to the amount of electricity the unit is capable of producing over a given time period.[172] Capacity factor therefore represents plant utilization over a period of time, analogous to the 100 hour annual utilization relied on for subcategorization in the ICE regulation. In this way, the ICE regulation provides an additional regulatory precedent for the proposal's use of capacity factor to subcategorize units.

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[167] Proposal at 33271 ("[T]he EPA has subcategorized many times in rulemaking under CAA sections 111(b) and 111(d) and based on a wide variety of physical, locational, and operational characteristics.").
[168] 80 Fed. Reg. 64510, 64608-10 (Oct. 23, 2015) (subcategorizing base load turbines based on electric sales exceeding a unit-specific threshold derived from design efficiency and non-base load turbines based on a capacity factor in relation to unit electric sales).
[169] 80 Fed. Reg. at 64609-10.
[170] *See, e.g.*, Proposal at 33319-26.
[171] *See* 78 Fed. Reg. 6674 (Jan. 20, 2013); 40 C.F.R. §§ 60.4204, .4205, 60.4211(f)(2).
[172] EIA, *Glossary*, https://www.eia.gov/tools/glossary/index.php?id=Capacity_factor#:~:text=Capacity%20factor%3A%20The%20ratio%20of,operation%20during%20the%20same%20period (last visited Aug. 7, 2023).

EPA's past regulations provide ample support for the agency's continued use of subcategories in its section 111 regulatory design to differentiate sources on the basis of shared qualities, such as utilization.

IV. Recommendations for Gas

Analysis of existing gas units operating between 2017 and 2021 reflects that it is rare for gas units to change their capacity factor by large amounts year to year.[173] In other words, plants that run below a 20 percent, 15 percent, or 10 percent capacity factor will typically stay below those respective thresholds from year to year. This is similarly true for plants that operate below and above a 50 percent capacity factor, although there is higher chance of movement across the 50 percent threshold compared to lower capacity thresholds.[174] This data—which reflects how gas units behave in practice—ultimately supports EPA's use of capacity factors to subcategorize gas units and the feasibility of those units committing to a single compliance pathway.

While EDF supports EPA's use of subcategories, EDF recommends that EPA strengthen requirements for the basic or foundational combustion technologies under the Rule by promulgating standards based on combined-cycle technology for the intermediate load subcategory for new gas. EPA should adjust the capacity factor threshold between the low load and intermediate load subcategory so that it is no higher than a 10 percent capacity factor. In addition, EPA should base the standards on state-of-the-art thermal efficiency. For existing gas units, EPA must prevent worsening pollution from these units, ensure rigorous applicability and prevent leakage that could harmfully erode the carbon pollution standards proposed for gas and coal, and ensure that emission guidelines reflect the best system of emission reduction.

a. New Gas Recommendations[175]

As proposed, the intermediate load subcategory's BSER is currently based on use of simple cycle turbines. However, the majority of intermediate load generation is provided by combined cycle units, thus the "best" system of emission reduction should not be based on simple cycle turbines.[176] Combined cycle units are far more efficient than simple cycle turbines, and basing the intermediate load subcategory's BSER on combined cycle will allow for additional carbon emissions reductions and fuel cost savings for operators.[177] Notably, simple cycle units can abide by a standard based on combined cycle technology by installing the heat recovery steam generator (HRSG), which is akin to retrofitting existing power plants with other types of emissions control technologies.

EPA's reasoning for promulgating the intermediate load standard based on simple cycle turbines is that "the capital cost of a combined cycle EGU is approximately 250 percent that of a comparable-sized simple cycle EGU," "the amount of GHG reductions that could be achieved by

[173] Memorandum from Synapse to Env't Defense Fund, Analysis of New Gas Unit Coverage Under EPA's Proposed 111 Rule at 4-6 (Aug. 2023) [hereinafter New Gas Memo] (submitted with these comments as Attachment 1B)
[174] *Id.*
[175] We incorporate by reference Section III.A through III.D of Sierra Club & Earthjustice et al., Comment on Docket No. EPA-HQ-OAR-2023-0072 [hereinafter Sierra Club & Earthjustice et al. Comment]
[176] *See* New Gas Memo, *supra* 173, at 3-6.
[177] Sierra Club & Earthjustice et al. Comment, *supra* note 175, Section III.A.

operating combined cycle EGUs as intermediate load EGUs is unclear," and that "intermediate load combustion turbines start and stop so frequently that there might not be sufficient periods of continuous operation where the HRSG would have sufficient time to generate steam to operate the steam turbine enough to significantly lower the emissions rate of the EGU."[178]

However, there is compelling evidence to the contrary.[179] Regarding costs, reports show that the capital costs for combined cycle units would be far less than 250 percent of a simple cycle unit's cost, and in many instances, even lower than capital costs for simple cycle units.[180] Use of combined cycle is *more cost-effective* due to reduced fuel costs.[181] In addition, combined cycle units can achieve far more emissions reductions than simple cycle turbines because they are more efficient.[182] Lastly, while intermediate unit loads may fluctuate throughout the day, they consistently operate from mid-morning to evening and do not "start and stop" frequently.[183]

In addition to basing the intermediate load subcategory on combined cycle technology, EPA should lower the capacity factor for the low load subcategory so that it includes units no higher than a 10 percent capacity factor threshold. The 20 percent capacity factor means that only a small number of gas units would be affected by the intermediate and base-load categories; Based on the 2021 gas fleet, only 15.1 percent of gas units operated above a 20 percent capacity factor.[184]

Gas units in the intermediate and base load subcategories may choose to avoid compliance costs, which could lead to an increase in generation from lower capacity units. Because a 20 percent capacity factor is higher than the average capacity factor for peaker plants, this shift could lead to an increase in operation and CO2 emissions from low load units. In order to avoid this increase in emissions from low load units, the EPA should lower the capacity factor threshold between the low load and intermediate load subcategory. Based on the 2021 gas fleet, a 10 percent capacity factor would expand the intermediate and base-load subcategories to collectively include 19.7 percent of the gas fleet (see figure 11).[185] Expanding the intermediate load subcategory to include these additional units will help to protect against unintended increases in CO2 emissions from low-capacity factor units. Not only will lowering the capacity factor for intermediate load plants result in additional public health and welfare benefits, but operating combined cycle units at a 10 percent capacity factors will also remain cost-effective due to savings in fuel costs.[186]

[178] Proposal at 33287.
[179] *See* Sierra Club & Earthjustice Comment, *supra* note 175, Section III.A.
[180] *See id.*
[181] *Id.*
[182] *Id.*
[183] *Id.*
[184] New Gas Memo, *supra* 173, at 7.
[185] *Id.*
[186] *See* Sierra Club & Earthjustice Comment, Section III.B.

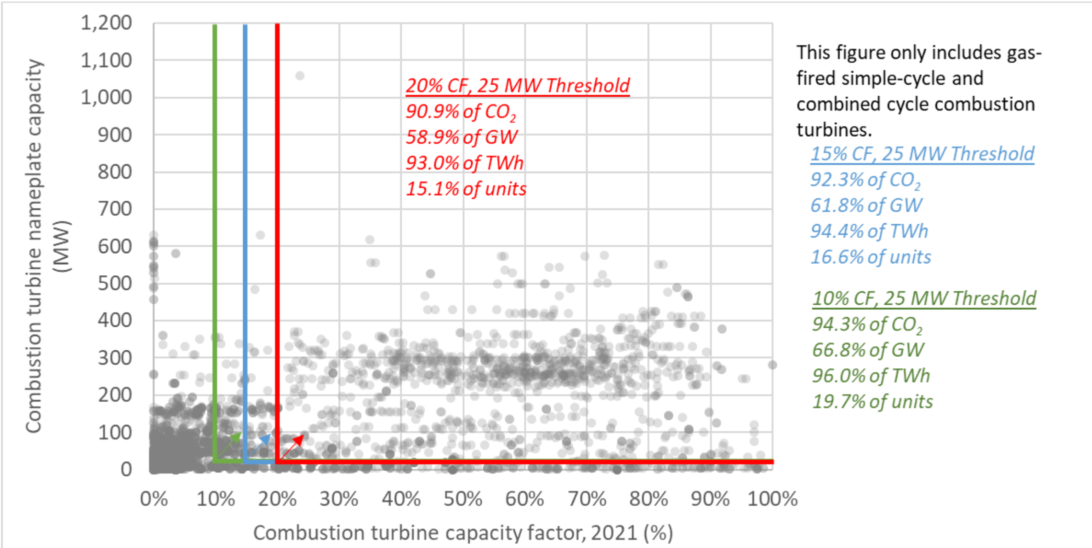

Figure 11: 20 percent, 15 percent, and 10 capacity factor thresholds applied to 2021 gas units larger than 25 MW[187]

EPA should require the standards for new gas units to be based on highly generation-efficient turbines.[188] Today, GE's most advanced H-class turbines have >64% thermal efficiency.[189] GE's most efficient gas turbine for 50Hz frequencies (9HA.02) has 64.1% net combined cycle efficiency with 848-1680 MW of net output.[190] Their most efficient turbine for 60Hz frequencies (7HA.03) has >64% net combined cycle efficiency with 640-1282 MW of net output.[191] 7HA combined cycle plants provide a 60% reduction in CO2 emissions compared to similarly sized coal-fired electric generating units.[192] Both H-class turbines also have rapid response hot start up times of less than 30 minutes.[193]

Siemens' most efficient heavy duty gas turbine for 50Hz frequencies (SGt5-9000HL) has a combined-cycle efficiency of >64% and a gross output of 880-1760 MW.[194] Their most efficient turbine for 60Hz frequencies (SGT6-9000HL) has a combined-cycle efficiency of >64% and a

[187] New Gas Memo, *supra* 173, at 7, fig. 6.
[188] *See* Sierra Club & Earthjustice Comment, *supra* note 175, Section III.C.
[189] Gen. Elec. *9HA gas turbine poster*, https://www.ge.com/content/dam/gepower-new/global/en_US/downloads/gas-new-site/products/gas-turbines/ged7504-9ha-product-poster-2021-2022.pdf (last visited Aug. 3, 2023).
[190] *Id.*
[191] Gen. Elec., *7HA.01/.02/.03 fact sheet*, https://www.ge.com/content/dam/gepower-new/global/en_US/downloads/gas-new-site/products/gas-turbines/7ha-fact-sheet-product-specifications.pdf (last visited Aug. 3, 2023).
[192] Gen. Elec., *7HA gas turbine poster*, https://www.ge.com/content/dam/gepower-new/global/en_US/downloads/gas-new-site/products/gas-turbines/ged7505-7ha-product-poster-2021-2022.pdf (last visited Aug. 3, 2023).
[193] Gen. Elec., *supra* note 191.
[194] Siemens Energy, *SGT5-9000HL | 593 MW | 50 Hz*, https://www.siemens-energy.com/global/en/offerings/power-generation/gas-turbines/sgt5-9000hl.html (last visited Aug. 3, 2023).

gross output of 655-1310 MW.[195] Siemens, in November 2017, stated that global turbine producers have the capacity to construct 400 large gas turbines (>100 MW) each year, but predicted annual demand to require about 110 units per year.[196] The company is currently investigating technologies to increase performance and lower emissions with a mid-term goal of reaching a 65% efficiency rate.[197]

And for simple cycle turbines, Baker Hughes LM9000 simple-cycle turbine provides an efficiency of >44%.[198]

b. Existing Gas Recommendations

EPA must address the CO2 pollution from both new and existing gas-burning power plants to carry out its statutory responsibility under the Clean Air Act to protect human health and welfare from harmful air pollution. Gas-burning power plants have overtaken coal plants as the single largest contributor to climate-destabilizing pollution in the power sector. Further, as reflected in Figure 12, below, the CO2 pollution from gas-burning power plants has steadily and considerably risen over the past twenty years. In 2022, CO2 pollution from gas-fired power plant combustion was a staggering 900 million tons *before* considering the extensive methane pollution and other airborne contaminants associated with the extraction, storage and transmission of gas.

[195] Siemens Energy, *SGTG-9000HL (60 Hz)*, https://www.siemens-energy.com/global/en/offerings/power-generation/gas-turbines/sgt6-9000hl.html (last visited Aug. 3, 2023).
[196] Press Release, Siemens Energy, *Siemens tackles structural market changes and strengthens global competitiveness* (Nov. 16, 2017), https://press.siemens.com/global/en/pressrelease/siemens-tackles-structural-market-changes-and-strengthens-global-competitiveness.
[197] Siemens Energy, *Annual Report 2017* 5 (2017), https://www.siemens.com/investor/pool/en/investor_relations/Siemens_AR2017.pdf.
[198] Baker Hughes, *Baker Hughes LM9000 confirmed as world's most efficient simple cycle gas turbine after reaching key testing milestone for Arctic LNG 2* (June 9, 2020), https://www.bakerhughes.com/company/news/baker-hughes-lm9000-confirmed-worlds-most-efficient-simple-cycle-gas-turbine-after.

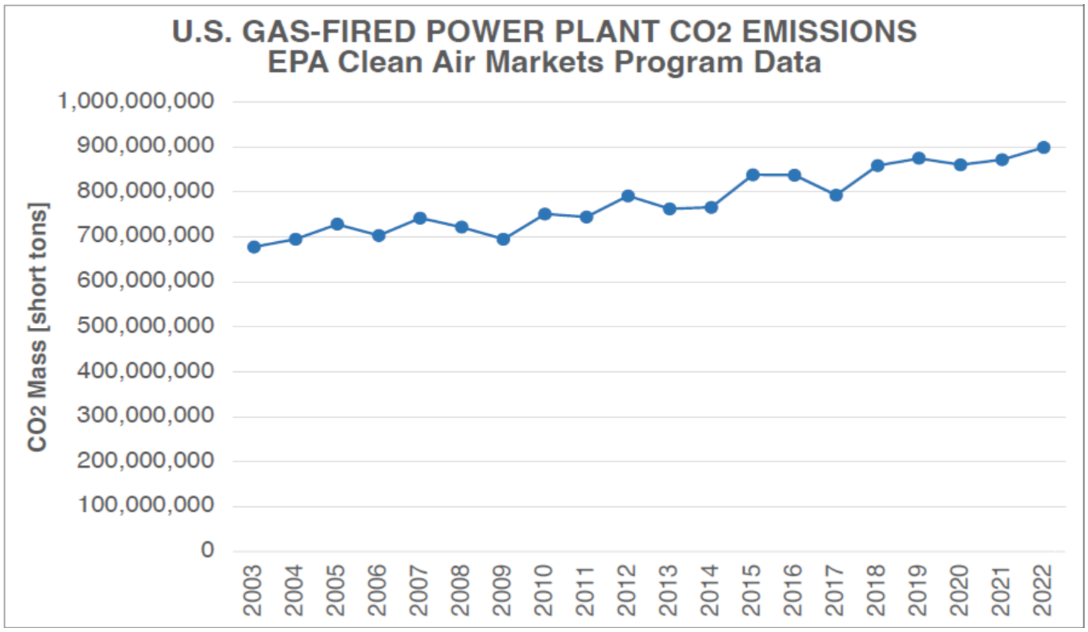

Figure 12: U.S. Gas-Fired Power Plant Carbon Emissions

EPA's final action addressing the pollution from existing gas burning power plants must have the following three central features.

<u>EPA Must Prevent Worsening Pollution.</u> The alarming rise in CO_2 pollution from gas-burning power plants requires immediate protective action. EPA must ensure that its standards for new gas-fired power plants, under both 111(b)/NSPS and the PSD Preconstruction Review Permit program, are rigorous in reflecting the "best" pollution limits including the ready availability of fast start combined cycle units and, under PSD, the ready availability of lower cost clean energy solutions. See *Alaska Dep't of Envtl. Conservation v. EPA*, 540 U.S. 461 (2004) (the Supreme Court found the term "best" has a strong normative meaning and requires the selection of "the technology that can *best* reduce pollution within practical constraints." *Id.* (emphasis in original). As discussed in detail below, the statute's PSD Pre-Construction Review Permit program also explicitly requires EPA and state permitting authorities to consider clean energy "alternatives" to new gas-burning power plants.

<u>EPA Must Ensure Rigorous Applicability and Prevent Leakage that Could Harmfully Erode the Carbon Pollution Standards Proposed for Gas and Coal</u>. As proposed, EPA's existing gas standards cover an exceedingly small portion of the pollution and existing units. For example, based on the 2021 gas fleet, EPA's existing gas standards cover only 2.5 percent of gas units and 28.7 percent of CO_2 from those units.[199] Instead of complying with emission limits, these units may opt to lower their capacity to avoid applicability thereby leading to a loss in potential carbon pollution reductions. Likewise, serious leakage may occur if existing coal units regulated under

[199] Memorandum from Synapse to Env't Defense Fund, Analysis of Existing Gas Unit Coverage Under EPA's Proposed 111 Rule (Aug. 2023) [hereinafter Existing Gas Memo] (submitted with these comments as Attachment 1C).

the Rule shift generation to unregulated existing gas. A similar shift could occur to unregulated existing gas-burning power plants that is effectuated to avoid new source standards.

EPA must carefully consider applicability to prevent carbon pollution increases from unregulated sources. We draw here directly from the referenced analysis carried out by Synapse. [200] That analysis shows, for example, that moving to a 40 percent capacity factor threshold and 100 MW thresholds would cover existing gas units that were responsible for over three quarters of the CO2 gas unit pollution and more than 80 percent of generation in 2021 and yet less than 10 percent of the units in the fleet.[201] Covering relatively few additional units in this way would greatly improve coverage of the Proposed Rule and support overall emissions reductions.

Here are key findings from the Synapse analysis:

> ***Changing the capacity factor threshold and the size threshold would maximize the coverage of existing gas units under the Proposed 111 Rule***
>
> As shown in Figure 13 and Table 14, moving to a 40 percent capacity fact threshold and a 100 MW size threshold would likely yield the largest increase in coverage of existing gas units compared to other tested thresholds.[202]

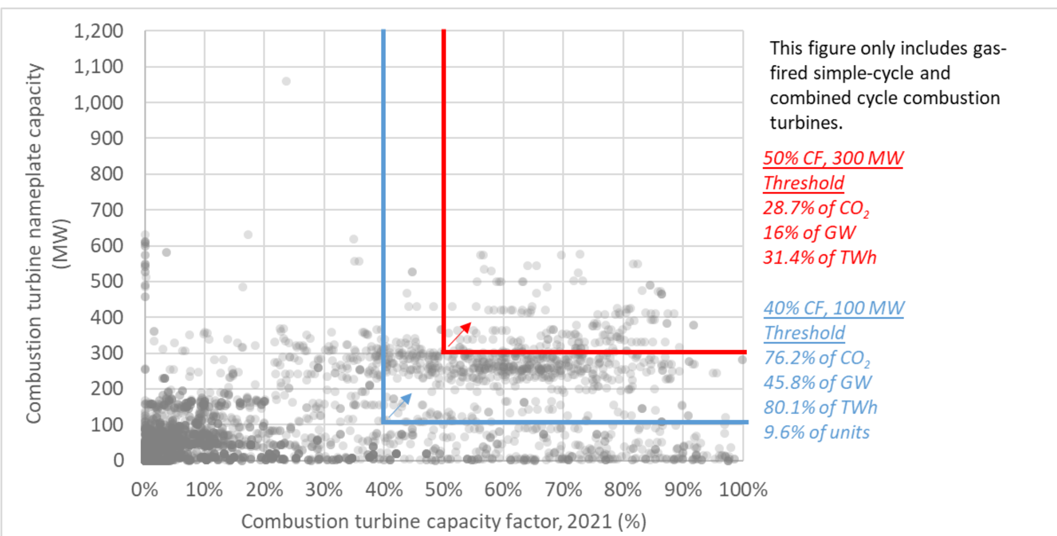

Figure 13: Coverage of 2021 gas units within the intermediate and baseload categories with different size thresholds[203]

[200] *Id.*
[201] *Id.*
[202] *Id.*
[203] *Id.*

Percentage of 2021 Gas CO2 Emissions Covered by 111

	Capacity Factor Threshold	
Size Threshold (MW)	>50%	>40%
>300	28.7%	31.4%
>200	62.4%	70.2%
>100	67.5%	76.2%

Percentage of 2021 Gas Generation Covered by 111

	Capacity Factor Threshold	
Size Threshold (MW)	>50%	>40%
>300	31.4%	34.3%
>200	66.5%	75.1%
>100	70.6%	80.1%

Percentage of 2021 Gas Capacity Covered by 111

	Capacity Factor Threshold	
Size Threshold (MW)	>50%	>40%
>300	16.0%	18.4%
>200	35.7%	42.8%
>100	37.9%	45.8%

Percentage of 2021 Gas Units Covered by 111

	Capacity Factor Threshold	
Size Threshold (MW)	>50%	>40%
>300	2.5%	2.9%
>200	7.0%	8.4%
>100	7.8%	9.6%

Figure 14: Changes to 2021 existing gas unit coverage within the intermediate and baseload categories under different size and capacity factor thresholds[204]

EPA Must Ensure Emission Guidelines Reflect the Best System of Emission Reduction. EPA must also ensure that its final standards reflect the "best system of emission reduction" in limiting climate-destabilizing CO2 and other deleterious contaminants from existing gas plants.

V. EPA's Proposed Subcategorization of Existing Sources is Anchored in the Text, Structure, and Purpose of Section 111(d).

EPA's longstanding interpretation of section 111(d) to establish subcategories for existing sources is fully anchored in the Act's text, structure, and purpose for the regulation of these sources.[205] Section 111(d)(1) directs EPA to "prescribe regulations which shall establish a procedure … under which each State shall submit to the Administrator a plan" with existing source standards of performance.[206] As the Supreme Court recently explained, "EPA retains the primary regulatory role in Section 111(d)," with the Agency, "not the States, decid[ing] the amount of pollution reduction that must ultimately be achieved…by again determining, as when setting the new source rules, 'the *best system of reduction*…that has been adequately demonstrated'" for the existing sources.[207] Consistent with the statute's allocation of the "primary regulatory role" to the agency, EPA's understanding of its "broad authority" under section 111(d) to include subcategorization as a regulatory tool "follows from the fact that these provisions authorize the EPA to determine the BSER."[208] As discussed in the section above, the congressional delegation

[204] *Id.*
[205] Proposal at 33345 ("EPA has broad authority under CAA section 111(d) to identify subcategories.").
[206] 42 U.S.C. 7411(d)(1).
[207] *West Virginia v. EPA*, 142 S. Ct. 2587, 2601-02 (2022) (emphasis added).
[208] Proposal at 33270.

of authority for EPA to determine the BSER reflects ample authority to provide for subcategorization anchored in the statutory text, enumerated statutory factors, and purpose.

The agency's Interpretation Is sound because the structure of the Act requires EPA to set the BSER for existing sources under similar procedures as for determining the BSER for new sources.[209] As discussed, the purpose of subcategorization under section 111 is to aid the agency in "establishing" the standard of performance, and thus the determination of the BSER.[210] Therefore, EPA's interpretation of its authority to establish subcategories for existing sources is securely grounded in the statute because, as described above in the context of new plants, it permits the agency to better tailor individual BSERs to the unique characteristics of specific subsets of plants.[211]

EPA has long interpreted section 111(d) to permit the agency to subcategorize existing sources. Ever since EPA issued its original section 111(d) implementing regulations in 1975, the agency has interpreted the existing source framework to allow for a parallel subcategorization structure to section 111(b).[212] In the 1975 implementing regulations, EPA underscored that subcategorization for existing sources is meant to allow its emissions guidelines to be better "tailored" to the particular circumstances of different sets of sources.[213]

Since EPA must consider the BSER factors of section 111(a)(1) in determining standards of performance for existing sources as with new sources, the agency must consider costs in setting the BSER. EPA's 111(d) implementing regulations reinforce how subcategorizing may be desirable to ensure reasonable "costs of control" for different subsets of units.[214]

Therefore, EPA's determination that subcategorization is appropriate for existing power plants is consistent with its longstanding and sensible interpretation of the structure of 111(d) as

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[209] *See* 42 U.S.C. § 7411(d) (requiring EPA to establish cooperative federalism approach to determining "standards of performance" for existing sources); *id.* §7411(a)(1) (providing definition of "standard of performance" to include determination of the "best system of emission reduction").
[210] *See id.* § 7411(b)(2) (providing authority to "distinguish among classes, types, and sizes within categories of new sources for the purpose of establishing" new source performance standards).
[211] Proposal at 33345 (interpreting 111(d) to provide authority to "place types of sources into subcategories when they have characteristics that are relevant to the controls that the EPA may determine to be the BSER for those sources").
[212] 40 Fed. Reg. 53340 (Nov. 17, 1975), codified at 40 C.F.R. § 60.22(b)(5) (describing how EPA "will specify different emission guidelines or compliance times or both for different *sizes, types, and classes* of designated facilities when costs of control, physical limitations, geographical location, or similar factors *make subcategorization appropriate*") (emphasis added).
[213] 40 Fed. Reg. 53340, 53343 (Nov. 17, 1975) (specifying that "EPA's emission guidelines will reflect subcategorization within source categories where appropriate, taking into account differences in sizes and types of facilities and similar considerations, including differences in control costs…Thus, EPA's emission guidelines will in effect be *tailored to what is reasonably achievable by particular classes* of existing sources…") (emphasis added).
[214] 40 Fed. Reg. 53340 (Nov. 17, 1975), codified at 40 C.F.R. § 60.22(b)(5).

permitting subcategorization to ensure the cost reasonableness of the BSER for different subsets of sources.[215]

VI. Regulatory Precedent Supports the Use of Operating Horizon as an Approach to Subcategorization.

Irrespective of any particular technology that EPA determines to be adequately demonstrated as the BSER, EPA's decision to subcategorize existing coal plants based on operating horizon is grounded in both statutory authority, as discussed above, and regulatory precedent.

EPA's past regulatory actions provide support for the proposal's division of a source category into subcategories on the basis of operating horizon. Operating horizon, like utilization as discussed, also impacts the cost-reasonableness of new pollution control equipment because capital costs for the installation of more costly control systems must generally be amortized over longer periods.[216] Therefore, a subcategorization approach based on operating horizon – generally requiring less stringent control requirements for plants with shorter remaining lifespans and more stringent requirements for plants with longer operating horizons – can be a sensible way to ensure that a BSER is cost effective for different types of plants.

The EPA created a framework by defining different categories based on operating horizon most recently in its 2020 steam electric effluent guidelines under the Clean Water Act.[217] Units planning to retire by 2028 were differentiated from other units and offered a less stringent control requirement because installing new controls would not be cost-effective.[218] Operating horizon thus served as an effective tool to define separate categories of sources in order to ensure the cost effectiveness of the new control requirements.

Prior actions demonstrate how EPA has employed differentiated regulatory pathways for coal units with shorter operating horizons that merit less stringent control requirements due to cost considerations, reinforcing EPA's subcategorization approach based on operating horizon. In 2011, EPA approved a regional haze state implementation plan allowing a coal unit with a federally enforceable retirement by 2020 to avoid more stringent emission controls.[219] The unit was allowed to comply with an alternative standard under the state plan recognizing that the owner/operator was committing to cease all coal operations five years after EPA's approval of the state plan.[220] In 2014, EPA provided for a coal plant to switch to natural gas by 2017, indicating

[215] Proposal at 33341, 33344 (responding to suggestions from industry, EPA developed subcategories reflecting minimal control requirements for those coal plants closing in the near future, recognizing that "the cost reasonableness of GHG control technology options differ depending on a coal-fired steam generating unit's expected operating time horizon").
[216] Proposal at 33344.
[217] Steam Electric Reconsideration Rule, 85 Fed. Reg. 64650, 64679 (Oct. 13, 2020).
[218] 85 Fed. Reg. 64650, 64679 (Oct. 13, 2020).
[219] 76 Fed. Reg. 12651, 12660 (Mar. 8, 2011) ("This alternative approach would allow PGE Boardman to commit to cease burning coal by December 31, 2020, and in the interim operate with less expensive control technology.").
[220] *Id.* at 12662-63 (providing that the facility owner "may elect to comply with" either a more rigorous emissions standard through 2040, or a less stringent standard if the plant permanently ceases burning coal within five years of EPA's approval of the state plan).

that the plant must "cease burning coal" as a federally enforceable retirement of that plant's use of the fuel type as a requirement in lieu of the plant's installation of new pollution control equipment.[221] These prior regulatory actions and many others illustrate the use of alternative pathways with federally enforceable retirements based on the limited operating horizons of coal units, adding support for the alternative subcategories coal plant owners may opt into under EPA's proposal.

The 2015 NSPS for natural gas EGUs, while subcategorizing units based on utilization, as discussed above, can be understood as analogous to differentiating units by operating horizon because both approaches employ subcategorization to achieve cost reasonableness and because with lower utilization, like shorter operating horizon, "the costs are spread over less product produced," tailoring compliance costs.[222]

Ample statutory and regulatory authority supports the subcategorization of existing coal plants based on operating horizon with federally enforceable retirements. This structure is consistent with both the statute and practical concerns in light of the different cost-effectiveness values of operating coal plants of differing remaining lifespans and considering how requiring additional controls for plants with shorter operating horizons may lead to greater pollution in contradiction to the purposes of the Act by postponing the planned retirements of a significant number of coal plants.[223]

VII. <u>States Should Timely Issue Their Plans and EPA Should Timely Review Such Plans</u>

To be clear, two years as proposed is more than an ample amount of time for state plan submittal. Moreover, this prolonged time has its own potential adverse impacts – and potential harm. Not surprisingly, there are numerous programs requiring state anti-pollution measures under the Clean Air Act, federal environmental programs, and state laws and initiatives that provide shorter periods of time for state planning. These state anti-pollution measures have also been carried out while ensuring meaningful community engagement, a pillar of state action. Given this, it would be eminently reasonable for EPA to consider whether to more closely track the timeline for state plan submission outlined in the 111d implementing regulation guidance (15 months). We respectfully urge EPA to make it clear that states may move forward with anti-pollution plans well before the two years, do so ensuring full and meaningful community engagement, and that EPA will in turn take swift action in reviewing those state plans.

States have an important role in adopting and carrying out state plans under section 111(d) and the implementing regulations to achieve the required pollution reductions. At the same time, as recognized by the Supreme Court, EPA is ultimately responsible for ensuring the pollution reductions required by the statute are achieved.[224] In carrying out the state and EPA partnership under the cooperative federalism architecture of the Clean Air Act and section 111, any state may

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[221] 79 Fed. Reg. 5031, 5192 (Jan. 30, 2014) ("Rather than install the control equipment required by the Wyoming SIP, PacifiCorp will convert the unit to fire natural gas by the end of 2017.").
[222] *See* 80 Fed. Reg. 64510, 64602, tbl. 15 (Oct. 23, 2015); Proposal at 33345.
[223] *See* 42 U.S.C. § 7411; Proposal at 33343.
[224] *West Virginia v. EPA*, 142 S. Ct. 2587, 2601-02 (2022).

choose to decline to move forward with state plans. In that case, timely federal plans would be necessary to ensure the pollution reductions required by the Clean Air Act are achieved. EPA should strive to review state plan submissions in less time than the proposed 12 months, and commit in the final rule to reaching a decision on the entirety of a plan within 9 months of submission.[225]

VIII. EPA Must Strengthen the Remaining Useful Life and Other Factors (RULOF) Framework to Guide States and Limit Inappropriate Applications.

a. Subcategorization of Existing Coal Plants by Operating Horizon Does Not Preclude States from Considering RULOF Where Imposing EPA's BSER on Specific Plants Would Be Unreasonable.

Section 111(d)(1) permits a state "to take into consideration, among other factors, the remaining useful life of the existing source to which the standard applies" when the state is applying a standard of performance to a "particular source" in state plan preparation.[226] The section 111 implementing regulations further specify that a state may consider applying these factors, often called "remaining useful life and other factors" (RULOF), to produce a less stringent standard or longer compliance schedule for an individual facility than the EPA's emission guidelines.[227]

In December of 2022, EPA proposed to modify the section 111 implementing regulations (subpart Ba) to clarify what a state must show to invoke RULOF as a threshold matter when including a less stringent standard for a particular source in a state plan.[228] The subpart Ba proposal also clarifies the process for determining a less stringent standard of performance based on RULOF.[229] EPA intends to finalize the proposed section 111 implementing regulations before the section 111 carbon proposal.[230]

The section 111 carbon dioxide proposal effectuates the RULOF provision of section 111(d)(1), as it permits states to consider RULOF when applying a standard of performance to an individual source, even if that source falls within a subcategory based on operating horizon. The proposed rule specifies that EPA's authority to define and set BSERs for subcategories in a source category is distinct from the states' authority to take RULOF into consideration.[231] Thus, despite the

[225] *See* 88 Fed. Reg. at 33,405-06.
[226] 42 U.S.C. § 7411(d)(1).
[227] 40 C.F.R. § 60.24(f).
[228] 87 Fed. Reg. 79176, 79196-99 (Dec. 23, 2022).
[229] 87 Fed. Reg. at 79200.
[230] Proposal at 33381.
[231] Proposal at 33345 ("EPA's statutory obligation is to determine a generally applicable BSER for a source category, and where that source category encompasses different classes, types, or sizes of sources, to set generally applicable BSERs for subcategories accounting for those differences. By contrast, States' authority to invoke RULOF is premised on the State's ability to take into account the characteristics of a particular source that may differ from the assumptions EPA made in determining BSER generally."). *See also id.* at 33271 ("Regardless of whether the EPA subcategorizes within a source category for purposes of determining the BSER and the emission performance level for the emission guideline, a State retains certain flexibility in assigning standards of performance to its affected EGUs.").

subcategorization of sources on the basis of "different classes, types, or sizes," states may still apply RULOF to individual sources consistent with section 111(d)(1).[232]

EPA's illustrations of possible applications of RULOF for units within subcategories show how state consideration of RULOF may serve as a useful tool in a system with subcategory-specific deadlines and standards. For example, in some instances, planning and construction of a control system may not be possible within a short time to meet a presumptively approvable standard before a compliance deadline based on the unique circumstances of an individual plant, or if unforeseen circumstances such as reliability concerns require a unit to temporarily operate at a higher level, necessitating a switch in subcategory after a given deadline.[233] In these cases, where rationally justified based on the facts and law, states may invoke RULOF to extend deadlines or adjust emissions standards to be less stringent.[234]

Nevertheless, EPA also has an important overarching statutory responsibility under section 111 that it must balance with RULOF applications – to uphold the integrity of its BSER determination to ensure that its regulation adequately protects human health and welfare from dangerous existing source air pollution.[235] This requires EPA's careful assessment of state invocations of the RULOF mechanism where RULOF would produce less stringent applicable standards or more attenuated timelines. In certain cases, EPA's overarching directive to limit harmful pollution from existing sources by upholding the integrity of its BSER determination will require the agency to reject a state's invocation of RULOF as to a particular source. It is for this reason that EPA has developed an implementing framework requiring a state to demonstrate that a particular standard or timeline as applied to a particular source is unreasonable as a threshold matter before it may invoke RULOF for that source.[236]

The touchstone of a state's RULOF showing, as envisioned under the proposal, is that "fundamental differences" exist between the particular EGU and what EPA considered when determining the BSER.[237] To make this showing, states must rely on the same types of evidence that EPA used in its BSER determination – evidence that speaks to the physical possibility and technical feasibility of installing the BSER, the costs of the system, non-air quality health and

[232] 42 U.S.C. § 7411(b)(2), (d)(1).
[233] Proposal at 33404.
[234] *Id.*
[235] *Id.* at 33374 (explaining that the structure and purpose of section 111 require that state plans "achieve equivalent stringency as applying the EPA's presumptive standards of performance to each" affected source).
[236] *See* 40 C.F.R. § 60.24(f) (providing that in order to invoke RULOF, a state must first show at least one of three circumstances: "(1) Unreasonable cost of control resulting from plant age, location, or basic process design; (2) Physical impossibility of installing necessary control equipment; or (3) Other factors specific to the facility (or class of facilities) that make application of a less stringent standard or final compliance time significantly more reasonable"); 87 Fed. Reg. 79176, 79196-99 (Dec. 23, 2022) (proposing to add "technical infeasibility" to the second circumstance and modify the third to read "other circumstances specific to the facility that are fundamentally different from the information considered in the determination of the BSER in the emission guidelines"). *See also* Joint Environmental Commenters, Comments on Adoption and Submittal of State Plans for Designated Facilities: Implementing Regulations Under Clean Air Act Section 111(d), at 11 (Feb. 27, 2023), https://www.regulations.gov/comment/EPA-HQ-OAR-2021-0527-0099 (advocating against the inclusion of "technical infeasibility" as a basis for RULOF).
[237] Proposal at 33382.

environmental impacts and energy requirements from the BSER, as well as the extent of emissions reductions from the system.[238] This is a necessary requirement, grounded in the statute, given that EPA's overarching prerogative is to reconcile the potential merits of RULOF applications – which include potential benefits, but also by their nature result in relaxed standards and greater pollution – with its BSER, which is designed to benefit health and welfare through pollution reduction. In this balancing, EPA must ensure that a RULOF variance is truly justified by the specific circumstances of a given EGU that deviate so substantially from the conditions giving rise to EPA's BSER determination as to merit a relaxed standard.

b. EPA Properly Characterizes RULOF Based on Plant Age and Amortization Period as Unlikely to Be Acceptable for Subcategorized Coal Plants.

In the case of applications of RULOF to sources within the subcategories for existing coal, EPA appropriately specifies that for such sources, successful RULOF demonstrations based on the factors of amortization period and unit age are not likely to be acceptable.[239] This is because EPA already internalized these factors as a basis for the varied BSER and emission guidelines for the four existing coal subcategories, and so it would be difficult for a state to demonstrate that there are "fundamental differences" from EPA's BSER evaluation that would warrant a RULOF variance. These subcategories are designed based on specific operating horizons and necessarily incorporate the amortization of capital infrastructure investments over the remaining years of plant operation, as determined by reference to the enforceable date of plant closure at the end of a subcategory's operating horizon.[240]

Plant age is another predicate for determining whether the installation of new controls would be reasonable in terms of cost. For older plants, it is generally not reasonable to require large capital investments, because unlike newer plants, older plants cannot amortize those costs over many years. EPA is accounting for the limited useful life of an older plant by allowing these plants to opt into a subcategory with fewer operating years but relaxed emissions-control requirements. Conversely, EPA accounts for the plant age of a newer plant by allowing such a plant to opt into a category with a longer operating horizon but greater pollution control requirements that are reasonable because the plant can amortize them over a longer period. Therefore, EPA appropriately proposes to find that a subcategorization framework based on operating horizon adequately accounts for amortization and plant age.

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[238] *Id.*
[239] *Id.* at 33383 ("The EPA therefore does not anticipate that states would be likely to demonstrate the need to invoke RULOF based on a particular coal-fired EGU's remaining useful life, although doing so is not prohibited under these emission guidelines.").
[240] Because the subcategories already internalize these factors, it would be unlikely as a practical matter for a state to make a successful showing that the amortization period for a control technology exceeds the remaining useful life of a subcategorized plant, as would be necessary to make a persuasive case for RULOF. *See also* Regional Haze Regulations and Guidelines for Best Available Retrofit Technology (BART) Determinations; Final Rule, 70 Fed. Reg. 39,104, 39169 (July 6, 2005) (providing guidance on plant age consideration in context of analogous RUL provision of Regional Haze Program, where if plant age exceeds the amortization period these factors should have "essentially no effect" in impacting control costs for BART).

EPA's implementing regulations proposal requires EPA to include two timing mechanisms in its individual emissions guidelines. First, it requires an emission guideline to provide the outermost retirement date that may potentially support a RULOF showing to ensure that RULOF is not abused by states attempting to obtain less stringent control requirements for sources based on retirements so far in the future that they cannot reasonably support a RULOF variance.[241] Second, on the other end of the spectrum, the implementing regulations proposal accounts for those facilities that plan to imminently close by requiring only a business as usual emissions standard so long as the facilities commit to closure prior to the imminent closure date provided in EPA's emission guideline.[242]

In the current proposal, EPA notes the surface-level similarity between the outermost and imminent retirement approach of the RULOF implementing regulations and the subcategories designed around different enforceable retirement dates in the present proposal.[243] However, whereas the subcategories, as the primary regulatory framework, apply to existing sources to provide the BSERs outside the RULOF context, the outermost and imminent retirement structure only applies to sources seeking RULOF variances, the exception to the rule. States may still attempt to circumvent the subcategory framework entirely by making a RULOF showing for sources that have unreasonably distant retirement dates, despite EPA's guidance that RULOF would be unlikely to be approved under these circumstances.[244] In other words, the distinct application of the subcategory approach versus the imminent and outermost retirement approach does not obviate the concern that states may "attempt to account for the remaining useful life for a designated facility whose retirement date does not reasonably warrant a less stringent standard," as EPA proposes to find in the present proposal.[245]

EPA should not supersede its proposed subpart Ba imminent and outermost retirement dates framework, but instead should proceed to set those dates to coordinate with the subcategory structure to ensure consistency. For existing coal units, this means an imminent retirement date of no later than the date EPA selects in the final rule for retirements in the imminent-term subcategory and an outermost retirement date to coordinate with the date EPA selects for the medium-term subcategory. This way, states will have clarity that the window of acceptable retirements supporting reduced control requirements under the subcategorization framework will provide the only potentially acceptable window of retirements to support less stringent requirements in a RULOF context as well. This would better fulfill the purpose of the subpart Ba

[241] 87 Fed. Reg. 79176, 79201 (Dec. 23, 2022) ("If the EPA did not identify an outermost retirement date or specified methodology and conditions, then a state plan could attempt to account for the remaining useful life for a designated facility whose retirement date does not reasonably warrant a less stringent standard.").
[242] 87 Fed. Reg. at 79202 ("In the case of an imminently retiring source, the EPA is proposing that the state apply a standard no less stringent than one that reflects the designated facility's business as usual.").
[243] Proposal at 33385.
[244] *Id.* at 33383, 33385.
[245] *See* 87 Fed. Reg. at 79201; Proposal at 33385 (proposing to supersede the application of subpart Ba for coal units with respect to establishing the "outermost and imminent dates to cease operations for invoking RULOF based on an affected EGU's remaining useful life").

timing requirements – to protect against improperly providing a RULOF variance authorizing increased emissions based on an unreasonably distant plant retirement.

EPA's subcategorization approach based on operating horizon gives owners and operators increased flexibility to choose between different compliance pathways that better coordinate with the unique investment circumstances specific to their plants, especially the age of the plant and the amortization period for new infrastructure. And while EPA specifies that RULOF as to these factors as indicative of unreasonable cost is unlikely, it acknowledges that individual plants may have specific circumstances that may still qualify for the use of RULOF.[246]

c. The Proposal Includes Additional RULOF Flexibilities to Address the Attributes of Specific Plants: State Adjustments to the Baseline for Presumptively Approvable Standards, Federal Plan Adjustments, and Increased Control Stringency.

In addition to permitting states to apply RULOF as a flexibility allowing for less stringent emissions limits or lengthier compliance timelines as discussed above, the proposed rules also allow states to employ RULOF in the context of adjusting baseline emissions to set presumptively approvable standards for individual plants. States may use RULOF to determine an appropriate adjustment for historical plant data serving as a baseline for presumptively approvable standards of performance when the historical data is not indicative of future plant use due to significant anticipated changes in operation.[247] In this way, states may utilize RULOF to provide an additional flexibility for plants within EPA's presumptively approvable standards of performance methodology.

Another application for RULOF is in the federal plan context. If EPA disapproves a state plan, then EPA can provide for less stringent standards or longer compliance schedules in its federal plan following the proper methodology set out for states to follow in the proposed rule.[248] This could allow EPA to correct deficiencies in state plans, such as where a state selects an unlawful alternative BSER once RULOF is properly invoked, or where a state makes errors in calculating and applying the standard of performance.[249] Thus, even if a state improperly accounts for RULOF in its state plan, this efficiency gives another opportunity for the establishment of a reasonable standard properly reflecting the particular circumstances of a specific plant.[250]

Finally, EPA reasonably proposes in its implementing regulations to interpret that section 111(d)(1) authorizes state plans to include more effective standards than are required by EPA's emissions guideline.[251] In this way, states could determine that plants with longer operating horizons should take on greater responsibility for controlling pollution than plants with relatively short operating horizons. This interpretation adds to the list of ways EPA is critically

[246] Proposal at 33383.
[247] *Id.* at 33375, 33384.
[248] Proposal at 33406.
[249] *See id.* at 33384.
[250] It is also consistent with the statutory requirements for federal plans. *See* 42 U.S.C. § 7411(d)(2)(B).
[251] 87 Fed. Reg. 79176, 79204 (Dec. 23, 2022).

interrogating how to best effectuate Congress's direction to permit RULOF considerations in establishing emissions standards for existing sources.

d. An Efficient RULOF Framework with Minimum Thresholds Would Streamline State Plan Preparation and Ensure EPA's Timely Review of State RULOF Demonstrations.

EPA should include minimum acceptable thresholds in the power plant GHG emission RULOF framework wherever possible, but especially for unreasonable costs.[252] Doing so would improve the efficiency of state plan preparation and review.

The Act requires robust showings for RULOF in order to meet the text, structure and purpose of section 111(d).[253] For these reasons, state plans invoking RULOF must not undermine the stringency of EPA's BSER.[254] The implementing regulations proposal clarifies that EPA's general RULOF framework is designed to ensure consistency across states, that the use of RULOF does not "undermine and render meaningless the EPA's BSER determination," and that states and the regulated sources are provided a "clear analytical framework" for creating "satisfactory plans that the EPA can ultimately approve."[255]

The implications of EPA's RULOF framework are significant. For EPA to maintain the stringency of its BSER determination, consistency of standards between states must be maintained.[256] The proposed rule will not meet the statutory purposes if particular states apply for many RULOF variances while other states do the work of substantial pollution reduction. Similarly, the RULOF mechanism must be implemented in such a way as to maintain consistency of standards between similar sources. It would be unreasonable for similarly situated sources to have significantly different control stringencies as a result of RULOF. Another concern is that delays in state plan approvals due to inadequate RULOF demonstrations may undermine the EPA's BSER because it would not be implemented in a timely fashion.

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[252] *See also* Joint Environmental Commenters, *supra* note 236, at 9 ("The regulatory text should also make clear that the RULOF guardrails outlined in the preamble are minimum requirements for state plan approval.").

[253] *See* 42 U.S.C. § 7411(d)(1) (requiring the Administrator to "establish a procedure" requiring states to submit plans establishing "standards of performance…for any existing source for any air pollutant" that would have such a standard "if such existing source were a *new source*," among other requirements) (emphasis added); *id.* § 7411(b)(1)(A) (requiring the listing of a new source category to be regulated when, in the Administrator's judgment, the source category "causes, or contributes significantly to, air pollution which may reasonably be anticipated to *endanger public health or welfare*") (emphasis added). *See also* Proposal at 33374 (providing purpose of Act's regulation of existing pollution sources to "mitigate air pollution that is reasonably anticipated to endanger public health or welfare").

[254] Proposal at 33381.

[255] *Id.* at 33381-82 (summarizing 87 Fed. Reg. 79176 (Dec. 23, 2022)).

[256] *See, e.g.*, 87 Fed. Reg. 79197 ("Without a clear analytical framework for applying RULOF, the current provision may be used by states to set less stringent standards such that they could effectively undermine the overall presumptive level of stringency envisioned by the EPA's BSER determination and render it meaningless.").

Thus, states and operators would benefit from greater clarity on the RULOF showing required for plan approval.[257] Owners and operators could make more informed investment decisions and states could allocate resources more wisely in creating their state plans. Concrete standards can provide such clarity while conserving EPA's capacity to conduct administrative review of state plans. In addition, greater clarity on RULOF showings would ensure greater consistency and more effectively uphold the stringency of EPA's BSER.

Statutory authority supports EPA's ability to define the relevant factors for RULOF and shape how they should be considered in its review of state plans.[258] Thus, EPA has the authority to create minimum thresholds for individual factors in state RULOF submissions, wherever possible, to expedite state plan preparation as well as EPA approval. Several authorities support EPA's use of minimum thresholds, even where individualized determinations are still required.[259] Although EPA's determination on whether to approve RULOF in a state plan is based on a totality of the circumstances assessment of several factors that may point in different directions, having some concrete guidance for what is unacceptable in the context of individual factors would still provide states greater clarity about what an acceptable showing entails.[260]

In particular, EPA should provide greater guidance about the robustness of the showing required for unreasonable control costs supporting state RULOF demonstrations. Authorities also support requiring states to make robust cost demonstrations to support RULOF in their state plans.[261] While some factors, such as plant location considerations, may not lend themselves to clear

[257] *See* Proposal at 33382 (specifying that RULOF demonstrations must include evidence of "fundamentally different" costs, and cannot rely on "minor, non-fundamental differences between a particular affected EGU and what the EPA determined was reasonable for the BSER"); *id.* at 33382 ("There could be instances in which an affected EGU may not be able to implement the presumptively approvable standard of performance in accordance with the precise metrics (*e.g.*, at exactly the same $/ton CO2 reduced or exactly the same distance from a pipeline connection) of the BSER determination but is able to do so within a reasonable margin. In such instances, it would not be reasonable for a State to apply a less stringent standard of performance.").

[258] EPA is required to review and act on state plans under the structure of 111(d), and it is EPA's interpretation that is reviewed by courts. 5 U.S.C. § 706(2)(A); *accord* 42 U.S.C. § 7607(d)(9)(A). Further, the text of 111(d)(1) implies that EPA can set conditions on how states consider RULOF. *See, e.g.,* 87 Fed. Reg. at 79203 (interpreting "other factors" of section 111(d)(1) to include consideration of community impacts from RULOF since the Act does not specify these factors and EPA has discretion to "identify the appropriate factors and conditions under which the circumstance may be reasonably invoked").

[259] *See, e.g., EPA v. EME Homer City Generation L.P.,* 572 U.S. 489, 500 (2014) (describing EPA's use of minimum thresholds for determining significant contributions to interstate pollution in state implementation plans, for example, excluding "as *de minimus* any upwind State that contributed less than one percent of the three NAAQS to any downwind State 'receptor'") (emphasis in original); *Heckler v. Powell,* 461 U.S. 458 (1983) (upholding DHHS's minimum thresholds for social security disability determinations); IRS, Pub. 946, *How to Depreciate Property* (2020), https://www.irs.gov/publications/p946#en_US_2020_publink1000107316 (requiring bright-line rules on determinable useful life for tangible property depreciation to demonstrate tax deduction eligibility).

[260] For example, if a RULOF application relied on one factor that did not reach the threshold for unreasonableness, EPA could swiftly disapprove the application, providing the state applicant with the applicable threshold or other information needed to correct the deficiency. EPA could also expedite the process of state plan review and revision by informing the state of any such bright-line deficiencies in its initial "completeness" review of state applications.

[261] *See, e.g.,* BART Guidelines, 40 C.F.R. Pt. 51, App'x Y, IV.D.4.a.4 (requiring cost of controls to be estimated using procedures in EPA's Control Cost Manual for mandatory facilities in regional haze program); *Oklahoma v. EPA*, 723 F.3d 1201, 1211-13 (10 Cir. 2013) (upholding regional haze plan disapprovals based on the state's failure to follow these procedures).

thresholds, the cost factor does. However, EPA's proposal is unclear about exactly which costs are unreasonable outliers.[262] It would be far more efficient for a state to know which control costs EPA will ultimately find unreasonable in its state plan review, and therefore whether the cost for a particular source could be a factor supporting RULOF.

A clearer and more straightforward approach would be for EPA to publish minimum thresholds for states to demonstrate the unreasonableness of the cost factor that may form a possible basis for RULOF eligibility. EPA could provide tables built around its BSER determinations for differing unit configurations and apply a standard statistical formula to define a normal distribution for each unit type. Then, it could set the outlier threshold to produce numerical limits for different types of plants at different operating capacities. The 95th percentile that EPA uses in its example is a reasonable threshold to ensure that costs are true outliers to its BSER determination.[263]

These cost distribution tables would be beneficial by providing states thresholds where costs could be considered unreasonable, improving the efficiency of RULOF showings based on this factor. Thus, minimum thresholds would provide states with useful guidance on how to make well-supported RULOF demonstrations, while also ensuring that the statute's core requirements are honored.

In addition to providing useful guidance for states, thresholds would increase the transparency of EPA's review of state RULOF showings, which would ultimately benefit the public at large. This innovation would also be in keeping with the proposed measures to increase the transparency of operators' compliance with the GHG standards of performance through public documentation standards.[264]

EPA should include minimum thresholds as part of its RULOF framework wherever possible, but especially for the cost factor. Such thresholds would improve the efficiency of state plan preparation and EPA review of state plans as well as ensure that the stringency of EPA's BSER is adequately maintained as required by the Act.

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[262] In an example with a fleetwide average cost of between $64-78/ton CO_2 that EPA relied on to determine the BSER for a particular source type, we only know for certain that a cost in this range of reasonableness for the BSER cannot be found unreasonable by a state to establish RULOF. However, anything above this range is a question mark – it is not necessarily unreasonable. EPA notes that the averages are based on data from individual plants, and that some plants with costs exceeding the average ranges would still incur reasonable costs for RULOF purposes. Proposal at 33382-83.

[263] *Id.* at 33375 (illustrating a potential approach to unreasonable costs being above the 95th percentile of operating costs for the fleetwide average for that type of plant and operating capacity). EPA should also delimit the types of assets that may be included in economic hardship showings to ensure a rigorous accounting of relevant assets. Section 111(d)(1) permits states to consider the RULOF "of the existing source," not ancillary assets that do not emit the pollutant at issue, such as the road to the plant. 42 U.S.C. § 7411(d)(1). EPA should also require robust showings of relevant and reliable documentation to substantiate unreasonable costs. *See* 87 Fed. Reg. 79176, 79202 (proposing "reliable and adequately documented sources of cost information" to ensure that "RULOF has been appropriately accounted for").

[264] Proposal at 33400 (requiring owners and operators to post compliance documentation including increments of progress, milestones, and emissions data to public websites).

e. **EPA Should Not Allow States to Use Aggregate Demonstrations to Establish RULOF Variances Because this Would Undermine the Stringency of EPA's BSER.**

EPA should supersede its proposed implementing regulations for the power plants emissions guidelines and disallow aggregate demonstrations for power plants invoking RULOF because aggregation is inconsistent with EPA's touchstone justification for the invocation of RULOF, that the fundamental differences of an *individual* plant make EPA's BSER unreasonable as to *that plant*.[265]

The subcategory approach and RULOF process included in these emissions guidelines already provide ample flexibilities for owners, operators, and states to tailor emissions control pathways suited to the economics of individual power plants. We agree with EPA that it is not appropriate for sources "with less-stringent, source specific standards based on RULOF to comply with those standards through trading."[266] It would similarly be inappropriate to permit sources to claim RULOF variances based on aggregate demonstrations. Under a system that authorizes aggregate demonstrations as a basis for establishing the threshold applicability for RULOF, a state may make a single showing to derive a less stringent pollution control standard for a potentially large class of similarly situated plants.[267] This presents the risk that a state would be able to justify increased power plant pollution for a significant number of plants in a single showing, undermining the integrity of EPA's BSER, and thus the statute's core health and welfare purposes.[268]

Aggregation is by its nature inconsistent with the touchstone justification for invoking RULOF – that the fundamental differences of a power plant make EPA's BSER unreasonable as to that plant – because it derives values from several plants at once.[269] This is especially problematic in the power plant context due to the unique characteristics of individual facilities making aggregate showings more inappropriate than for other, more homogeneous, source categories. Therefore, EPA should prohibit aggregate demonstrations in RULOF showings in the power plant GHG context in order to ensure the integrity of EPA's BSER, the consistency of existing source emissions control between states, and the efficacy of the program's health and welfare statutory mandate.

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[265] *Id.* at 33382.
[266] *Id.* at 33393-94.
[267] *See id*. at 33374; *id*. at 33384, n. 637 ("To the extent that a state seeks to apply RULOF to a class of affected EGUs that the state can demonstrate are similarly situated in all meaningful ways, the EPA proposes to permit the state to conduct an aggregate analysis of the BSER factors for the entire class of EGUs for which RULOF has been invoked."). *See also* 87 Fed. Reg. at 79199, n. 45 (allowing states to "account for RULOF when applying standards of performance to a class of designated facilities. For purposes of administrative efficiency, a state may be able to calculate a uniform standard of performance that accounts for RULOF using *a single set of demonstrations* to meet the proposed requirements described in this section if *the group of sources* has similar characteristics.") (emphasis added); *id*. at 79200, n. 46 (allowing a state to conduct an "aggregate analysis" of the BSER factors "for the entire class").
[268] 42 U.S.C. § 7411.
[269] Proposal at 33382.

f. EPA Must Provide Detailed Guidance on the "Meaningful Engagement" Standard So that States Adequately Consider the Effects of RULOF Determinations Yielding Less Stringent Standards and Timelines on the Most Impacted Communities.

EPA's requirement that states consider the effects on the most impacted and vulnerable communities from increased power plant GHG pollution produced from a RULOF source in the state planning process is a positive step forward.[270] However, in order for this to be more than merely a "check the box" procedural step, it is important for EPA to add more detail to the meaningful engagement standard, both in the context of the implementing regulations proceeding, as well as in this proposal.[271] This is because meaningful engagement is the standard that EPA is proposing to use to review state efforts to address the impacts to vulnerable communities as states prepare plans for controlling carbon emissions from existing EGUs.[272] It is thus a critical standard for ensuring that states robustly engage with the most impacted communities and that these communities' perspectives are also *meaningfully heard* and *meaningfully considered* by the states in crafting their plans. Community "buy-in" to regulatory decisions, by itself, is not a sufficient, nor even an appropriate, way of thinking about engagement. For EPA's engagement framework to be truly meaningful, stakeholders representing the most impacted communities, who have often been historically excluded from state proceedings, must be empowered to meaningfully participate and share their views, and decisionmakers must thoughtfully consider and address them. The following sections provide recommendations to better reach these goals.

First, EPA must provide guidance to the states in the final rule on how to adequately identify the communities who are most vulnerable to increased power plant pollution as a result of RULOF determinations so that these communities can effectively participate as stakeholders in state RULOF proceedings.[273] Without detailed guidance from the EPA, states may have difficulties

[270] *See* 87 Fed. Reg. at 79190-92. EPA's implementing regulations proposal cites section 111(d) and the CAA generally as providing the statutory basis for the meaningful engagement standard. *See id.* at 79203 (Dec. 23, 2022) (interpreting section 111(d)'s failure to specify the "'other factors' that the EPA's regulations should permit for a state to consider in applying a standard of performance" to provide EPA discretion "to identify the appropriate factors and conditions under which the circumstances may be reasonably invoked in establishing" a less effective emissions standard); *id.* (describing how in order to determine whether a state plan is "satisfactory" as required under section 111(d)(2), EPA must determine if a "plan's consideration of RULOF is consistent with section 111(d)'s overall health and welfare objectives," that a less stringent standard could "result in disparate health an environmental impacts to communities most affected by and vulnerable to those impacts," and that EPA's "lack of attention to such potential outcomes would be antithetical to the public health and welfare goals of CAA section 111(d) and the CAA generally").

[271] *See id.* at 79191 (seeking comment on definition of "meaningful engagement" with the most impacted and vulnerable communities); *id.* at 79192 (specifying that EPA's individual emission guidelines should provide further details about the identification of pertinent stakeholders specific to the pollution emitted from the source category at issue); Proposal at 33399-33400 (seeking comment on "meaningful engagement" within the context of state planning for existing EGU carbon standards).

[272] Proposal at 33397-99.

[273] *See* 87 Fed. Reg. at 79192 (proposing for EPA to provide further information in its individual specific emissions guidelines "on [the] impacts of designated pollutant emissions that EPA expects will assist the states in the identification of their pertinent stakeholders"); Proposal at 33386.

assessing the health and welfare impacts of increased carbon pollution and other airborne contaminants from power plants subject to less effective standards due to the application of RULOF.[274]

In addition, EPA should provide clear guidance to states in these regulations documenting, in particular, how already-overburdened communities with greater historical pollution exposures will likely face more severe health and welfare risks from exposures to even relatively small incremental amounts of power plant pollution, and how states should emphasize these baseline pollution exposures in their consideration of the health and welfare risks attributable to additional ongoing power plant pollution, as well as the risks from new technologies, such as CCS and hydrogen co-firing.[275] Thus, it is absolutely critical for EPA to provide ample assistance to the states in these regulations so that the states can overcome the several challenges embedded in the process of identifying the most vulnerable communities as a threshold matter.

Second, it is also critical for EPA to add specific content to the meaningful engagement standard so that states are required to meaningfully consider the perspectives of and impacts to the most affected and vulnerable stakeholders in RULOF proceedings. EPA's requirements for states to submit documentation showing information about their efforts to consider the effects on vulnerable communities in their RULOF proceedings is a good start.[276] Yet, EPA should add more specific substantive obligations, such as by committing to disapprove any less stringent standard that increases harm on vulnerable communities,[277] and requiring states to consider at least three contrasting control options for potential RULOF sources to ensure a thorough comparison of the health and welfare risks to the most vulnerable and affected communities, as well as possible pathways to avoid these dangers.[278]

If a state is not required to conduct a robust comparative analysis that includes a meaningful analysis of the varied impacts to vulnerable communities, the process may run the risk of being an empty information request where even community members who potentially participate in proceedings may lack significant information about alternative compliance frameworks that may

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[274] *See, e.g.,* Proposal at 33398 (expecting that states identify as relevant stakeholders "communities within the State that are most affected by and/or *vulnerable to the impacts of climate change*…" through meaningful engagement, as well as communities located near power plants and relevant infrastructure like pipelines) (emphasis added).
[275] *See, e.g., id.* (quoting 87 Fed. Reg. at 79191) (noting that the "increased vulnerability of communities may be attributable, among other reasons, to both an accumulation of negative and lack of positive environmental, health, economic, or social conditions within these populations or communities").
[276] Proposal at 33386; *id.* at 33398 (noting that EPA expects states to identify the most impacted and vulnerable communities to RULOF source, "gather information about the potential pollution impacts and benefits of control, and document how they have considered that information in setting source-specific standards of performance for RULOF sources through their meaningful engagement processes").
[277] *See* Joint Environmental Commenters, *supra* note 236, at 12 ("The agency should commit to disapproving any less effective standard that would increase harm to such a [vulnerable] community.").
[278] *See* 87 Fed. Reg. 79176, 79203 (proposing to require that a state provide in its draft state plan submission a summary of the results of its consideration of the impacts on communities from RULOF where "a range of options for reasonably controlling a source based on RULOF" exists); *id.* at 79203 (providing an example of such a showing: "a comparative analysis assessing potential controls on a designated facility and the corresponding potential impacts on affected vulnerable communities").

yield considerably healthier outcomes for their families – simply because such alternatives were not considered by the state in its RULOF proceedings.

This assessment, to be meaningful, must also include consideration of co-pollutant impacts. Section 111(a)(1) implicitly requires EPA to consider changes in co-pollutants, including increases and reductions, in identifying the BSER.[279] It would be arbitrary and capricious for EPA to approve state plans that entirely ignore the collateral risks or benefits of changes in co-pollutant emissions.[280]

In sum, EPA must ensure that its meaningful engagement standard is robust both for general purposes of state plan development, and especially so that any increased pollution from the weakening of EPA's BSER for existing sources through the RULOF mechanism is carefully scrutinized for impacts to the most vulnerable and affected communities. In particular, EPA must provide greater guidance to the states on the ways they must identify relevant members of these communities and address their concerns. EPA must also add detail to the meaningful engagement standard so that it ensures not only procedural fairness but also states' meaningful consideration of alternatives that would provide substantially improved health and welfare outlooks for these impacted communities.

IX. EPA Must Strengthen the Meaningful Engagement Standard to Ensure Robust Protections for Vulnerable Communities in State Planning Initiatives Setting Standards for Existing Sources.

Community feedback warrants serious consideration. EPA should ensure that, in reviewing comments on this proposal's implementation of the meaningful engagement standard in the power plant carbon dioxide context, it incorporates feedback provided by underserved and historically underrepresented communities in its final rule and explain how that feedback was incorporated and addressed in the rule (or provide a rationale for why it was not). We additionally urge EPA to continue to conduct outreach and to incorporate feedback from underserved and historically underrepresented communities regarding meaningful engagement and make plans to continually improve state plan preparation and review.

As Joint Environmental Commenters expressed of the meaningful engagement framework in their January 2023 comments on the section 111(d) implementing regulations proposal, EPA should be commended "for formalizing the critical procedures to solicit and encourage meaningful public engagement with those communities most affected by pollution sources."[281]

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[279] 42 U.S.C. § 7411(a)(1). *See also* 87 Fed. Reg. at 79203 ("As described in this section, if a designated facility qualifies for a less stringent standard based on RULOF, the EPA is proposing the state plan must identify a source-specific BSER based on the same factors and metrics the EPA considered in determining the BSER in the [emission guideline]. Therefore, *state plans must consider health and environmental impacts* in determining a source-specific BSER informing a RULOF standard, just as the EPA is statutorily required to take into account these factors in making its BSER determination.") (emphasis added).
[280] *See* Joint Environmental Commenters, *supra* note 236, at 12.
[281] *See* Joint Environmental Commenters, *supra* note 236, at 5.

Because section 111 requires EPA to "establish a procedure similar to that provided by section 110 under which each State shall submit" a plan implementing the emission guidelines,[282] and because section 110 requires that plans be adopted by a state "after reasonable notice and public hearings,"[283] the meaningful engagement standard in this power plant carbon rule must also effectuate these important requirements. Furthermore, given that the central purpose of section 111 is to control "air pollution which may reasonably be anticipated to endanger public health and welfare,"[284] a state must provide all those potentially endangered by a state plan to control, in the present proposal, power plant carbon dioxide pollution, "reasonable notice and public hearings" in order for EPA to potentially find the state plan satisfactory.[285]

EPA's guidance to the states is invaluable, because the task of identifying stakeholders poses formidable challenges for states,[286] who apart from resource limitations, are required to ensure that large numbers of vulnerable people are afforded a meaningful opportunity to participate. This is because power plant carbon dioxide emissions are a major driver of climate change, which in turn threatens the public health and welfare in multiple ways, but to provide just one example, by increasing the frequency of extreme weather events, such as deadly heat waves, hurricanes, wildfires, and tornadoes, to name a few.

In fact, as these comments are now being written, the United States is entering a historic period of record-breaking summer heatwaves, where people are suffering acutely from the effects of the carbon pollution–suffering from heat strokes where their internal organs are "frying themselves from the inside out" and where emergency room patients are being put in body bags filled with ice so that their internal temperatures can be brought down to safe levels.[287] But if these comments were being written in the fall, people would likely be suffering from extreme life-threatening wildfires, and if they were being written in the spring, yet more people would be suffering from mudslides and flooding from abnormal climate-change induced precipitation events. This is why it is crucial for states to meaningfully engage with everyone at risk, but

[282] 42 U.S.C. § 7411(d)(1).
[283] *See id.* § 7410(a)(1).
[284] *See id.* § 7411(b)(1)(A).
[285] *See id.* § 7411(d)(2)(A). EPA's implementing regulations proposal provides section 111(d) and section 301(a)(1) as authorities supporting its adoption of the meaningful engagement standard. *See* 87 Fed. Reg. 79176, 79190 (explaining that a "key consideration" of state plan development under section 111(d) is the impact of the plan on public health and welfare and that "[a] robust and meaningful public participation process" is necessary to ensure that the "full range of [ ] impacts are understood and considered"); *id.* at 79191 (noting that section 111(d) requires EPA to create a process "similar" to the process under section 110 and that "section 110(a)(1) requires states to adopt and submit SIPs after 'reasonable notice and public hearings'"); *id.* at 79192 (providing section 301(a)(1) as additional authority since it authorizes EPA "to prescribe such regulations 'as are necessary to carry out [its] functions under [the CAA],'" and that the "meaningful engagement requirement would effectuate the EPA's function under CAA section 111(d) in prescribing a process under which states submit plans to implement the statutory directives of this section").
[286] *See* 87 Fed. Reg. at 79192 (proposing for EPA to provide states "additional guidance" in the applicable emissions guideline "on the impacts of designated pollutant emissions that EPA expects will assist the states in the identification of their pertinent stakeholders").
[287] Drew Hawkins, Morning Edition, *How New Orleans is Coping with a Surge in Heat-Related Illnesses*, NPR (July 28, 2023), https://www.npr.org/2023/07/28/1190663428/how-new-orleans-is-coping-with-a-surge-in-heat-related-illnesses.

especially those most vulnerable to climate change, to develop plans that will lessen this pervasive year-round suffering for those on the front lines of the climate crisis – or as the statute puts it, to address power plant carbon dioxide air pollution because it is endangering "public health and welfare."[288] It is imperative for EPA to require states to do more when it comes to the most vulnerable – it is because this population on the front lines of the climate crisis will suffer the very real and the very painful effects of climate change the most acutely.

EPA should provide states ample guidance on how to identify stakeholders that are the most vulnerable to the harmful effects of climate change caused by power plant carbon pollution. EPA's guidance for states should provide information on the specific populations states should ensure have access to the statute's protections based on the most pertinent types of climate change risks for individual states and geographies. For example, for all states at risk of extreme heat, EPA's guidance should require states to target unhoused populations, agricultural and other outdoor workers, and low-income households lacking access to air conditioning, among others, who are all at a far higher risk for heat exhaustion and heat stroke during extreme heatwaves. For coastal states at risk due to climate change induced sea level rise, EPA should provide guidance for states to prioritize outreach with populations including those living in low-lying areas who are most at risk of flooding. And for areas at risk of a greater frequency of tornados due to climate change, EPA should direct states to include mobile homeowners as well as the unhoused in the group of most vulnerable stakeholders.[289] While the views of all commenters are important, agencies should seek out impacted communities because of the history of their being both severely impacted by pollution and its health effects, and less well represented in public processes and siting decisionmaking.

One potential methodology for identifying stakeholders based on climate change risks is EDF's Climate Vulnerability Index (CVI).[290] This tool calculates climate risks for different communities based on several baseline vulnerabilities – including health, social and economic, environmental, and infrastructure vulnerabilities.[291] The CVI additionally incorporates three climate risk categories – extreme weather events, social and economic risks, and health risks impacting communities. States could use the CVI scores for individual census tracts, or vulnerability scores derived from other methodologies, to identify the most climate-vulnerable communities who should be included as stakeholders in the state planning process.

We strongly support the proposal's requirement that states identify and engage with communities near existing EGUs and pipelines constructed under state plan requirements to "ensure that there

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[288] 42 U.S.C. § 7411(b)(1)(A).

[289] Seth Borestein, *How Living in a Mobile Home Makes You More Likely to Die in a Tornado*, AP News (July 28, 2023), https://apnews.com/article/tornado-mobile-home-death-crushed-b3a0e41ffd83a2681a92b8e4dad0ef06.

[290] *See* P. Grace Tee Lewis et al., *Characterizing Vulnerabilities to Climate Change Across the United States*, 172 Env't. Int'l (2023), https://doi.org/10.1016/j.envint.2023.107772. *See also* Jeremy Proville, *Understanding How Communities Are Vulnerable to Climate Change Is Key to Improving Equity and Justice*, EDF (Mar. 29, 2023) (explaining that the CVI will officially launch later this summer).

[291] P. Grace Tee Lewis et al., *Characterizing Vulnerabilities to Climate Change Across the United States*, 172 Env't. Int'l at 2 (2023), https://doi.org/10.1016/j.envint.2023.107772.

are adequate opportunities for public input on decisions to implement emissions control technology (including but not limited to CCS or low-GHG hydrogen)."[292] The EPA correctly recognizes the importance of "facility- and community-specific circumstances, including the existence of cumulative impacts affecting a community's resilience or where infrastructure buildout would necessarily occur in an already vulnerable community," and that the meaningful engagement standard is "designed to identify and enable consideration of these and other facility- and community-specific circumstances," including "concerns with emissions control systems, including CCS and hydrogen co-firing."[293] Thus, for these same reasons, EPA must expand the list of required stakeholders to include not only the communities surrounding pipeline infrastructure, but also those communities near other infrastructure required by any adoption of CCS or hydrogen co-firing at existing power plants, including communities near carbon sequestration wells and communities near hydrogen production facilities, among other potential infrastructure. The environmental justice community has raised significant concerns on the impacts of CCS and hydrogen technologies, underscoring the need to engage with communities at the state level who are most vulnerable to potential harms from these technologies.

Additionally, although there may be a great deal of overlap with those communities most vulnerable to climate change as well as those communities living near existing power plants and necessary infrastructure, EPA should require states to explicitly identify and include environmental justice communities as stakeholders. These communities have historically suffered the burden of increased levels of pollution and continue to be some of the most vulnerable communities, more acutely experiencing the harms of continuing power plant carbon pollution despite potentially not being proximately located next to existing plants. For example, environmental justice communities may live near fossil fuel extraction and production facilities, industrial facilities other than power plants, Superfund sites, or new power plants. The cumulative pollution experienced by environmental justice communities, including even relatively small incremental levels of pollution from existing power plants, may significantly increase the health and welfare risks to these communities. Environmental justice communities are also less likely to engage in state proceedings for a number of reasons.[294] This makes it all the more important for states to proactively reach out and actively support environmental justice community engagement.

One formidable obstacle to meaningful environmental justice community participation is the highly technical nature of power sector regulatory proceedings. An analysis of major proceedings

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[292] Proposal at 33398-99. It is also especially important to reach stakeholders living in proximity to existing EGUs because these communities may not have had the opportunity to weigh in on the standards for these sources when they were first constructed. *See* 87 Fed. Reg. at 79191; Proposal at 33399.
[293] Proposal 33399.
[294] *See, e.g.*, American College of Environmental Lawyers, *Environmental Justice: Where Are the Roadblocks?* JD Supra (Jan. 20, 2021), https://www.jdsupra.com/legalnews/environmental-justice-where-are-the-7811624/ (providing examples of environmental justice community barriers in a land use siting context as "lack of resources, limited free time, and restricted access to political networks"). *See also* B.S. Offenbacker, *Overcoming barriers to effective public participation*, in Brownfield Sites II (A. Donati et al, editors) 281, 284-87 (2004) (describing perceptual, political, and logistical barriers to community participation).

in 2017 at state public utility commissions throughout 12 states found that community groups comprised only 45 of 815 parties making filings, or 5.5% of the total comments received on these significant rulemakings.[295] Considerable variation between states also existed, with community group participation spanning from 0% in Texas to 10.9% in New York.[296] As the authors note, "[u]tilities dominate energy proceedings with their expertise and resources, allowing them to wield outsized influence in many cases," having "command of the complex technical and economic aspects of the proceedings, and the ability to develop the necessary supporting evidence."[297]

State proceedings on power plant emissions control pose the same obstacles for community members interested in participating. Providing support for full and inclusive participation would empower environmental justice communities to be able to advocate on their own behalf.[298] EPA should provide guidance to the states indicating best practices for engaging with stakeholders, such as by providing workshops with inclusive technical and legal support.[299] Incorporating participatory tools, such as surveys and facilitated focus groups, would increase the interactivity of proceedings and encourage participants to overcome obstacles. In addition, states must incorporate best practices to address the practical obstacles that often make it challenging for community members to attend meetings, such as by providing multiple and varied meeting times and locations, offering multiple modes of participation (in-person and virtual), and offering wraparound support such as childcare, meals, and travel stipends.[300]

Another important goal of meaningful engagement is to ensure that the process encourages and values the sharing of lived experiences. This would better inform real-world, reality-based planning. Residents know the realities of their communities that may not be reflected in quantitative data. To paint a complete picture, proceedings should value experience-based qualitative information in addition to traditional data sources.[301] Understanding lived experiences can also help to identify data gaps and/or errors.

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[295] *Shelley Welton & Joel Eisen, Clean Energy Justice: Charting an Emerging Agenda*, 43 Harv. Envtl. L. Rev. 307, 352 (2019).
[296] *Id.*, at 352 n. 242.
[297] *Id.*, at 348-49.
[298] *See, e.g.*, Frontline Resource Institute, *About Us – Our Living Vision*, https://www.frontlineresourceinstitute.org/about/ (supporting "frontline communities working to advance environmental justice and climate justice by providing the resources and technical assistance to build a world where all can achieve healthy, safe, and sustainable environments").
[299] *See, e.g.*, EPA, *The Plain English Guide to the Clean Air Act* (2007), https://www.epa.gov/clean-air-act-overview/plain-english-guide-clean-air-act.
[300] *See also* Environmental Defense Fund et al., Comments on Guidance Implementing Section 2(e) of the Executive Order of April 6, 2023 (Modernizing Regulatory Review), Docket No. OMB-2022-0011, at 5-7 (June 6, 2023), https://www.regulations.gov/comment/OMB-2022-0011-0036 (offering additional ways to increase participation, such as public trainings, guides to explain the process, a public information hotline, and by providing a variety of communication methods, for instance, listserv subscriptions, social media, and websites); EPA, Public Participation Guide (last updated July 5, 2023), https://www.epa.gov/international-cooperation/public-participation-guide.
[301] *See, e.g.*, Erin Brock Carlson & Martina Angela Caretta, *Legitimizing Situated Knowledge in Rural Communities Through Storytelling Around Gas Pipelines and Environmental Risk*, 68 Technical Communication (Nov. 2021); Peggy M. Shepard et al., *Advancing Environmental Justice through Community-Based Participatory Research*, 110

In characterizing and evaluating the risks to vulnerable communities, states must consider the cumulative impacts of carbon pollution and additional contaminants from existing power plants with the impacts from all other sources of pollution on affected communities – such as industrial sources, automobiles, heavy-duty vehicles, and agriculture – even if those sources are located in other states or jurisdictions. In addition, states should be required to consider the increased cumulative pollution from co-located sources, including other emission points at a single facility.

States should also be required to consider potential changes in the levels of co-pollution of other dangerous pollutants, such as NOx and PM, due to proposed control measures – whether increases or decreases – as they assess the significance of impacts on vulnerable communities in the meaningful engagement context. Since the overriding purpose of section 111 is to control "air pollution" that endangers "public health and welfare," it would be arbitrary and capricious for EPA to approve a state plan that did not consider the resulting health and welfare impacts from changes in co-pollutants resulting from the pollution controls.[302]

In addition, because state plans must uphold the integrity of EPA's BSER for existing power plants, EPA must ensure that a state's plan effectuates EPA's consideration of the "nonair quality health and environmental impact and energy requirements" when EPA selected the BSER.[303] In the context of systems including hydrogen co-firing or CCS, vulnerable communities facing water scarcity risks to their health and welfare may be further burdened by control measures that may require large quantities of scarce freshwater.[304] Furthermore, communities living near pipelines or other infrastructure required by these technologies may be at a higher risk of suffering the effects of an explosion or asphyxiation from leaks. EPA must ensure that states also consider such nonair quality health and welfare impacts as part of the meaningful engagement requirement.

In addition to examining the burdens, it is also important to analyze who benefits in the context of carbon pollution reduction:

> The core concern of energy justice is *ensuring the equitable access to the benefits* from the energy sector in the transition to a low-carbon regenerative economy. These benefits include cleaner air, cleaner water, and health improvements from

Env't. Justice 139 (Apr. 2002), https://climateaccess.org/sites/default/files/Advancing%20Environmental%20Justice%20through%20Community-Based%20Participatory%20Research_EnvironmentalJustice.pdf; Sadaf Shallwani & Shama Mohammed, *Community-Based Participatory Research: A Training Manual for Community Researchers* (Jan. 2007), https://www.researchgate.net/publication/236003971.

302 42 U.S.C. § 7411(b)(1)(A).

303 *See id.* § 7411(a)(1).

304 *See, e.g.,* Emily Grubert, *Water Consumption from Electrolytic Hydrogen in a Carbon-Neutral US Energy System*, 4 Cleaner Production Letters (June 2023), https://www.sciencedirect.com/science/article/pii/S2666791623000106 (estimating under central uptake scenario electrolytic hydrogen production freshwater consumption of 15% of total 2014 U.S. freshwater consumption for energy by 2050); Lorenzo Rosa et al., *Hydrological Limits to Carbon Capture and Storage*, 3 Nature Sustainability 658 (2020) (documenting how CCS could further stress scarce water resources for communities near 43% of the world's power plants).

> renewable energy generation; the wealth and income created by clean energy assets and jobs; and the associated social and political empowerment of marginalized communities that these improved outcomes would make possible. Without access to these benefits, energy policy will continue to disenfranchise whole classes of people, as the harms and benefits of energy fall unevenly when policymakers do not pay special attention.[305]

Just as it is important to consider who benefits from renewable resources, it is important to consider which stakeholders benefit in the context of power plant emissions control. When regulatory strategies do not ensure equitable access to the benefits of regulation, continued disenfranchisement occurs and the "benefits of energy fall unevenly."[306] EPA should require states to consider the benefits as well as the burdens to the most vulnerable communities to ensure that other communities are not reaping all of the rewards while the most vulnerable communities continue to suffer from greater baseline health and welfare dangers.

EPA should also require states to coordinate outreach and engagement with other states or tribal authorities where emissions from sources near state or tribal borders impacts neighboring areas.[307]

As Joint Environmental Commenters discuss in their comments on the implementing regulations proposal, EPA should augment its list of required reporting criteria states must submit to ensure that states robustly engage with communities, including by providing information on the timing and frequency of engagement in the plan development process, the languages the engagement is conducted in, the accessibility of engagement locations and times, and responses to comments.[308] In the RULOF context where a state is considering a less effective control standard, states should be required to submit a robust explanation on why the state chose the option it did, including how it justifies any increased pollution or other additional negative health or environmental burden on already-overburdened communities.

Several resources serve as useful examples of guiding principles and best practices to inform EPA's guidance to states on approaches to public participation, stakeholder outreach, and community engagement in the meaningful engagement standard for state proceedings on limiting existing power plant carbon dioxide pollution. Joint Environmental Commenters documented several resources in their comments on the implementing regulations proposal,[309] including:

- The Principles of Environmental Justice (1991), https://www.ejnet.org/ej/principles.pdf.
- Jemez Principles for Democratic Organizing (1996), https://www.ejnet.org/ej/jemez.pdf.

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[305] Subin G. DeVar, *Equitable Community Solar: California & Beyond*, 46 Ecology Law Quarterly 1017, 1023 (2019), https://www.ecologylawquarterly.org/wp-content/uploads/2020/08/Equitable-Community-Solar.pdf (internal citations omitted) (emphasis added).
[306] *Id.*
[307] *See* Proposal at 33399.
[308] *See* Joint Environmental Commenters, *supra* note 236, at 6.
[309] *See* Joint Environmental Commenters, *supra* note 236, at 6-8.

- WE ACT for Environmental Justice, Community Engagement Brief, https://www.weact.org/wp-content/uploads/2022/10/Community-Engagement-Brief-092322- FINAL.pdf.
- International Association for Public Participation, Public Participation Pillars, https://cdn.ymaws.com/www.iap2.org/resource/resmgr/communications/11x17_p2_pillars_broch ure_20.pdf.
- PolicyLink & The Kirwan Institute, The Community Engagement Guide for Sustainable Communities, https://www.policylink.org/sites/default/files/COMMUNITYENGAGEMENTGUIDE_LY_FIN AL%20%281%29.pdf.
- Tribal Collaboration Working Group of the All of Us Research Program Advisory Panel, Considerations for Meaningful Collaboration with Tribal Populations, https://allofus.nih.gov/sites/default/files/tribal_collab_work_group_rept.pdf.
- Facilitating Power, The Spectrum of Community Engagement to Ownership, https://movementstrategy.org/wp- content/uploads/2021/08/The-Spectrum-of-Community-Engagement-to-Ownership.pdf.
- Oregon Environmental Justice Task Force, Practices for Oregon's Natural Resource Agencies 5-6, 16-19 (2016), https://www.oregon.gov/odot/Business/OCR/Documents/Oregon_EJTF_Handbook_Final.pdf.
- Colorado Environmental Justice Action Task Force, Final Report of Recommendations 33-44 (Nov. 14, 2022), https://drive.google.com/file/d/1l4rN-o3h3OJg8TciUzh-qxytULvyD_NE/view.
- Washington State Environmental Justice Task Force, Recommendations for Prioritizing EJ in Washington State Government 64-68, Appendix C (2020), https://healthequity.wa.gov/sites/default/files/2022-01/EJTF%20Report_FINAL%281%29.pdf.
- Minnesota Pollution Control Agency, Environmental Justice Framework 9 (May 2022), https://www.pca.state.mn.us/sites/default/files/p-gen5-05.pdf.
- California Air Resources Board, Community Engagement Model (2023), https://ww2.arb.ca.gov/community-engagement-model.
- White House Office of Information and Regulatory Affairs, Broadening Public Engagement in the Federal Regulatory Process, https://www.whitehouse.gov/omb/information- regulatory-affairs/broadening-public-engagement-in-the-federal-regulatory-process.

X. <u>The Inflation Reduction Act Reinforces EPA's Established Authority to Adopt Protections under Section 111 Addressing Power Plant Carbon Dioxide Emissions</u>

In the IRA, Congress enacted a broad array of measures designed to reduce greenhouse-gas emissions and expedite the nation's transition to a clean energy economy. *See generally* White House, *Building a Clean Energy Economy: A Guidebook to the Inflation Reduction Act's Investments in Clean Energy and Climate Action* (Jan. 2023), https://www.whitehouse.gov/wp-content/uploads/2022/12/Inflation-Reduction-Act-Guidebook.pdf.

As examined above, the IRA provides substantial, long-term funding that will support carbon reductions in the United States' electric power system and drive greenhouse-gas emission reductions throughout the economy. Among other things, it extends and modifies the existing Renewable Energy Production Tax Credit for electricity produced from renewable resources like wind, solar, and geothermal energy (section 13101, $51 billion) and the existing Investment Tax Credit to expand clean energy manufacturing for electric vehicles, wind turbines and solar panels (§ 13102). It extends and modifies the federal tax credit for carbon sequestration (§ 13104). It provides a new technology-neutral production tax credit for net-zero generating and storage facilities (§ 13701, $11.2 billion), and establishes a new Clean Energy Investment Credit (§ 13702, $50.858 billion). It provides major funding for clean energy investments by rural electric cooperatives (§22004, $9.7 billion). And the IRA provides loans and investments to support transmission facility financing (§50151) and planning (§ 50153). These, among other measures are expected to reduce greenhouse gas emissions from the power sector substantially, making the baseline emissions levels preceding regulations substantially lower. [310]

In addition, the IRA puts in place the most significant and far-reaching amendments to the Clean Air Act in more than a generation, see Greg Dotson & Dustin J. Maghamfar, *The Clean Air Act Amendments of 2022: Clean Air, Climate Change, and the Inflation Reduction Act*, 53 Env. L. Reptr. 10017 (2023) ("Dotson & Maghamfar"). These amendments included new sections on Clean Heavy-Duty Vehicles (IRA Sec. 60101, new CAA Section 132); reducing air pollution at ports (IRA Section 60102, new CAA Section 133); establishing a Greenhouse Gas Reduction Fund to support deployment of clean energy technology in low-income and disadvantaged communities (IRA Section 60103, new CAA Sec. 134); a Low Emission Electricity Program providing new funding to reduce emissions from electricity generation and use (IRA Section 60104, new CAA 135); a new incentive program to reduce methane emissions from petroleum and natural gas systems (Sec. 60113, new CAA Sec. 136), and a new section providing for Greenhouse Gas Air Pollution Plans and Implementation Grants (IRA Section 60106, new CAA Sec. 137). In addition, the IRA's amendments include new statutory provisions confirming and clarifying the status of greenhouse gases under the CAA.

a. Reaffirmation of EPA's Authority to Regulate Greenhouse Gases Under the CAA

Among these new Clean Air Act amendments added by the IRA are provisions that emphatically reaffirm and reinforce EPA's statutory authority and duty to regulate the emissions of greenhouse gases. As House Energy and Commerce Committee Chair Frank Pallone explained, the Act "reinforces the longstanding authority and responsibility of the [EPA] to regulate [greenhouse gases] as air pollutants under the Clean Air Act." 168 Cong. Rec. E868 (2022). The IRA adds an array of amendments to Title I of the Clean Air Act repeatedly defining "greenhouse gas" as "the air pollutants carbon dioxide, hydrofluorocarbons, methane, nitrous oxide, perfluorocarbons, and sulfur hexafluoride"— the same six gases included in EPA's 2009

[310] The above CBO estimates of IRA incentives likely significantly underestimate their true value due to the uncapped nature of the tax credits. *Compare* Cong. Budget Office (CBO), *supra* note 134 (estimating $369 billion in IRA incentives through 2031), *with* Goldman Sachs, *supra* note 135 (estimating $1.2 trillion in IRA incentives over same period).

Endangerment Finding (and its 2016 finding under Section 231 of the Clean Air Act). *See, e.g.*, 42 U.S.C. § 7432(d)(4) (definition in new Clean Air Act Section 132(d)(4), in provision promoting clean heavy-duty vehicles); *id.* § 7433(d)(2) (new Clean Air Section 133(d)(2), in provision concerning air pollution at ports); *id*. § 7434(c)(2) (new Clean Air Act Section 134(c)(2), in provision establishing a Greenhouse Gas Reduction Fund); *id*. § 7435(c) (new Clean Air Act Section 135(c), part of the Low Emissions Electricity Program).

These provisions express Congress's judgment that each of the enumerated chemical compounds falls within the definition of "air pollutant," which applies throughout the Clean Air Act (including Title I). 42 U.S.C. § 7602(g) (Clean Air Act-wide definition of "air pollutant"); *see also id*. § 7437 (new Clean Air Act Section 137 providing $5 billion in support for development and implementation of plans to address "greenhouse gas *air pollution*") (emphasis added).[311] These provisions demonstrate that GHGs are in no sense second-class pollutants under the Act; to the contrary, Congress recognizes them as a high priority for EPA action.

b. Increasing Protections Under Section 111 By Reducing Control Costs and Spurring Development and Availability of Emission Controls

The IRA's large investments in emissions-reducing technologies and clean energy infrastructure bear upon EPA rulemakings under the CAA, including its rulemakings addressing power-sector emissions under Section 111. Section 111 requires that EPA consider cost and assess the technical feasibility of pollution control. In order to determine a rule's effects, EPA must define baseline conditions. The IRA investments are highly relevant to baseline conditions, and expected to expedite the development and application of pollution-reducing technologies. By helping to support and catalyze existing trends where clean power technologies are increasingly broadly available at lower cost, these congressionally-set forth investments will enable stronger protections consistent with Section 111's requirements. *See* Dotson & Maghamfar, 53 ELR at 10029 ("A recent analysis of the cost impacts of the IRA found that the average cost of clean electricity generation and storage technologies would cause a double-digit percentage decline in the average cost of electricity over the lifetime of a facility relative to their pre-IRA counterparts.") (citing Ian Bowen et al., *How Clean Energy Economics Can Benefit From the Biggest Climate Law in US History*, ICF (Sept. 16, 2022), https://www.icf.com/insights/energy/clean-energy-economic-benefits-us-climate-law).[312] By

[311] Furthermore, as discussed below, provisions including Section 135 the Inflation Reduction Act require that EPA must, among other responsibilities, use existing Clean Air Act regulatory authorities to reduce emissions of greenhouse gases. Because those Clean Air Act provisions authorize EPA to regulate emissions of "air pollutants," these IRA provisions further confirm that greenhouse gases *are* indeed such pollutants. See also, e.g., Clean Air Act § 136, codified at 42 U.S.C. § 7436(f)(6)(A) (Methane Emissions Reduction Program), expressly referencing emissions requirements under Section 111(b) and (d). *See also* Clean Air Act § 135(a)(6), 42 U.S.C. § 7435(a)(6) (requiring EPA to "ensure that reductions in greenhouse gas emissions are achieved *through use of the existing authorities of this Act*") (emphasis added)).

[312] *See also* Statement of Chairman Pallone, 168 Cong. Rec. E879 (Aug. 26, 2022) ("The tax credits for CCUS and clean hydrogen production included in this Act may also figure into CAA Section 111 GHG regulations for new and existing industrial sources as well as other CAA requirements, such as permitting under Section 165. As noted above, Congress anticipates that EPA may consider CCUS or clean hydrogen as candidates for BSER for electric generating plants as well as for other fossil fuel-fired industrial sources. Further, Congress anticipates that EPA may consider the impact of the CCUS and hydrogen production tax credits in lowering the costs of those measures.

reducing the costs of producing and delivering clean electricity, the IRA enables greater pollution reductions and public health and welfare protections under provisions like Section 111. Because the IRA's large investments in clean energy technology will have far-reaching effects upon the economics of the power sector, it is critical that EPA's new rulemakings, including regulations establishing emissions limits under Section 111, reflect these new realities.

c. Statutory Mandate for Additional Emissions Reductions Beyond Updated Baseline: The Low Emissions Electricity Program.

The IRA amends the CAA to establish a new Section 135 that appropriates funds for EPA to establish a Low Emissions Electricity Program ("LEEP"). The new section sets aside funds for a variety of initiatives to reduce power-sector pollution: $17 million for consumer-related education and partnerships; $17 million for education, technical assistance, and partnerships within low-income and disadvantaged communities; $17 million for industry-related outreach and technical assistance, and $17 million for outreach and technical assistance to state, tribal, and local governments.

In addition, and of particular salience to this rulemaking, the LEEP pairs a mandate that EPA conduct a fresh, up-to-date, real-world baseline assessment of power sector emissions, with new statutory requirements (also backed by new funding) that the agency ensure that its policies actually secure emissions reductions beyond any reductions that would occur as a result of any other causes (as reflected in EPA's newly calculated baseline). "This amounts to a significant new development in EPA's mandate to address climate pollution from power plants." Dotson & Maghamfar, 53 Env. L. Rprtr. at 10034.

First, Section 135(a)(5) of the IRA requires and funds an assessment of the anticipated reductions in GHG emissions that result from changes in domestic electricity generation and use through fiscal year 2031, that is, the emissions reductions expected to occur anyway from factors such as the extensive multi-year clean energy investments under the IRA itself, investments and incentives under IIJA, market trends toward cleaner energy, state and local climate and clean energy policies, private sector initiatives and commitments, and demand-side changes (such as federal, state or private demand-response programs and increased energy efficiency of electricity-consuming appliances). These multi-dimensional policies, drivers and changes are discussed in more detail above. Paragraph 5 provides $1 million in funds "to assess, not later than 1 year after the date of enactment of this section, the reductions in greenhouse gas emissions that result from changes in domestic electricity generation and use that are anticipated to occur on an annual basis through fiscal year 2031." Section 135 thus

… Congress anticipates that regulatory requirements to reduce emissions imposed on coal-fired electricity generating plants will require additional investments by these plants—investments that non-emitting plants will not have to make. Such a rulemaking would be clearly authorized under Section 111, consistent with its meaning since enactment.").

> imposes on EPA a broad and comprehensive duty, instructing the Agency to focus on emissions related to the "generation" of electricity and also its "use." This spares EPA from having to unnecessarily cabin its examination of pollution and avenues for mitigation. It recognizes that more efficient use of electricity can reduce emissions just as cleaner sources of generation can. . . . . Congress understood in requesting this assessment that the process of decarbonizing U.S. electricity production was already well underway and accelerating even prior to enactment of the IRA. In 2020, more than double the amount of electricity was produced from zero-carbon sources (including wind and solar, nuclear, hydropower, and geothermal) compared to burning coal. Between 2015 and 2020, zero-carbon electricity generation grew by approximately 20% while coal-fired electricity generation declined by nearly 40%. By the time Congress passed the IRA, more than one half the U.S. population was served by states or territories that had enacted laws or adopted goals to eliminate GHG emissions from the power sector. Additionally, 75% of U.S. customer accounts are served by utilities with a 100% carbon-reduction target, or a utility owned by a parent company with a 100% carbon-reduction target. And since 2015, expert projections of power-sector carbon emissions in 2030 under a business-as-usual scenario (i.e., no additional policies prior to passage of the IRA) have changed from an expected 17% decline from 2005 levels to an expected 46%-50% decline. This indicates the rapid transition of the power sector to cleaner forms of energy production that is already occurring even prior to additional federal policy interventions. EPA is required to complete its assessment of anticipated emissions reductions within one year of enactment.

Dotson & Maghamfar, 53 Env. L. Rptr. at 10033 (citation omitted).

The challenge of ensuring that regulatory protections actually build upon progress already being achieved is illustrated by the Clean Power Plan experience. Following the promulgation of that rule in 2015, emissions from the power sector dropped rapidly even without the CPP ever being implemented; reductions owing to economic trends, state regulation, and other factors drove emissions reductions so rapidly that EPA concluded the CPP's standards would have had minimal effect or even be completely satisfied by these extrinsic trends by the time emission limitations were scheduled to become operative.[313]

[313] *See, e.g.*, EPA, Regulatory Impact Analysis for the Repeal of the Clean Power Plan and the Emission Guidelines for Greenhouse Gas Emissions from Existing Electric Utility Generating Units, at 2–35, EPA-HQ-OAR-2017-0355-26743 (June 2019) ("ACE RIA") (noting Edison Electric Institute's 2018 comment that Clean Power Plan's emissions-reduction total for *2030* would be achieved before Plan's initial compliance date in *2022*), https://www.epa.gov/sites/default/files/2019-06/documents/utilities_ria_final_cpp_repeal_and_ace_2019-06.pdf. *See also id.* at 2-35 ("Considering the national emission trends, the regional trends, the flexibility of the CPP, and the delayed time-line of the CPP, it is likely that there would be no difference between a baseline that includes the CPP and one that does not. For all these reasons, the EPA believes that repeal of the CPP under current and reasonably projected market conditions and regulatory implementation is not anticipated to have a meaningful effect on emissions of [carbon dioxide,] other pollutants or regulatory compliance costs.").

The IRA pairs this newly required assessment of baseline power sector emissions through FY 2031 with new funding to allow EPA to satisfy an express obligation "to ensure" that Clean Air Act regulation actually achieves emissions reductions beyond those expected to occur from other causes. New CAA Section 135(a)(6) provides EPA with $18 million in funds "to ensure that reductions in greenhouse gas emissions are achieved through use of the existing authorities of this Act, incorporating the assessment under paragraph (5)." Since Section 111 directly authorizes regulatory limits on power sector GHG emissions, see *Am. Elec. Power Co. v. Connecticut*, 564 U.S. 410, 424 (2011) (noting that Section 111 "speaks directly" to power plants' carbon dioxide emissions), it is clearly prominent among the "existing authorities" EPA must employ under Section 135(a)(6). As House Energy and Commerce Committee Chair Frank Pallone put it, "CAA Section 111 is one of the 'existing authorities' funded by Section 60107 of this Act … Congress intends that EPA construe its authority under the existing CAA authorities broadly, consistent with the requirements of those authorities, so EPA can promulgate impactful and innovative regulations, as appropriate." 168 Cong. Reg. E868.

Importantly, new Section 135(a)(6) builds off the preceding paragraph – the assessment of emission reductions that will occur from factors other than CAA regulation – and requires that EPA adopt CAA measures to drive emissions reductions beyond that baseline. As Dotson and Maghamfar explain:

> By requiring a "reduction" that incorporates EPA's assessment, Congress is directing the Agency to use the authorities of the CAA to achieve greater reductions than would otherwise be achieved. Moreover, while the activities under the first four pots of funding would be expected to reduce GHG emissions from the power sector, none of those activities would mandate reductions. EPA will have to determine what combination of legally enforceable regulations and use of other authorities under the Act satisfy the requirement to "ensure" such reductions occur.

53 Env. L. Report. at 10033.

Section 135(a)(5) and (6) have important implications for the current rulemaking under Section 111: EPA has an IRA-reinforced mandate to adopt robust emissions-reduction requirements under Section 111 that ensure real, additional emissions reductions beyond those already occurring in a rapidly changing power sector. These requirements should inform EPA's decisions on the stringency of its section 111 rules. To satisfy its obligations under the IRA-LEEP, EPA should structure its rules under Section 111 to ensure that the additionality requirements can be met even if (as occurred in dramatic fashion with the CPP) emissions reductions occur more rapidly than currently anticipated.

XI. <u>EPA Must Address the Public Health and Environmental Risks Associated with Hydrogen</u>

While hydrogen could have a role in the clean energy transition, it also poses significant climate and environmental justice risks. Hydrogen infrastructure is largely undeveloped, which underscores the need to proactively create a clear and effective regulatory structure and avoid reactive regulation like that which has characterized natural gas infrastructure buildout.

Unless the public health and environmental impacts are addressed, hydrogen could be worse for the climate in the near-term than the fossil fuels it would replace. Hydrogen-related policies must be evaluated based on their comprehensive effectiveness in delivering on climate, public health, environmental, and equity goals, and adapted through a continuous learning process as more research becomes available.

a. Hydrogen Infrastructure Buildout Entails Significant Climate and Environmental Justice Risks

Hydrogen is often touted as a promising decarbonization solution. However, whether hydrogen delivers climate benefits depends on how it is produced, transported, stored, and used. Today, less than 1% of hydrogen is made from renewable energy; the rest is made using fossil fuels, usually through a high-polluting process.[314] Hydrogen production globally is responsible for more greenhouse gas emissions than all of Germany.[315] Many stakeholders rightly focus on the climate impacts of hydrogen production methods (i.e., from natural gas resulting in "grey" hydrogen or "blue" if paired with carbon capture, or from renewable energy sources resulting in "green" hydrogen). Stakeholders have also raised concerns about end-use combustion, which can emit significant amounts of health-harming pollution.[316]

i. Hydrogen leakage risks

Hydrogen leakage along the supply chain can be significant and may also undermine potential benefits because hydrogen itself is a potent indirect greenhouse gas.[317] Recent studies have found hydrogen's warming power is over 35 times larger than CO2 pound for pound over the 20 year period after it is emitted, and about 12 times larger over 100 years – values that are 2-6 times higher than previously thought.[318] When hydrogen is released directly into the atmosphere, it contributes to climate change by "affecting chemical reactions that increase the amount of greenhouse gases including methane, tropospheric ozone, and stratospheric water vapor."[319]

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[314] Saadat & Gersen, *Reclaiming Hydrogen for a Renewable Future: Distinguishing Fossil Fuel Industry Spin from Zero-Emission Solutions*, Earthjustice (2021), https://earthjustice.org/features/green-hydrogen-renewable-zero-emission. In the U.S. today, nearly all hydrogen (95%) is produced from fossil fuels through an energy intensive industrial process called steam methane reformation (SMR), and roughly 60% of domestic hydrogen demand comes from crude oil refineries, where it is used to lower the sulfur content of diesel. *Id.* at 10.

[315] *Id.* (0.83 gigatons of CO2 in 2018).

[316] Combustion of hydrogen for energy in end-use sectors does not emit greenhouse gases, but it can produce significant NOx emissions. Alastair C. Lewis, *Optimising air quality co-benefits in a hydrogen economy: a case for hydrogen specific standards for NOx emissions*, 1 Env. Sci. Atmospheres 201 (2021), https://pubs.rsc.org/en/content/articlelanding/2021/ea/d1ea00037c.

[317] Ocko & Hamburg, *Climate consequences of hydrogen leakage*, 22 Atmos. Chem. & Phys. 9349 (Feb. 2022), https://acp.copernicus.org/articles/22/9349/2022/; Mejia et al, *Hydrogen leaks at the same rate as natural gas in typical low-pressure gas infrastructure*, 45 Intl. J. of Hydrogen Energy 8810 (2020), https://www.sciencedirect.com/science/article/abs/pii/S0360319919347275.

[318] *Id.; see also* Warwick et al., *Atmospheric Implications of Increased Hydrogen Use*, Dep't for Bus., Energy & Indus. Strategy (July 20, 2022) https://www.gov.uk/government/publications/atmospheric-implications-of-increased-hydrogen-use.

[319] Ocko & Hamburg, *supra* note 317.

Hydrogen molecules are small and slippery, so the risk of leakage from various sources across production, transmission, storage, and end use can significantly undercut the climate benefits of hydrogen deployment.[320] Moreover, operational practices including intentional venting, purging, and flaring hydrogen are common, which can release substantial levels of hydrogen into the atmosphere.[321] When evaluating infrastructure buildout and use cases, research should be conducted into emissions rates associated with different stages of the supply chain, and mechanisms and best practices should be incorporated to evaluate and minimize potential negative climate impacts.[322] Hydrogen applications that require greater transport and infrastructure connectivity increase the potential for leaks, whereas localized applications at or near the production source can minimize leakage risks.[323]

Recent peer-reviewed research analyzes the climate implications of hydrogen leakage under a range of possible emission scenarios.[324] In best-case scenarios assuming a 1% hydrogen emission rate across the entire infrastructure chain, the researchers find that "blue" hydrogen made from natural gas (with the carbon dioxide completely captured and 1% methane emission from the gas supply chain) could cut warming effects compared to traditional fossil fuels by roughly 70% over 20 years.[325] "Green" hydrogen produced using renewable electricity does even better, cutting the climate impact by over 95%.[326] But at a 10% hydrogen emission rate – which many scientists say is plausible – blue hydrogen (with 100% carbon capture and 3% upstream methane leakage) could actually *increase* the 20-year warming impact by 25%.[327] Green hydrogen with higher emissions would still reduce the 20-year warming effects by two-thirds relative to fossil fuels, but far less than the climate-neutral promise that many hydrogen champions claim.[328] Understanding and mitigating hydrogen emissions and leakage rates is therefore critical for determining the lifecycle greenhouse gas implications and potential benefits.

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[320] S. Esquivel-Elizondo et al., *Wide Range in Estimates of Hydrogen Emissions from Infrastructure*, OSF Preprints (Apr. 13, 2023), doi:10.31219/osf.io/unzrm.
[321] *Id.*; *see also* Jasmin Cooper et al., *Hydrogen emissions from the hydrogen value chain-emissions profile and impact to global warming*, 830 Science of The Total Env't (July 15, 2022), https://doi.org/10.1016/j.scitotenv.2022.154624; Frazer-Nash Consultancy, *Fugitive Hydrogen Emissions in a Future Hydrogen Economy* 6 (2022), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1067137/fugitive-hydrogen-emissions-future-hydrogen-economy.pdf;
[322] Detection and measurement of hydrogen leaks currently face technological barriers and cannot be done at the scale and level of precision necessary for mitigating climate impacts. Technologies are currently in the demonstration phase; however, it is not clear when these technologies will be ready for widescale or regulatory deployment. There are many known best practices that can be adopted to mitigate emissions risks. *See, e.g.*, EDF, *Preventing and mitigating hydrogen emissions from infrastructure*, https://www.edf.org/sites/default/files/2023-07/H2%20Emissions%20Mitigation%20Factsheet_08MAY2023.pdf (last visited Aug. 7, 2023).
[323] Frazer-Nash Consultancy, *supra* note 321
[324] Ocko & Hamburg, *supra* note 317.
[325] *Id.*
[326] *Id.*
[327] *Id.*
[328] *Id.*

ii. Grid electrolysis risks

Hydrogen produced by electrolysis also poses unique concerns because it requires significant electricity. If electrolyzers are powered by the average U.S. electricity mix, the lifecycle emissions of hydrogen are significantly worse than even hydrogen derived from fossil fuels with unabated emissions. To ensure that hydrogen produced through electrolysis actually produces "clean" hydrogen, it must be powered by renewable energy resources. This can be achieved by either building dedicated renewable resources to power the electrolyzer or connecting to the grid and offsetting emissions caused by grid electricity consumption by purchasing clean energy attributes (CEAs) or renewable energy credits (RECs) or by signing a power purchase agreement (PPA). To verify and ensure that electrolysis is not driving up systemwide electricity grid emissions, three conditions must be met (the "Three Pillars"):

1. **New clean supply or additionality:** Electrolyzers should be powered by new clean energy that is not already on the grid or energy that otherwise wouldn't be available on the grid.
2. **Hourly time-matching:** Electrolyzers must run during the same hours as the clean electricity is being generated.
3. **Deliverability:** Electrolyzers should use local sources of clean electricity that are physically delivered to them by facilities in their region of the grid.[329]

Each is necessary to ensure that hydrogen is produced with very low greenhouse gas emissions that achieve the cleanest tier of the section 45V tax credit and EPA's proposed definition of "low-GHG" hydrogen. In the absence of these pillars, the grid will respond to increased marginal load by ramping up fossil fuel resources, increasing carbon emissions by hundreds of millions of tons and worsening local air pollution.[330]

iii. Risks of increased NOx emissions from burning blends of hydrogen and natural gas

As EPA recognizes, "the combustion characteristics of hydrogen . . . can increase emissions of the criteria pollutant NOx."[331] For example, one study predicts that burning pure hydrogen would emit more than six times as much NOx as burning methane, the main component of natural gas.[332] NOx emissions could be reduced through advances in pollution control technology or by lowering flame temperatures, but this requires either lower volumes of hydrogen in the

[329] Wilson Ricks, et al., *Minimizing emissions from grid-based hydrogen production in the United States*, 18 Env't Research Letters (2023), https://iopscience.iop.org/article/10.1088/1748-9326/acacb5.
[330] *Id.*
[331] 88 Fed. Reg. 33312 (May 23, 2023).
[332] Salih & Pinarbasi, *Investigations on Performance and Emission Characteristics of an Industrial Low Swirl Burner While Burning Natural Gas, Methane, Hydrogen Enriched Natural Gas and Hydrogen as Fuels*, 43 Int'l J. of Hydrogen Energy 1994, 1205 (Jan. 11, 2018), https://www.sciencedirect.com/science/article/abs/pii/S0360319917319791.

combustor or de-rating the engine which results in efficiency losses and power decreases.[333] We urge EPA to thoroughly evaluate this risks associated with increased NOx emissions and take appropriate action to address those risks and ensure NOx emissions do not increase as a result of compliance with EPA's proposed hydrogen co-firing standards, including by requiring the use of control technologies.

iv. Risks of hydrogen infrastructure and pipeline buildout

In addition to the climate implications, hydrogen leakage poses safety concerns. This is the case primarily in indoor settings and enclosed spaces, where a hydrogen leak can pose a fire hazard when mixed with air at certain concentrations, and an asphyxiation hazard when it displaces oxygen in the air. Because its molecules are very small, hydrogen is more prone than methane to leaking through joints, cracks, and seals in infrastructure. It can also permeate directly through materials used for natural gas distribution faster than methane, leading to deterioration and embrittlement of pipelines and other infrastructure. This means that existing natural gas infrastructure is generally not suitable to transport hydrogen unless blended with natural gas in a mixture that contains 20% or less hydrogen.[334] Monitoring and repairing leaks from hydrogen infrastructure is thus also important from a safety perspective. However, smaller leaks of hydrogen that are cumulatively harmful to the climate may be below the level that would cause safety concerns.

In addition to the serious safety risks posed by hydrogen pipeline and infrastructure buildout, there are important environmental justice risks posed by increased use of hydrogen. For example, many existing hydrogen production facilities are located in the Gulf Coast and similar geographies that are already overburdened by petrochemical facilities and other large polluting infrastructure. Increased demand and use of hydrogen may drive greater production at these facilities or the development of new, similar facilities in overburdened areas. Increased demand for hydrogen in new end uses is likely to drive increased hydrogen pipeline buildout as well.

b. Hydrogen Production Methods Significantly Influence the Fuel's Lifecycle Emissions Profile

Hydrogen is not a naturally occurring fuel source and must therefore be produced using feedstocks and energy inputs. The production methods vary widely in their greenhouse gas emissions impacts, and higher carbon intensity modes of production can greatly reduce or eliminate the benefits of switching from fossil fuels to hydrogen in end uses. Available production methods include: renewable electrolysis (no direct emissions); nuclear electrolysis (no direct emissions); grid electrolysis (significant upstream power sector emissions); steam

[333] Mirko Bothien et al., *Hydrogen Gas Turbines: The Path Towards a Zero-Carbon Gas Turbine, European Turbine Network*, at 9 (Jan. 2020), https://etn.global/wp-content/uploads/2020/01/ETNHydrogen-Gas-Turbines-report.pdf.
[334] Jochen Bard, et al., *The Limitations of Hydrogen Blending in the European Gas Grid*, Fraunhofer Inst. for Energy Econ. and Energy Sys. Tech. 27 (2022), https://www.iee.fraunhofer.de/content/dam/iee/energiesystemtechnik/en/documents/Studies-Reports/FINAL_FraunhoferIEE_ShortStudy_H2_Blending_EU_ECF_Jan22.pdf.

methane reformation (SMR) or autothermal reforming (ATR) without CCS (direct methane and CO_2 emissions and upstream methane from gas production); SMR or ATR with CCS (upstream methane from gas production and CO_2 leakage); biomass gasification; and other fossil-derived hydrogen, like coal gasification.

Currently, nearly all hydrogen in the U.S. is produced from natural gas through SMR without CCS. These methods emit CO_2 as a byproduct of the hydrogen production resulting in a carbon intensity of between 8 and 12 kg of CO_2/kg H_2.[335] Projections show significant buildout and future hydrogen production from SMR and ATR facilities. Hydrogen produced using electricity from the current U.S. average grid has a carbon intensity of 21 kg of CO_2/kg H_2, while hydrogen produced through renewable electrolysis can achieve the lowest carbon intensity of 0.45 kg of CO_2/kg H_2 or less.[336]

The mode of production is thus central to hydrogen's emissions profile and its desirability as a clean fuel and a component of decarbonization efforts. While co-firing hydrogen in natural gas fired power plants reduces emissions at the stack, these gains could be offset by upstream emissions caused by hydrogen production. Moreover, because hydrogen has a lower caloric value than methane of equal volume, the more hydrogen used, the more cubic feet of gas blend is needed to generate the same amount of energy. One study found that hydrogen-natural gas blends at the common upper threshold of 20% has only a marginal climate benefit of 6-7% greenhouse gas savings, even without considering leakage.[337] Combusting high carbon-intensity hydrogen would have the net result of increasing greenhouse gas emissions. This underscores the importance of only allowing co-firing with low-GHG hydrogen to ensure overall greenhouse gas emissions are reduced.

c. Federal Incentives Are Driving Clean Hydrogen Production and Investments

Historic clean energy investments made by Congress in the Inflation Reduction Act (IRA) and the Infrastructure Investment and Jobs Act (IIJA) included billions of dollars of investments in hydrogen designed to promote truly low-carbon hydrogen that should be used in applications where hydrogen makes sense for the climate. These federal incentives are projected to increase hydrogen production in the coming years.

The IIJA directed the Department of Energy (DOE) to "develop an initial standard for the carbon intensity of clean hydrogen production," called the Clean Hydrogen Production Standard and funds a Regional Clean Hydrogen Hub Program and a Clean Hydrogen Research and Development Program.

The IRA also offers substantial tax credits for the production of qualified clean hydrogen. The Department of the Treasury is currently developing guidance for how the lifecycle carbon intensity of clean hydrogen will be determined. The tax credits are tiered by carbon intensity,

[335] Thomas Koch Blank & Patrick Molly, *Hydrogen Decarbonization Impact for Industry: Near-term challenges and long-term potential*, RMI (2020), https://rmi.org/wp-content/uploads/2020/01/hydrogen_insight_brief.pdf.
[336] *Id.*
[337] Jochen Bard, et al., *supra* note 333.

meaning the cleanest and lowest carbon intensity forms of hydrogen production receive the greatest tax credit.

Both of these significant Congressional actions clearly signal support for "clean" hydrogen determined by the lifecycle emissions profile of the hydrogen production process. While some higher-emitting forms of hydrogen may qualify for lesser tax credits or may be eligible for certain aspects of DOE funding, the thrust of both pieces of legislation is support for clean hydrogen and efforts to reduce lifecycle emissions of clean hydrogen production to the greatest extent possible. This Congressional support for clean, "low-GHG" hydrogen is consistent with and supports EPA's treatment of hydrogen in this proposal, as described further below.

d. "Low-GHG" Hydrogen Must Be a Component of Any BSER Based on Hydrogen Co-Firing

For various subcategories of gas plants, EPA proposes co-firing with "low-GHG" hydrogen as the BSER. EPA finds that the highest tier of the section 45V(b)(2) production tax credit, corresponding to hydrogen produced with the lowest lifecycle emissions, provides the appropriate definition of low-GHG hydrogen. That provision allows the highest available amount of production tax credit for hydrogen produced through a process that has lifecycle greenhouse gas emissions of 0.45 kg CO2e/kg H2 or less, from well-to-gate. EPA proposes that co-firing with hydrogen that meets this criterion qualifies as a component of the best system of emission reduction, taking into account the statutory considerations. EPA likewise appropriately finds that "[e]ach of the subsequent hydrogen production categories outlined in section 45V(b)(2) convey increasingly higher amounts of GHG emissions (from a well-to-gate analysis), making them less suitable to be a component of the BSER."[338] We agree with EPA's analysis, and below explain why a low-GHG requirement is necessary and justified and fits well with EPA's statutory authority under section 111(a)(1).

i. Best system of emission reduction

Section 111(a)(1) requires performance standards for both new and existing sources to reflect "the degree of emission limitation achievable through the application of the best system of emission reduction"—or BSER—"which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated."[339] EPA's designation of the BSER cannot achieve merely marginal emission reductions; it must cut pollution as much as feasible. In *Sierra Club v. Costle*, the D.C. Circuit held that "we can think of no sensible interpretation of the statutory words 'best technological system'[340] which would not incorporate the amount of air

[338] 88 Fed. Reg. 33310 (June 24, 2021).
[339] 42 U.S.C. § 7411(a).
[340] In 1977 Congress amended section 111(b) to require new source standards reflecting "the best technological system of continuous emission reduction." Clean Air Act Amendments of 1977, Pub. L. No. 95-95, § 109(c)(1)(A), 91 Stat. 685, 699-700. In 1990, Congress restored the original "best system of emission reduction" for this provision. Clean Air Act Amendments of 1990, Pub. L. No. 101-549, § 403(a), 104 Stat. 2399, 2631. This change had important implications for EPA's authority to include non-technological factors in a BSER determination. However, under both the BSER and "best technological system" language, EPA must take into account the quantity of air pollution reductions that its chosen system would achieve.

pollution as a relevant factor to be weighed when determining the optimal standard for controlling . . . emissions."[341] The court also rejected an argument that "'EPA may not consider total air emissions in deciding on a proper NSPS'" with the explanation that "this position [is] untenable given that one of the agreed upon legislative purposes . . . *requires* that the standards must maximize the potential for long term economic growth 'by reducing emissions *as much as practicable*.'"[342]

To fulfill its duty to maximize emission reductions, EPA must establish performance standards that reflect the BSER.[343] The text of section 111 and governing legal decisions interpreting it make clear that in designating BSER, EPA must first identify the various "systems of emission reduction" that have been "adequately demonstrated" for a given source category.[344] Of those systems, it must then select the "best," taking into account the extent of emission reduction achieved by the system, costs, nonair quality health and environmental impacts, energy requirements, and technological innovation.[345] Lastly, EPA must set the standard at a level that is "achievable"[346] but reflects the "maximum practicable degree" of "control[]."[347]

The D.C. Circuit has made clear that section 111 is a "technology-forcing statute." In this regard, when selecting the best system, EPA must look broadly at systems and techniques that may be in use in other, comparable industrial sectors; consider future improvements and refinements in emission reduction systems; and consider systems that are not necessarily in "actual, routine use somewhere."[348] Although EPA may not designate "purely theoretical or experimental means of preventing or controlling air pollution" as the BSER, or rely on a "crystal ball inquiry" to make its determination, it must reasonably "look[] toward what may fairly be projected for the regulatory future, rather than the state of the art at present." [349] EPA must also consider cost, and courts will uphold EPA's designation of the BSER so long as it is not "exorbitantly costly in an economic or environmental way"[350] or "unreasonable."[351]

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[341] 657 F.2d 298, 326 (D.C. Cir. 1981).

[342] *Id.* (emphasis added); *see also* 42 U.S.C. § 7401(b) (the Clean Air Act's fundamental purpose is "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." Three additional purposes are itemized, all of which aim to achieve "the prevention and control of air pollution." 42 U.S.C. § 7401(b). *See also* Summary of the Provisions of Conference Agreement on Clean Air Act Amendments of 1970, 116 Cong. Rec. 42,385 (Dec. 18, 1970) (sources regulated under section 111 "must be controlled to the maximum practicable degree regardless of location").

[343] 42 U.S.C. § 7411(a)(1).

[344] *See, e.g.*, 83 Fed. Reg. at 65,433-34 (expounding upon 42 U.S.C. § 7411(a)(1) and citing relevant cases, including *Costle*, 657 F.2d at 326, 343, 346-7, *Lignite Energy Council v. EPA*, 198 F. 3d 930, 933 (D.C. Cir. 1999), *Essex Chem. Corp. v. Ruckelshaus*, 486 F.2d 427, 433 (D.C. Cir. 1973), and *Portland Cement Ass'n v. EPA*, 513 F.2d 506, 508 (D.C. Cir. 1975)).

[345] 83 Fed. Reg. at 65,433-34 (Dec. 20, 2018).

[346] *Id.*

[347] 116 Cong. Rec. at 42,385.

[348] *Portland Cement Ass'n v. Ruckelshaus*, 486 F.2d 375, 391 (D.C. Cir. 1973); *see also* H. Rep. No. 91-1146, 91st Cong., 2d Sess. 10 (1970).

[349] *Id. See also ASARCO Inc. v. EPA*, 578 F.2d 319, 322 & 322 n.6 (D.C. Cir. 1978) (best system standard is designed to "*enhance* air quality and not merely to maintain it") (emphasis added); *Costle*, 657 F.2d at 347 n.174 (Congress's intent in enacting section 111 was "to induce, to stimulate, and to augment the innovative character of industry in reaching for more effective, less costly systems to control air pollution").

[350] *Essex Chemical Corp. v. Ruckelshaus*, 486 F.2d 427, 433 (D.C. Cir. 1973).

In *West Virginia*, the Supreme Court did not define the term "system of emission reduction."[352] It did apply the major questions doctrine to hold that the term "system" does not provide the requisite clear authorization to support the Clean Power Plan's BSER, which the Court described as "carbon emissions caps based on a generation shifting approach."[353] While the Court did not define the outer bounds of the meaning of "system," systems of emissions reduction like fuel switching, add-on controls, and efficiency improvements fall comfortably within the scope of prior practice as recognized by the terms, structure and purpose of the statute and reviewing courts.

ii. Low-GHG hydrogen is a necessary component of the "best" system of emission "reduction" based on hydrogen co-firing

Section 111(a)(1) authorizes and requires EPA to consider the potential negative environmental impacts of a control technology as well as the total amount of emission reductions when determining which system is "best." In the case of a system based on hydrogen co-firing, these considerations require EPA to determine that a system reliant on "low-GHG" hydrogen is the "best" system of emission "reduction" because it has the least negative environmental impacts and would reduce emissions to the greatest extent.

The D.C. Circuit has read "best" to authorize EPA to consider factors in addition to the ones enumerated in section 111(a)(1), that further the purpose of the statute.[354] In *Portland Cement Ass'n v. Ruckelshaus*, the D.C. Circuit held that under section 111(a)(1), EPA must consider "counter-productive environmental effects" in determining the BSER.[355] The court elaborated: "The standard of the 'best system' is comprehensive, and we cannot imagine that Congress intended that 'best' could apply to a system which did more damage to water than it prevented to air."[356] To meet this requirement, EPA must provide alongside a proposed standard "a statement of reasons that sets forth the environmental considerations, pro and con which have been taken into account as required by the Act[.]"[357]

In *Sierra Club v. Costle*, the court added that EPA must consider the amount of emission reductions and technology advancement in determining BSER.[358] The court's view that "best" includes additional factors that further the purpose of section 111 is a reasonable interpretation of that term in its statutory context. The court found that EPA's determination of whether a system

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[351] *Sierra Club v. Costle*, 657 F.2d 298, 343 (D.C. Cir. 1981).
[352] *West Virginia v. EPA*, 142 S. Ct. at 2615.
[353] *Id.* at 2614.
[354] The Supreme Court has likewise confirmed, in a closely related context dealing with an agency determination of the "best available control technology" or "BACT," that the term "best" must be given effect and imposes a constraint on agency discretion. *Alaska Dep't of Envtl. Conservation v. EPA*, 540 U.S. 461, 489 n.13 (2004). In the BACT context, the Court described "the essential statutory requirement" for the agency as the selection of "the technology that can *best* reduce pollution within practical constraints." *Id.* (emphasis in original). The term "best" in section 111(a)(1) likewise requires EPA to determine that the BSER is that which can best reduce pollution within the other statutory constraints.
[355] 486 F.2d 375, 385 (D.C. Cir. 1973).
[356] *Id.* at n.42.
[357] *Id.* at 385.
[358] 657 F.2d 298, 326, 346-47 (D.C. Cir. 1981).

of emission reduction that reduced certain air pollutants is "best" should be informed by impacts that the system may have on pollutants that affect public health or welfare.[359] It also found that "[c]ontrol technologies cannot be 'best' if they create greater problems than they solve."[360] The Supreme Court confirmed the D.C. Circuit's approach in *Michigan v. EPA*,[361] explaining that administrative agencies must engage in "reasoned decisionmaking" that, in the case of pollution control, cannot be based on technologies that "do even more damage to human health" than the emissions they eliminate.[362] EPA must therefore consider "counter-productive environmental effects" in determining the BSER.

The amount of emissions and potential reductions from the category of sources is likewise evident in the plain language of section 111(a)(1) as a factor EPA must consider in determining the "best system of emission reduction." Consistent with this plain language and the purpose of section 111, the D.C. Circuit has stated that the EPA must consider the quantity of emissions at issue or the "amount of air pollution."[363] Therefore, in determining what is "best," EPA has broad discretion to balance the enumerated factors and must holistically consider the amount of air pollution at issue, including greenhouse gas emissions and counter-productive greenhouse gas impacts.

When evaluating similar systems of emission reduction (e.g., 1) hydrogen co-firing or 2) low-GHG hydrogen co-firing), the terms "best" and "reduction" authorize and require EPA to determine that the system which reduces the most greenhouse gas emissions is the best system, other things being equal. It also requires EPA to comprehensively consider counter-productive environmental effects, which in this context include the lifecycle greenhouse gas emissions and other environmental impacts from hydrogen production, like conventional air pollution.[364] Just as the best system cannot be one that does more damage to water than it prevents to air, so too, the best system cannot be one that creates more greenhouse gas emissions elsewhere than it reduces at the source. Without a lifecycle definition, the production of hydrogen used for compliance poses a serious risk of increasing emissions. Ignoring this potential perverse outcome, especially in light of the readily available solutions to avoid it, would be arbitrary, and a system that allowed for such significant counter-productive effects would not be the "best."

The lifecycle emissions of hydrogen uniquely bear upon its desirability as a clean fuel and whether it is a component of the "best" system of emission "reduction." Different methods of hydrogen production have different greenhouse gas impacts, and the range of impacts is significant. For example, SMR emits CO2 and methane as a byproduct of the hydrogen production resulting in a carbon intensity of between 8 and 12 kg of CO2e/kg H2. Hydrogen produced using electricity from the current U.S. average grid has a carbon intensity of 21 kg of

[359] *Portland Cement Ass'n*, 486 F.2d at 385.
[360] *Id.* at 386.
[361] 576 U.S. 743 (2015).
[362] *Id.* at 750-52.
[363] *See Sierra Club v. Costle*, 657 F.2d 298, 326 (D.C. Cir. 1981) ("we can think of no sensible interpretation of the statutory words "best . . . system" which would not incorporate the amount of air pollution as a relevant factor to be weighed when determining the optimal standard for controlling . . . emissions").
[364] *Id.*

CO_2e/kg H_2,[365] while hydrogen produced with dedicated renewable resources can achieve a carbon intensity of <0.45kg/CO_2e/kg H_2. This large range of impacts means that hydrogen is not always desirable as a strategy for reducing greenhouse gas emissions by substituting it for fossil fuels. To make any sense as a method for reducing emissions in particular applications where electrification is infeasible, the hydrogen used in place of fossil fuels must be produced through a low-emissions process. Defining the lifecycle emissions profile of hydrogen to be purchased and used for compliance with this proposal is the best way of ensuring emission reductions and represents the product of "reasoned decisionmaking."

EPA is also required to consider the non-greenhouse gas air quality impacts that may result from the BSER.[366] Low-GHG hydrogen produced with <0.45kg/CO_2e per kilogram produced is hydrogen produced through electrolysis powered by renewable energy. This form of hydrogen production has no negative air quality impacts. Higher-GHG forms of hydrogen production (fossil-derived and grid electrolysis) produce significant amounts of greenhouse gases (methane and CO_2) *and* conventional air pollution, such as hazardous and smog-forming pollution (including methanol and NOx). EPA is therefore justified in its comprehensive consideration of air quality impacts and overall emission reductions to require only the use of low-GHG hydrogen as a component of the best system because it serves as a reasonable proxy for conventional air pollution from hydrogen production as well.

iii. EPA may consider and require measures that reduce a fuel's air pollution impacts when evaluating a "system of emission reduction" that relies on cleaner fuels

Fuel switching or reliance on cleaner fuels is a system of emission reduction that EPA has employed in the past and was pointed to in *West Virginia* as fitting within EPA's traditional authority under section 111.[367] Certain requirements related to the fuel's production, extraction, and preparation may control a fuel's emissions profile and whether the fuel is considered "clean," as EPA has long recognized. For example, EPA has set standards based on fuel cleaning to reduce sulfur emissions from coal used in power plants, and section 111(a)(1) specifically authorizes "precombustion cleaning or treatment of fuels."[368] Similarly, low-GHG hydrogen co-firing is a form of fuel switching based on a fuel produced from feedstocks through various methods that influence the extent to which it is considered "clean."

Since the 1970 Clean Air Act amendments, EPA has (with congressional acquiescence) interpreted section 111 to authorize basing standards of performance on off-site fuel cleaning.[369]

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365 Thomas Koch Blank & Patrick Molly, *supra* note 334.
366 42 U.S.C. § 7411(a)(7)(B).
367 *West Virginia v. EPA*, 142 S. Ct. at 2611.
368 *See, e.g.*, *Standards of Performance for New Stationary Sources*, 36 Fed. Reg. 24876, 24879 (Dec. 23, 1971).
369 For example, in 2007, in amending its standards of performance for industrial-commercial-institutional steam generating units, EPA required the owner or operator of such units to include "a signed statement from the owner or operator of the fuel pretreatment facility certifying that the percent removal efficiency achieved by fuel pretreatment was determined in accordance with the provisions of Method 19 of appendix A." 40 C.F.R. § 60.49b(n)(4); *see also*

Even during the period when Congress imposed the most narrow limits on section 111(a)(1) – 1977 to 1990 – Congress expressly authorized standards of performance to be based on fuel cleaning, whether or not undertaken by the source itself.[370] Fuel cleaning activities are frequently undertaken off-site, by parties not related to the affected source and the example of fuel cleaning sheds light on the scope of section 111, as well as Congress's understanding and recognition that methods of production, extraction, and preparation can impact of fuel's emissions profile.

EPA's original section 111 power plant rules for conventional pollutants read the statute as crediting similar low-emissions fuels based on off-site activities which were credited toward on-site percentage reductions for power plants: "credit may be given for any cleaning of the fuel, or reduction in pollutant characteristics of the fuel, after mining and prior to combustion."[371] Offsite fuel-cleaning is similar to the consideration of modes of hydrogen production. While hydrogen cannot be washed or treated to reduce its greenhouse gas emissions, the precombustion mode of production dictates its emissions profile. Like off-site fuel cleaning of coal for combustion in a power plant, which has been explicitly authorized by Congress,[372] off-site production of hydrogen using clean methods can reduce greenhouse gas impacts in furtherance of the purposes of section 111.

In other instances, EPA has relied on cleaner fuels as a component of a BSER without analyzing impacts from the fuel's production or potential pretreatment measures. However, EPA has not foreclosed such considerations as outside of the scope of section 111, and there are many practical reasons why the lifecycle emissions of certain fuels are more relevant than others. For example, with extracted fossil fuels, while the mode of production can impact emissions, it is not typically to the same degree as fuels produced artificially from feedstocks through energy-intensive processes. EPA has recognized that the latter pose unique concerns from a lifecycle emissions perspective. EPA has also not foreclosed the possibility that the lifecycle emissions of fossil fuels may be a relevant consideration under section 111. The statute's reference to the "best system of emission reduction" strongly supports an interpretation that would preclude reliance on technologies that in practical effect pose serious risks of actually increasing emissions of the regulated pollutant and other pollutants.

In carrying out its delegated responsibilities under the Clean Air Act, it is essential for EPA to consider measures related to the production of fuels transformed from feedstocks that are analogous to precombustion treatment for fossil fuels and achieve the same outcome sought by

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Amendments to New Source Performance Standards (NSPS) for Electric Utility Steam Generating Units and Industrial-Commercial-Institutional Steam Generating Units; Final Rule, 72 Fed. Reg. 32742 (June 13, 2007).

[370] Congress also understood that these techniques would not necessarily be accomplished at the individual source. For example, a House committee report indicates that an assessment of the best technological system of continuous emission reduction for fossil fuel fired power plants would include "various coal-cleaning technologies such as solvent refining, oil desulfurization at the refinery." H.R. Rep. No. 95-294, at 188 (May 12, 1977). Coal-cleaning, Senator Muskie observed, can occur at the "minemouth" (rather than at the source), and, similarly, other precombustion fuel treatment processes may or may not even be "undertaken by the source itself." Sen. Muskie, Sen. Consideration of H.R. Conf. Rep. No. 95-564, at 353 (Aug. 4, 1977).

[371] 44 Fed. Reg. 33580, 33581 (June 11, 1979); *Sierra Club*, 657 F.2d at 357, 368-373 (describing credit under section 111 for off-site "coal washing").

[372] 42 U.S.C. § 7411(a)(7)(B).

Congress, that of reducing emissions. Fuels that are produced through the transformation of feedstocks (e.g., hydrogen, ammonia, biofuels) are different in nature than fuels that are naturally occurring and which can be mined (e.g., coal, oil, gas). Fuels produced from feedstocks can have highly variable environmental impacts depending on the mode of production and the energy inputs required that readily justify EPA's consideration, and support requirements to minimize those impacts. Given the statute's plain language and purpose, and relevant judicial precedent, EPA plainly can take steps to ensure that use of a potential promising technology does not actually result in seriously harmful pollution impacts or actually increase overall emissions.

iv. Considering measures related to the production and lifecycle emissions of clean fuels, particularly hydrogen, is consistent with EPA's past treatment of biofuels

EPA has long recognized that some cleaner fuels, like biofuels, have emissions impacts associated with their production that influence their benefits and air pollution impacts. As described above, section 111 expressly recognizes low-emissions fuels as an appropriate component of a BSER—section 111(a)(7) refers to "reduction of the pollution generated by a source before such pollution is emitted into the ambient air, including precombustion cleaning or treatment of fuels." In past actions, EPA has recognized that "the overall net atmospheric loading of CO2 resulting from the use of a biogenic feedstock by a stationary source, such as an EGU, will ultimately depend on the stationary source process and the type of feedstock used, as well as the conditions under which that feedstock is grown and harvested."[373] EPA likewise noted "that biomass cannot be considered carbon neutral a priori, without an evaluation of the carbon cycle effects related to the use of the type of biomass being considered."[374]

In the ACE, rule EPA took the position that biomass co-firing was not a permissible way of meeting the emission limits, but the D.C. Circuit rejected that claim.[375] The court also rejected EPA's claim that compliance measures had to meet two criteria: (1) they had to be implemented at the source itself, and (2) they must be measurable at the source of emissions using data, emissions monitoring equipment or other methods to demonstrate compliance, such that they can be easily monitored, reported and verified at a unit.[376] EPA's rejected position in the ACE rule on biomass was also a shift from the agency's previous practice of "treat[ing] biogenic CO2 emissions resulting from the combustion of biomass from managed forests at stationary sources for energy production as carbon neutral."[377]

As with biofuels, the climate impacts of using hydrogen for co-firing in power plants depends in large part on the sourcing of the hydrogen and the method by which is it produced. A requirement for operators to purchase and utilize low-GHG hydrogen that is certified on a lifecycle emissions basis is a reasonable measure to reduce pollution from hydrogen that is

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[373] 79 Fed. Reg. 1446.
[374] *Id.*
[375] *Am. Lung Ass'n v. EPA*, 985 F.3d 914, 957 (2021).
[376] *Id.*
[377] 83 Fed. Reg. 44766 (Aug. 31, 2018); EPA, *EPA's Treatment of Biogenic Carbon Dioxide (CO2) Emissions from Stationary Sources that Use Forest Biomass for Energy Production* 1 (Apr. 23, 2018), https://www.epa.gov/sites/default/files/2018-04/documents/biomass_policy_statement_2018_04_23.pdf.

consistent with and analogous to EPA's past consideration of the lifecycle emissions of biofuels production. It is reasonable for EPA to consider the emissions caused by biofuels and hydrogen production and consider ways to minimize those emissions as a way of "reduc[ing] . . . the pollution generated by a source before such pollution is emitted into the ambient air."[378] And a requirement to procure and use low-GHG hydrogen is an appropriate way of addressing those considerations with respect to hydrogen.

v. Including a requirement to use "low-GHG" hydrogen is consistent with *West Virginia v. EPA*

The fundamental holding of *West Virginia v. EPA* is that Congress did not grant EPA in section 111(d) the authority to devise emissions caps based on the generation shifting approach the Agency took in the Clean Power Plan. The Court specifically noted that it has "no occasion to decide whether the statutory phrase 'system of emission reduction' refers exclusively to measures that improve the pollution performance of individual sources, such that all other actions are ineligible to qualify as the BSER."[379] And it pointed to systems based on fuel-switching a traditional air pollution control measure within EPA's authority.[380]

Considering hydrogen's lifecycle emissions when determining the BSER does not fun afoul of *West Virginia*, nor does including a requirement for operators to co-fire with low-GHG hydrogen. While in *West Virginia*, the "system" required a shift in electricity generation, a "system" of co-firing with low-GHG hydrogen would not require any generation shift or any reduced operation. Instead, co-firing with low-GHG hydrogen is an at-the-source technique that reduces pollution emitted by the source. It represents a BSER "based on the application of measures that would reduce pollution by causing the regulated source to operate more cleanly,"[381] and it can be met based on actions taken solely by the regulated entity at the source—by purchasing low-GHG hydrogen for combustion and by building or retrofitting turbines to be capable of combusting hydrogen blends. While the Court in *West Virginia* did not rule on whether EPA was limited to measures "inside the fenceline" of the regulated source, co-firing with low-GHG hydrogen is nonetheless something that occurs entirely within the fenceline. As with any BSER based on fuel-switching, the operator of the regulated source will have to purchase that fuel from a supplier or producer. The same is true with a BSER based on low-GHG hydrogen—the operator of an affected source will have to purchase low-GHG hydrogen from a producer or supplier.

vi. EPA's "low-GHG" hydrogen definition is consistent with the section 45V hydrogen production tax credit and EPA's past practice under the Renewable Fuel Standard Program

In enacting the section 45V tax credit under the IRA, Congress recognized EPA's historical expertise in lifecycle emissions analysis and defined the "lifecycle greenhouse gas emissions" of clean hydrogen by reference to the Clean Air Act definition in section 211(o), administered by

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[378] 42 U.S.C. § 7411(a)(7)(B).
[379] *West Virginia*, 142 S. Ct. at 2615.
[380] *Id.* at 2611.
[381] *Id.* at 2610.

EPA.[382] EPA has long analyzed lifecycle emissions under section 211's Renewable Fuel Standards (RFS) Program and there are important reasons why similar analysis and treatment should be applied to clean hydrogen.

Under section 211, EPA has the authority and directive to administer the RFS Program which requires a certain volume of renewable fuel to be blended into petroleum-based transportation fuel in order to gradually reduce greenhouse gas emissions over time.[383] EPA sets annual percentage standards specifying the total amount of renewable fuel, as well as three subcategories of renewable fuel, that must be used to reduce or replace fossil fuel present in transportation fuel, heating oil, or jet fuel.[384] The program was originally enacted in the Energy Policy Act of 2005, which amended the Clean Air Act and then was expanded in the Energy Independence and Security Act of 2007.[385]

EPA is required to analyze the "lifecycle greenhouse gas emissions" of each fuel in order to determine whether the fuel qualifies as a renewable fuel under the statute and regulations.[386] Section 211(o)(1)(H), defines "lifecycle greenhouse gas emissions" as the "aggregate quantity of greenhouse gas emissions (including direct emissions and significant indirect emissions such as significant emissions from land use changes) . . . related to full fuel lifecycle."[387] This includes "all stages of fuel and feedstock production and distribution, from feedstock generation or extraction through the distribution and delivery and use of the finished fuel to the ultimate consumer, where the mass values for all greenhouse gases are adjusted to account for their relative global warming potential."[388]

Under section 45V of the Internal Revenue Code, the clean hydrogen production tax credit, the Department of the Treasury must issue regulations describing how to measure a hydrogen producer's lifecycle greenhouse gas emissions for purposes of determining eligibility.[389] A hydrogen producer's lifecycle emissions—which include on-site emissions and upstream emissions, such as those from generating the electricity used to run the hydrogen electrolyzer—determine the value of the production tax credit the producer is qualified to claim. The credit value follows a sliding scale: the lower the lifecycle emissions, the higher the credit.

Section 45V, in a two-part definition, defines "lifecycle greenhouse gas emissions" by reference to section 211(o)(1)(H) of the Clean Air Act and the Department of Energy's GREET model. In relevant part, it also defines (by cross reference) lifecycle emissions as "the aggregate quantity of greenhouse gas emissions (including direct emissions and significant indirect emissions such as

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[382] 26 U.S.C. § 45V(c)(1) ("[T]he term "lifecycle greenhouse gas emissions" has the same meaning given such term under subparagraph (H) of section 211(o)(1) of the Clean Air Act (42 U.S.C. 7545(o)(1)), as in effect on the date of enactment of this section.").
[383] 42 U.S.C § 7456.
[384] EPA, *Overview for Renewable Fuel Standard*, https://www.epa.gov/renewable-fuel-standard-program/overview-renewable-fuel-standard (last visited Aug. 7, 2023).
[385] *Id.*
[386] *Id.*
[387] 42 U.S.C. § 7545(o)(1).
[388] *Id.*
[389] 26 U.S.C. § 45V.

significant emissions from land use changes) . . . related to the full fuel lifecycle, including all stages of fuel and feedstock production and distribution . . . ."[390] It then states that "lifecycle greenhouse gas emissions shall only include emissions through the point of production (well-to-gate), as determined by the most recent [GREET] model," or by a "successor" model determined by Treasury.[391] The GREET model is a lifecycle emissions model developed and maintained by Argonne National Laboratory, which is a research center associated with the Department of Energy.

Both section 211(o) of the Clean Air Act and section 45V (by reference to section 211(o)), define lifecycle greenhouse gas emissions to include "direct" and "significant indirect" emissions related to the "full fuel lifecycle." EPA's interpretation of section 211(o)'s reference to "significant indirect" emissions in the biofuel context generally requires consideration of three key components: "(1) the processes required to produce feedstocks, convert them into fuel, and deliver the fuel to the end-user [often referred to as "well-to-tank"]; (2) the emissions from the vehicle itself [often referred to as "tank-to-wheels"]; and (3) any direct or indirect changes in emissions not attributable to fuel production or use, including changes in land use."[392] In the 2013 RFS regulations, EPA expanded its interpretation of the lifecycle analysis definition and stated that in the lifecycle greenhouse gas emissions analysis for a fuel, the agency considers:

- Feedstock production—based on agricultural sector models that include direct and indirect impacts of feedstock production.
- Fuel production—including process energy requirements, impacts of any raw materials used in the process, and benefits from co-products produced.
- Fuel and feedstock distribution— including impacts of transporting feedstock from production to use, and transport of the final fuel to the consumer.
- Use of the fuel—including combustion emissions from use of the fuel in a vehicle.[393]

Congress was aware of EPA's existing, well-established interpretation of section 211(o) when it drafted the IRA.[394] By incorporating the section 211(o) definition into the IRA, Congress confirmed EPA's interpretation of that provision, and used the same language to direct Treasury to apply EPA's logic to hydrogen production. Treasury, in implementing section 45V, is therefore required to evaluate the lifecycle greenhouse gas emissions of hydrogen production on a systemwide basis, considering significant indirect emissions.[395] Just as EPA must consider the systemwide land use emissions stemming from production of a biofuel feedstock (e.g., corn), Treasury must consider systemwide power grid emissions stemming from production of a

[390] 26 U.S.C. § 45V(c)(1)(A) ("the term 'lifecycle greenhouse gas emissions' has the same meaning given such term under subparagraph (H) of section 211(o)(1) of the Clean Air Act (42 U.S.C. 7545(o)(1))").
[391] 26 U.S.C. § 45V(c)(1)(B).
[392] Brent D. Yacobucci & Kelsi Bracmort, *Calculation of Lifecycle Greenhouse Gas Emissions for the Renewable Fuel Standard (RFS)*, Cong. Research Serv. 7 (Mar. 12, 2010), https://crsreports.congress.gov/product/pdf/R/R40460/9.
[393] 40 C.F.R. § 80 (2012).
[394] *Lorillard v. Pons*, 434 U.S. 575, 581 (1978) (Congress is "presumptively aware" of an existing administrative interpretation of a statutory provision when it incorporates that provision, by reference, into a new law).
[395] *See* Letter from NRDC & CATF to Department of the Treasury re: Legal Requirements of 45V (April 10, 2023), https://www.nrdc.org/sites/default/files/2023-04/nrdc-catf-memo-ira-45v-legal-necessity-3-pillars-20230410.pdf.

hydrogen feedstock (e.g., electrons or natural gas). And, just as EPA must consider greenhouse gas emissions from the energy requirements of biofuel fuel production, Treasury must consider the same with respect to hydrogen production.

In creating alignment across the lifecycle greenhouse gas emissions definitions in the RFS Program and the clean hydrogen tax credit, Congress signaled its support for hydrogen considered to be low-GHG through the lifecycle analysis historically employed by EPA. It further provided the greatest support, in the form of the most significant tax credit, for hydrogen produced with lifecycle emissions less than 0.45kg/CO2e per kilogram produced. The legislative history also shows that Congress intended for clean hydrogen supported under section 45V to be available to EPA as a technology for reducing emissions in the context of this rulemaking.[396] This Congressional support for clean hydrogen production in section 45V, based on the Clean Air Act definition historically implemented by EPA, is consistent with EPA's decision to consider lifecycle emissions and align that consideration with its past practices and Treasury's action under section 45V. EPA's traditional expertise in lifecycle emissions analysis under the RFS, as recognized by Congress, likewise provides support for EPA adopting such a definition in this rulemaking.

We therefore urge EPA to finalize a lifecycle definition for "low-GHG" hydrogen that considers upstream emissions, systemwide grid emissions, and all significant direct and indirect emissions and requires a carbon intensity of less than 0.45kg/CO2e per kilogram produced and align it to the greatest extent possible with Treasury's final definition in section 45V guidance. In analyzing the lifecycle emissions of hydrogen production, EPA should not use the existing version of Argonne National Laboratory's GREET model,[397] but should rely on an updated version or alternative tool that most accurately reflects the full scope of emissions and includes basin-specific estimates of upstream methane leakage as well as rigorous treatment of grid emissions based on the three pillars.[398]

XII. <u>EPA Must Address Risks Associated with Carbon Capture and Sequestration Technologies</u>

Companies, such as AEP,[399] Chevron,[400] Exxon Mobil,[401] Southern Company,[402] and many others,[403] have shown support for CCS technologies, touting CCS as a leading technology in addressing climate change.

[396] Statement of Chairman Pallone, 168 Cong. Rec. E879 (Aug. 26, 2022) ("Congress anticipates that EPA may consider CCUS or clean hydrogen as candidates for BSER for electric generating plants as well as for other fossil fuel-fired industrial sources.").
[397] Argonne Nat'l Lab., *Hydrogen Life-Cycle Analysis in Support of Clean Hydrogen Production* 8 (2022), https://greet.es.anl.gov/publication-hydrogenreport2022.
[398] Ricks et al., *Minimizing emissions from grid-based hydrogen production in the United States*, 18 Env. Res. Letters (2023), https://iopscience.iop.org/article/10.1088/1748-9326/acacb5.
[399] AEP, Earnings Call Transcript (July 29, 2011) ("Going forward without a carbon legislation or without an appropriate approach to carbon and its impact it was simply not able for us to go forward and continue that project. It has been completed or will be completed through the base engineering drawings and activity that is and laid up for another day. We are encouraged by what we saw, we're clearly impressed with what we learned and we feel that we

While these and other entities have deployed CCS or supported CCS in the power sector, EPA must prioritize the concerns of communities who will be impacted by this technology. As the funding for, and scale of, carbon capture and sequestration projects accelerates, as contemplated under the IIJA, IRA and this proposed rule, it is essential that federal and state regulators prevent public health and environmental impacts throughout these projects' lifecycles and ensure rigorous and comprehensive industry compliance.

For CO2 storage, this means: no CO2 leakage to the atmosphere, no groundwater contamination, and no induced seismicity presenting risks to public health, safety or the environment, or otherwise presenting/raising public concerns. For CO2 transport, this means: proper design, siting, construction, operations and maintenance procedures to prevent ruptures that threaten the

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have demonstrated to a certainty that the carbon capture and storage is in fact viable technology for the United States and quite honestly for the rest of the world going forward.").

[400] *Chevron Invests in Carbon Capture and Removal Technology, Svante*, Chevron (Dec. 15, 2022), https://www.chevron.com/newsroom/2022/q4/chevron-invests-in-carbon-capture-and-removal-technology-company-svante; *Chevron Launches Carbon Capture and Storage Project in San Joaquin Valley*, Chevron (May 18, 2022), https://www.chevron.com/newsroom/2022/q2/chevron-launches-carbon-capture-and-storage-project-in-san-joaquin-valley; *Chevron and JERA Sign MOU to Explore Carbon Capture and Storage Projects in United States and Australia*, Chevron (Mar. 7, 2023), https://www.chevron.com/newsroom/2023/q1/chevron-jera-sign-mou-to-explore-carbon-capture-and-storage-projects-in-united-states-australia.

[401] ExxonMobil,2023 Progress Report (Dec. 15, 2022) (discussing use of CCUS reduce emissions); *Darren Woods Shares Strategy for Long-Term Growth in Lower-Carbon Future with Employees*, ExxonMobil (Mar. 11, 2021), https://corporate.exxonmobil.com/news/news-releases/2021/0311_darren-woods-shares-strategy-for-long-term-growth-in-lower-carbon-future-with-employees/. In 2023, ExxonMobil Low Carbon Solutions announced three separate carbon capture agreements, with Linde, CF Industries, and Nucor Corporation, achieving a milestone of 5 million metric tons per year (MTA). *ExxonMobil Signs Carbon Capture Agreement with Nucor Corporation, Reaching 5 MTA Milestone*, ExxonMobil (June 1, 2023), https://corporate.exxonmobil.com/news/news-releases/2023/0601_lcs-nucor-agreement.

[402] Southern Co., *Implementation and Action Toward Net Zero* 26 (2020), https://www.southerncompany.com/content/dam/southerncompany/pdfs/about/governance/reports/Net-zero-report_PDF1.pdf ("[O]ur world-class geologic sequestration research program continues to develop options to support the commercial deployment of CO_2 capture across our service territory. The program has demonstrated the ability to safely store large volumes of anthropogenic CO_2 in EPA-permitted wells").

[403] At the EPA hearings regarding Louisiana primacy, many companies signaled support for use of CCS technologies. *See* Public Hearing, Proposed State of Louisiana Underground Injection Control Program; Class VI Program Revision Application (June 22, 2023), https://www.youtube.com/live/hB3AcWeF5Y4?feature=share (Blake Phillips of Enlink Midstream stating "Because of EnLink's extensive pipeline network in Louisiana and proximity to CO_2 sources and sinks, EnLink has the capability to repurpose some of our pipelines from natural gas service to CO2 service, which improves project timelines and costs, and reduces environmental impacts."); *id.* (Charles Dabadie of ExxonMobil Low Carbon Solutions stating "Granting primacy class VI wells to Louisiana will enable us to tailor the implementation of CCS technologies to our specific geological conditions [and] to [receive] support by [a] highly knowledgeable network of industry and universities"); *id.* (Joe Colletti of ExxonMobil Low Carbon Solutions stating "Louisiana's expertise and highly skilled workforce will enable the state to become a global leader in the energy transition and [CCS]. CCS is a proven solution that can be implemented at scale to reduce existing emissions. CCS is not a new technology. It's been used safely and effectively around the globe for many decades and since the 1970s."); Public Hearing, Proposed State of Louisiana Underground Injection Control Program; Class VI Program Revision Application (June 23, 2023), https://www.youtube.com/live/G6qCUtVmQ0g?feature=share (Lee Stockwell, General Manager – United States Carbon Capture Utilization and Storage for Shell, stating that "CCS is essential to tackling climate change" and that Shell experience and expertise required for CCS to be done effectively."); *id.* (Ray Lasseigne, of TMR Exploration, stating support for CCS.)

health and safety of people who live, work and recreate near CO2 pipelines. For CO2 capture, this means: the air quality implications of the capture process must be understood and mitigated. For all three lifecycle phases, this means: preventing impacts to populations in proximity to carbon capture and sequestration activity, and modifying or denying permits for activity that would disproportionately burden communities facing environmental injustice.

The foundation for environmental integrity in carbon capture and sequestration is strong technical rules, full public transparency, and rigorous accountability.

- For storage, EPA's Class VI program is robust on paper, but with so few projects permitted under these rules to date, EPA must ensure continuous assessment and improvement in the coming years as it learns about potential issues as greater numbers of projects are built (including, e.g., enhanced regulation of induced seismicity, and protocols for state offshore CO2 storage in the absence of Underground Sources of Drinking Water) and should act on them as appropriate. For operators seeking to store CO2 using EPA's less stringent Class II program, however, EDF cautions that EPA and primacy states must carefully consider whether particular CO2 storage projects are permissible under Class II or whether such projects should be required to upgrade to Class VI protections.
- For pipelines, PHMSA must accelerate a rulemaking to provide modern and comprehensive oversight for CO2 pipelines, which are forecast to have significant buildout in the coming decades. Such pipelines have garnered significant opposition, including an ethanol-oriented buildout through the Midwest and Plains states, in part based on the Denbury CO2 pipeline rupture in 2019 in Satartia, MS, that sickened dozens, and the revelation of scant rules at the federal level. Enhanced technical rules for CO2 pipelines at PHMSA is a necessary but insufficient upgrade – states in charge of siting (and for interstate pipelines, FERC) will need to ensure the pipelines are not placed in geotechnically unstable areas where a break could cause pooling of CO2, a heavier-than-air asphyxiant. The possible presence of H2S in CO2 streams only heightens the importance of proper oversight of these pipelines, which can be up to 4' in diameter.
- For capture, EPA must investigate the toxicity of amines, especially secondary amines, as well as degradation compounds formed such as nitrosamines.[404] EPA must also investigate amine emissions thresholds from capture facilities and set forward regulatory guidelines. A careful assessment anchored in law and facts on whether the addition of capture equipment to an existing facility counts as a major or minor modification, determining the level of regulatory oversight, is also warranted. EPA must also further assess and regulate any increased air pollution resulting from the heightened energy

[404] *See e.g.,* Koornneef, et al., *Carbon Dioxide Capture and Air Quality*, Chemistry, Emission Control, Radioactive Pollution and Indoor Air Quality 27 (Mazzeo, ed., 2011) ("A significant increase of NH3 emissions may be caused by oxidative degradation of amine based solvents that possibly will be used in post-combustion CO2 capture."); Koornneef at 37 (discussing properties of families of amines, such as nitrosamines – "considered of particular concern because of their toxic and carcinogenic properties at extremely low levels" – and nitramines – "also of concern as they are suspected to be carcinogenic"); Sarang D. Supekar & Steven J. Skerlos, *Reassessing the Efficiency Penalty from Carbon Capture in Coal-Fired Power Plants*, 49 Envt'l Science & Tech. 12577, 12581 (Sept. 2015) ("[E]mission of carbon separation solvents such as monoethanolamine (MEA, a compound about as toxic as cyanide) could cause toxic exposure and smog formation.").

requirements of the carbon capture equipment, including increased NOx, PM, and SOx emissions.[405] Potential water pollution impacts, including from wastewater with high sulfate concentrations and amine salt solids,[406] as well as the impacts from increased use of water resources must additionally be studied and regulated accordingly.[407]

Three additional governance factors are essential: 1) sufficiently trained and funded oversight; 2) robust transparency and reporting; and 3) maintaining appropriate incentives for quality work through adequate liability regimes.

1. Sufficiently Trained and Funded Oversight

Getting the rules right is a necessary but not sufficient precondition for CO2 capture and sequestration that prevents public health and environmental impacts. How those rules are implemented is just as, and possibly even more, important. This means having a trained regulatory staff for permitting, inspections, model assessment, site closure, and any other functions related to a CO2 capture and sequestration project for its lifetime.

Inadequately funded and trained regulators could lead to less rigorous evaluation of permits and operating sites. This is not an industry where corner-cutting is acceptable, because of the environmental, climate, and public health and safety risks posed by poorly regulated sites.

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405 *See, e.g.,* Zhang et al., *Environmental Impacts of Carbon Capture, Transmission, Enhanced Oil Recovery, and Sequestration: An Overview*, Envt'l Forensics 301, 302-03 (2013) (describing two sources of carbon capture air pollution - first, the pollution from the "energy penalty," or increased energy required to run the carbon capture equipment, and second, new pollution emitted as a result of the carbon capture chemical process); Koornneef et al., *supra* note 404 ("Increase in primary energy input as a result of the energy penalty for CO2 capture may for some technologies and substances result in a net increase of emissions …[with] [t]he largest increase… [in] the emission of NOx and NH3 when equipping power plants with post-combustion capture."); Koornneef at 34-35 ("The introduction of CCS (only post- and pre-combustion) is expected to lead to a further increase of NOx (up to 1.5 ktonne), PM (up to 70 tonne) and NH3 emissions (up to 0.7 ktonne)."); Koornneef at 33, tbl. 3 (summarizing SOx emissions of between +14% to +100% in three studies with natural gas combined cycle carbon capture as compared to plants without carbon capture); European Environment Agency, *Carbon Capture and Storage Could Also Impact Air Pollution* (Nov. 17, 2011) (predicting a significant increase in ammonia emissions from carbon capture, as well as increase of PM and NOx emissions "in line with the amount of the additional fuel consumed").

406 Zhang et al., *supra* note 405, at 302 (discussing how carbon capture generates amine salt waste byproducts with low biodegradability and wastewater with high sulfate concentrations due to the need to pre-treat flue gas to control SO2 concentrations).

407 *See, e.g.,* Lorenzo Rosa et al., *Hydrological Limits to Carbon Capture and Storage*, 3 Nature Sustainability 658 (2020) (documenting how CCS could further stress scarce water resources for communities near 43% of the world's coal power plants); David Luebke, *Advanced CO2 Capture*, Nat'l Energy Tech. Lab. (NETL), Post-Combustion CO2 Capture Workshop, *Opportunities & Challenges for Post-Combustion Capture: US DOE Research Activities*, slide 4 (July 11, 2010) (citing NETL & DOE, *Estimating Freshwater Needs to Meet Thermoelectric Generation Requirements – 2009 Update* (Sept. 2009) (estimating power sector implementation of carbon capture to increase water consumption by 80 percent due to greater compression and cooling needs). *See also* Munish K. Chandel et al., *The Potential Impacts of Climate-Change Policy on Freshwater Use in Thermoelectric Power Generation*, 39 Energy Policy 6234, 6234 (2011) ("Both greater electricity demand and potential climate change may increase water use, potentially leading to restrictions on water availability...").

The imperative for rigorous training and oversight implicates regulators at EPA headquarters and in the regions, and state oil and gas, pipeline, and environmental regulatory agencies across an array of disciplines.

Sufficient staffing and training is the bedrock for oversight and compliance, and EDF and other observers will be watching closely to see if policymakers are imbuing relevant regulatory agencies with sufficient resources to prevent public health and environmental impacts.

2. Robust Transparency and Reporting

A key element of transparency is for project operators to provide accurate and verifiable data on how much CO2 has been captured and stored on a net basis along with documentation, preferably third-party verified, of the quantification of those captured and stored volumes, generally through a regulatory accounting schema like the U.S.'s Greenhouse Gas Reporting Program's Subpart RR or proposed Subpart VV.

In addition to trustworthy CO2 capture and storage data being made available regularly to the public, it is also essential that the public have opportunity for input during various phases of project development, and particularly on completed applications and proposed permits. Meaningful public engagement is essential -- foundational. It is the bedrock responsibility of all policy-makers. Period. It should be noted that while meaningful public engagement and opportunity for public comment is essential, it is not a substitute for a thorough and substantive accounting of environmental justice implications of projects and mitigation to ensure no disproportionate community burden from a project's health and environmental impacts.

3. Maintaining Appropriate Incentives for Quality Work Through Adequate Liability Regimes

EDF is deeply concerned about state statutes that exempt Class VI storage operators from post-closure liability before statutes of limitation have run. In EDF's recent comments on Louisiana's Class VI primacy application to EPA, EDF noted that "[s]uch statutes induce a moral hazard by failing to disincentivize sub-standard work, and encourage the participation in the market of operators unwilling to accept the consequences of their actions. They also fly in the face of assurances of the long-term safety of this technology, sending a deeply mixed message to an already skeptical public."[408]

Properly sited, operated and closed CO2 sequestration projects under Class VI are expected by the IPCC to essentially retain their stored CO2 indefinitely.[409] But without traditional liability

[408] The Environmental Defense Fund, Comment Letter on the Proposed Louisiana Underground Injection Control Program Class VI Primacy Rule (July 3, 2023), Docket ID No. EPA-HQ-OW-2023-0073, https://www.regulations.gov/comment/EPA-HQ-OW-2023-0073-0221.

[409] IPCC, 2022: Summary for Policymakers [P.R. Shukla, J. Skea, A. Reisinger, R. Slade, R. Fradera, M. Pathak, A. Al Khourdajie, M. Belkacemi, R. van Diemen, A. Hasija, G. Lisboa, S. Luz, J. Malley, D. McCollum, S. Some, P. Vyas, (eds.)] , SPM C.4.6. In: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A.

schemas to act as an additional security on top of regulatory oversight, the chance of problems in the post-closure period goes up – no one wishes to repeat the mistakes made in the long-term oversight of oil and gas production wells, currently subject of a major federal clean-up effort.[410] EDF has provided extensive analysis to EPA documenting that it is impermissible for the Agency to grant primacy to states with liability exclusions contrary to federal law for CO2 storage project operators, and has discouraged DOE from funding such projects in such states.[411]

Commercial insurance projects are widely available to cover post-closure liability, and sophisticated developers understand that if they do a good job of siting, operation and closure, the risk of long-term liability is very low, and manageable. And project development continues apace in jurisdictions without special liability treatment for CO2 storage operators. But for states that nevertheless insist on implementing liability exclusions, EDF believes it is contrary to law and flies in the face of common sense to relieve operators of criminal or contractual liability; liability resulting from intentional torts, gross negligence, and willful deceit of willful concealment of relevant information; liability resulting from situations where deficient or erroneous information was used to support approval of site closure; liability resulting from the violation of applicable laws or regulations during the project's lifetime; liability related to contamination of Underground Sources of Drinking Water; and liability that exceeds amounts available in state carbon storage management funds.

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Preventing adverse public health and environmental impacts of CO2 capture, transport and storage, whether associated with power plants or in any industrial context, is essential and requires comprehensive, transparent and accountable federal and state regulatory action —and will require strong and continuous oversight from qualified regulatory authorities, universal compliance by project owners and operators, truly meaningful public engagement and input, and an across-the-board effort to prevent environmental injustices.

XIII. EDF Recommends that EPA Issue Guidance Pertaining to the Requirements of the Alternatives Analysis under Section 165(a)(2) and BACT Analyses for GHG Emissions

As discussed by EPA in its proposed rulemaking, EPA's proposed NSPS standards are directly relevant to the federal prevention of significant deterioration (PSD) permitting program, given that NSPS provides the floor for all determinations of best available control technology (BACT).[412] EPA states in its proposed rulemaking that "the fact that a minimum control

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Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: 10.1017/9781009157926.001 at 22. ("If the geological storage site is appropriately selected and managed, it is estimated that the CO2 can be permanently isolated from the atmosphere.")

[410] U.S. Dep't of Interior, *Orphaned Wells*, https://www.doi.gov/orphanedwells (last visited Aug. 7, 2023).

[411] The Environmental Defense Fund, Comment Letter on Proposed Council on Environmental Quality Carbon Capture, Utilization, and Sequestration Guidance – Docket No. CEQ-2022-0001 (April 13, 2022), https://downloads.regulations.gov/CEQ-2022-0001-0062/attachment_1.pdf.

[412] *See* 88 Fed. Reg. 33,240, 33,406-33,408 (May 23, 2023) ("BACT cannot be set at a level that is less stringent than the standard of performance established by an applicable NSPS, and the EPA refers to this minimum control level as the 'BACT floor.'"). *See also* 42 U.S.C. § 7479(3) ("In no event shall application of "[BACT]" result in

requirement is established by an applicable NSPS does not mean that a permitting authority cannot select a more stringent control level of the PSD permit or consider technologies for BACT beyond those that were considered in developing the NSPS."[413]

EDF urges EPA to clarify that § 165(a)(2) of the CAA provides an additional PSD requirement that states must consider alternatives to a proposed new or modified stationary source. More specifically, under § 165(a), PSD permits may not issue before the proposed permit has, among other things, been subject to review in accordance with the CAA and "public hearing has been held with opportunity for interested persons . . . to appear and submit written or oral presentations on the air quality impact of such source, *alternatives thereto*, control technology requirements, and other appropriate considerations."[414] The EPA has, in the past, interpreted this provision to provide the opportunity for a permitting authority to consider alternative, inherently lower-emitting technologies, such as the installation of an integrated gasification combined cycle (IGCC) power plant in lieu of constructing a coal-fired power plant.[415] However, the EAB has also stated that permitting authorities have the discretion as to whether to evaluate alternatives and has relied on EPA policy statements that permitting authorities are not required to consider BACT control options that would "redefine the source."[416]

EPA should issue clear guidance regarding implementation of CAA § 165(a)(2) and regarding the GHG BACT control options that should be considered by permitting authorities in the context of this NSPS rulemaking. To facilitate technological advancement in zero to low-emitting energy sources, it is necessary and appropriate to consider, in PSD application reviews and in BACT analyses, the best technological approaches to minimize GHG emissions, even those that might result in the permitted facility being different than what was originally proposed. For example, for an electric utility proposing to construct a simple cycle gas peaking turbine, using energy storage in lieu of constructing a gas-fired peaking unit is a valid alternative to the facility and should be evaluated as a BACT option/alternative for GHG emissions. And as previously noted, a recent study on the levelized costs of energy shows that utility-scale solar, solar plus storage, geothermal, onshore wind, and wind plus storage all have a lower levelized cost per megawatt-hour than gas peaking plants.[417] When the tax subsidies of the Inflation Reduction Act (IRA) are taken into account, the costs per megawatt-hour for these and other renewable forms of energy production are even further reduced such that several of these renewable energy production

emissions of any pollutants which will exceed the emissions allowed by any applicable standard established pursuant to section 7411 or 7412 of [the CAA]."); *accord* 40 C.F.R. § 52.21(b)(12).

[413] Proposal at 33,408.

[414] 42 U.S.C. § 7475(a)(2) (emphasis added).

[415] *See, e.g.*, Letter from Mr. Stephen D. Page, Director, US EPA Office of Air Quality Planning and Standards (OAQPS), to Mr. Paul Plath, Senior Partner, E3 Consulting, LLC, "Best Available Control Technology Requirements for Proposed Coal-Fired Power Plant Projects," (Dec. 13, 2005).

[416] *See, e.g.*, *In re Prairie State Generating Co.*, 13 E.A.D. 1, 22-26 (EAB 2006).

[417] *See* Lazard, Lazard's Levelized Cost of Energy 2 (Apr. 12, 2023), https://www.lazard.com/research-insights/2023-levelized-cost-of-energyplus/.

options would have a lower levelized cost in terms of cost per megawatt-hour than a gas-fired combined cycle power plant.[418]

As EPA has stated, the CAA's legislative history is clear that "Congress intended BACT to perform a technology-forcing function."[419] EPA has also stated that "in section 160 of the CAA, Congress emphasized that public participation and a careful assessment of relevant factors is crucial to all decision-making under the CAA's PSD provisions."[420]

For the minimization of GHG emissions from new and modified sources, it is imperative that EPA adopt guidance that directs permitting authorities to carefully evaluate GHG control and minimization options, including alternatives to the proposed facility. Not only would such policy assist in advancing zero to low-emitting technologies, but it could also have the benefit of reducing/eliminating all other air emissions associated with fossil fuel-fired energy production. This will benefit the general public and will be especially helpful to those communities experiencing disproportionate burdens from environmental harms.

EPA's Office of General Counsel recently acknowledged and opined that § 165(a)(2) allows EPA to "incorporate environmental justice considerations when issuing PSD permits."[421] Section 165(a)(2) is more than discretionary: it provides a clear statutory requirement that permitting agencies hold a public hearing and consider case-by-case air quality impacts, alternatives, controls, and other considerations related to a proposed source or modification.

Unfortunately, EAB caselaw based on past EPA policy has shifted this clear mandate to consider alternatives to a proposed action to a discretionary authority to consider only those specific alternatives and arguments raised by the public itself.[422] EPA should take this opportunity to align its regulations and guidance with the CAA's requirements by placing the obligation on permitting entities themselves to explore zero- to low-emitting technologies and alternatives in the context of GHG BACT analyses and also to consider alternatives to a proposed source (including source siting, source need, "no build" options, and other case-specific factors) raised in public hearings and comments. EPA must issue such policy to fulfill the technology-forcing mandate of the PSD program and BACT requirements with respect to GHG emissions, to fully effectuate the CAA's requirements, and to meet the Biden Administration's goals of addressing environmental justice in air permitting actions. Moreover, this policy is necessary to be consistent with the overall mandates of the PSD program, including CAA Section 160(1) ("to

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[418] *Id.* at 2-3.
[419] EPA, Mem. Re *Transmittal of Background Statement on "Top-Down" Best Available Control Technology (BACT)* 5 (June 13, 1989) (citing S. Rep. No. 95-252, 95th Cong., 1st Sess. 31 (1977), reprinted in 3 A Legislative History of the CAA Amendments of 1977 at 1405; 123 Cong. Rec. S9171, 3 Legislative History at 729 (remarks of Sen. Edmund G. Muskie, principal author of 1977 Amendments)).
[420] *Id.*
[421] EPA OGC, *EPA Legal Tools to Advance Environmental* Justice, Publication No. 360R22001, at 40 (May 2022); *see also id.* at 41 (concluding environmental justice *must* be considered in connection with PSD permits based on Executive Order 12898).
[422] *See, e.g.*, *Prairie State*, 13 E.A.D. at 22-26 (considering § 165(a)(2) and concluding a permitter has discretion to consider and/or identify alternatives, but no "independent duty to investigate alternatives raised in public comments").

protect public health and welfare from any actual or potential adverse effect which…may reasonably be anticipated to occur…notwithstanding attainment and maintenance of all national ambient air quality standards and CAA §160(5) ("to assure that any decision to permit increased air pollution…is made only after careful evaluation of all of the consequences of such a decision and after adequate procedural opportunities for informed public participation in the decisionmaking process."). We thus urge EPA to issue clear guidance that a proper evaluation of GHG BACT must include analyses of alternatives to a proposed source or modification to be consistent with the mandates of the PSD program.

Thank you for your consideration of these comments.

Respectfully submitted,

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Attachments:

***Attachment 1A*:** Susan F. Tierney, Analysis Group, *U.S. Coal-Fired Power Generation: Market Fundamentals as of 2023 and Transitions Ahead* (Aug. 2023).

***Attachment 1B*:** Memorandum from Synapse to Env't Defense Fund, Analysis of New Gas Unit Coverage Under EPA's Proposed 111 Rule (Aug. 2023)

***Attachment 1C*:** Memorandum from Synapse to Env't Defense Fund, Analysis of Existing Gas Unit Coverage Under EPA's Proposed 111 Rule (Aug. 2023)