Comments of the Attorneys General of California, Connecticut, Delaware, Illinois, Iowa, Maine, Maryland, Massachusetts, Minnesota (by and through its Minnesota Pollution Control Agency), New Jersey, New Mexico, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Vermont, Virginia, Washington, and the District of Columbia, the Maryland Department of the Environment, and the cities of Boulder, Chicago, Los Angeles, New York, Philadelphia, and South Miami, and Broward County

on

the Environmental Protection Agency's Proposed Review of Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units, 83 Fed. Reg. 65,424 (Dec. 20, 2018)

Docket ID No. EPA–HQ–OAR–2013–0495

March 18, 2019

EXECUTIVE SUMMARY

The Attorneys General of California, Connecticut, Delaware, Illinois, Iowa, Maine, Maryland, Massachusetts, Minnesota (by and through its Minnesota Pollution Control Agency), New Jersey, New Mexico, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Vermont, Virginia, Washington, and the District of Columbia, the Maryland Department of the Environment, and the cities of Boulder, Chicago, Los Angeles, New York, Philadelphia, and South Miami, and the county of Broward (together, "States and Cities") submit these comments in opposition to the Environmental Protection Agency's (EPA) proposed Review of Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units, 83 Fed. Reg. 65,424 (proposed Dec. 20, 2018) (Proposed Rule). EPA intends that the Proposed Rule will replace the currently effective carbon dioxide (CO_2) standards of performance (Current Standard), 80 Fed. Reg. 64,510 (Oct. 23, 2015), which established the first nationwide emission limits new, modified, and reconstructed fossil fuel-fired electric generating power plants.

The States and Cities urge EPA to withdraw the Proposed Rule and leave the Current Standard in place. EPA promulgated the Current Standard in 2015 after considering an extensive factual record and explaining and supporting its legal justifications for its action. For new coal-fired power plants, the CO_2 emission limit in the Current Standard is based on what a modern plant could achieve by capturing a portion of its CO_2 emissions and storing it underground. EPA found that this partial carbon capture and sequestration (partial CCS) was the best system of emission reduction under Clean Air Act section 111 based on EPA's analysis of its technical feasibility and cost and the availability of geological storage sites throughout the country. The Current Standard is a rational, legal, and necessary response to the increasing harms from CO_2 pollution.

In contrast to its thoroughly supported 2015 rulemaking, EPA bases its new Proposed Rule on vague generalizations, illogical conclusions, unwarranted (and often even unacknowledged) changes in position, and distortions of the factual record. In its haste to roll back prudent CO_2 emission limits that exist under current law, EPA disregards, without reasonable explanation, the contrary and inconvenient findings it made just three years ago. The Supreme Court has identified this type of behavior as a hallmark of arbitrary and capricious rulemaking. Further, replacing the Current Standard with the weaker Proposed Rule is contrary to the requirements and purpose of the Clean Air Act.

EPA bases its reversal of its 2015 findings entirely on two new assertions. First, it says that partial CCS is more expensive than it previously believed. Second, it says that partial CCS is not available over as wide an area of the country as it previously believed. EPA's analysis of both of these issues is flawed and not nearly sufficient to overcome the contrary factual record EPA established in 2015. In reality, in the past three years the evidence that partial CCS is a reasonable and effective CO_2 control strategy has only grown. In addition, the majority of states have shown through their statutes and regulations that CCS is a demonstrated system of emissions reduction and/or that CCS adds value to businesses.

For its revised cost calculation, EPA improperly inflates the cost of partial CCS to make it appear harder to implement. The agency fails to explain why each of the components of its new calculation are superior to its previous multifaceted economic analysis. And, none of EPA's new cost calculations is sufficient to support EPA's conclusion that the cost of partial CCS is so great under the legal test for reasonableness that it can no longer be considered the best system of emission reduction. EPA's new cursory economic analysis avoids even calculating what impact the Proposed Rule will have if a new coal-fired power plant were to be built, even as it admits that CO_2 emissions would increase.

EPA's new discussion of the geographical availability of partial CCS is remarkable for its lack of analysis, disregard of facts, and leaps of logic. EPA previously found that more than enough potential underground storage capacity existed to store as much CO_2 as needed by any coal-fired plants and that pipelines would provide sufficient access to those sites from around the country. Nevertheless, EPA now feels that geological storage is not sufficiently available, ostensibly based on two new conclusions: (a) A type of geologic formation that EPA did not rely on in 2015 and that accounts for a tiny fraction of potential storage capacity must be disregarded; and (b) some areas of the country do not get as much rainfall as others so it might be harder to operate a CCS system in some places. EPA fails to provide evidence that either of these factors would support EPA reversing its well-considered determination in 2015 that partial CCS was sufficiently available across the nation that it should be considered the best system of emission reduction.

Research since EPA issued the Current Standard in 2015 has added to the overwhelming scientific evidence that greenhouse gas emissions are an immediate and escalating threat to well-being of people, the economy, and the environment, both in the United States and around the world. The States and Cities are already experiencing the severe effects of climate change, and further delay in reducing these risks would be inexcusable. EPA should put its efforts into protecting the public from the harms of greenhouse gas emissions and leave the Current Standard in place, instead of increasing the risk to public health and the environment by rolling back reasonable controls on dangerous pollutants, which is exactly what EPA seeks to do in the Proposed Rule.

I. INTRODUCTION

A. Recent evidence of climate change

Since EPA's publication of the original new source performance standard in 2015, the Earth experienced the warmest year on record—2016—breaking records set previously in 2014 and 2015.[1] Collectively, the past five years, from 2014 to 2018, are the warmest years in the modern record.[2] Climate science over these five years bolstered what has long been the

[1] *Global Temperature*, National Aeronautics and Space Administration, https://climate.nasa.gov/vital-signs/global-temperature/ (last visited Mar. 14, 2019).

[2] Press Release, National Aeronautics and Space Administration, 2018 fourth warmest year in continued warming trend, according to NASA, NOAA (Feb. 6, 2019), https://climate.nasa.gov/news/2841/2018-fourth-warmest-year-in-continued-warming-trend-according-to-nasa-noaa/. Global temperatures during 2018's first half were the hottest on record during a La Niña year. Press Release, World Metrological Organization, July sees extreme

conclusive consensus: Earth's climate system is rapidly changing, primarily due to human activity, and demands an ambitious, all-hands reduction of greenhouse gas emissions in order to avert the gravest impacts to American economies, ecosystems, and lives.

In 2017 and 2018, the U.S. Global Change Research Program released the Fourth National Climate Assessment (Fourth Assessment) in two volumes, which together review the current state of climate change science and detail ongoing and projected future physical impacts of global warming.[3] Coordinated by lead authors across 13 federal agencies, including EPA, the Fourth Assessment represents the work of over 300 governmental and non-governmental experts. It was externally peer-reviewed by a committee of the National Academy of Sciences, Engineering, and Medicine and underwent several rounds of technical and policy review by their member agencies.[4] In short, it is the federal government's authoritative analysis of climate science and the impacts of climate change on the United States. One key conclusion is stark, but hopeful: by shifting from our current high-emissions scenario to a low-emissions scenario, "[b]y the end of this century, thousands of American lives could be saved and hundreds of billions of dollars in health-related economic benefits gained each year."[5] Future generations would benefit even more.

The Earth's climate is rapidly changing. Earth's atmosphere now contains a higher concentration of CO_2 than it has in the past three million years.[6] In 2017, that concentration was 400 parts per million (ppm); in 2018, atmospheric CO_2 levels exceeded 410 ppm for the first time, then reached 411 ppm in May 2018. The growth rate of the global CO_2 level is accelerating: in the 1980s, it averaged 1.6 ppm per year and in the 1990s, 1.5 ppm per year, but

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weather with high impacts (Aug. 1, 2018), https://public.wmo.int/en/media/news/july-sees-extreme-weather-high-impacts.

[3] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Volume I (D.J. Wuebbles, et al., eds., 2017), https://science2017.globalchange.gov/ (Fourth Assessment, Vol. I); U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II, (D.R. Reidmiller et al. eds., 2018), https://nca2018.globalchange.gov/ (Fourth Assessment, Vol. II); *see generally* Global Change Research Act of 1990, Pub. L. No. 101-606. Both Volumes I and II of the Fourth Assessment are available in the rulemaking docket for the Clean Power Plan replacement. *See*, *e.g.*, Docket Nos**.** EPA-HQ-OAR-2017-0355-24806; EPA-HQ-OAR-2017-0355-26637. Note that EPA has incorporated into the rulemaking docket for the Proposed Rule all documents in the rulemaking docket for the Clean Power Plan replacement. *See* U.S. EPA, Memorandum, Incorporation by Reference of Docket No. EPA-HQ-OAR-2017-0355 (Dec. 2018), Docket ID EPA-HQ-OAR-2013-0495-11938.

[4] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II: Report-in-Brief, 1-2 (D.R. Reidmiller et al. eds., 2018), https://nca2018.globalchange.gov/downloads/NCA4_Report-in-Brief.pdf (Fourth Assessment, Vol. II: Report-in-Brief).

[5] Fourth Assessment, Vol. II: Report-in-Brief, at 102.

[6] Fourth Assessment, Vol. I, at 31.

increased to 2.2 ppm per year during the last decade. Historically high levels of coal, oil, and natural gas consumption are fueling these escalating CO_2 growth rates.[7]

High atmospheric CO_2 concentrations have, in turn, driven historically high global temperatures. Global annual average surface air temperature increased by 1.8°F (1.0°C) from 1901 to 2016, the Fourth Assessment concluded. "This period is now the warmest in the history of modern civilization."[8] Melting ice sheets and glaciers, caused by the increases in temperatures, have accelerated global mean sea level rise faster during the last century than in any previous century in at least 2,800 years, contributing to daily tidal flooding increases in over 25 Atlantic and Gulf Coast cities.[9] Reduced snow cover threatens regional water supplies,[10] while ocean acidification endangers marine aquaculture and major ecosystems.[11] In fact, researchers project oceans will become more acidic than they have been in the last 14 million years due to the amount of atmospheric CO_2 they have absorbed to date.[12]

The science behind attribution of extreme storms to anthropogenic climate change continues to improve, and climate models generally show the planet's warming produces more frequent intense hurricanes.[13] Future hurricanes will have stronger maximum winds, move more slowly, and drop more precipitation, according to a modeling analysis of 22 recent hurricanes by U.S. government scientists.[14] Similarly, in 2018, U.S. government and academic scientists found warmer sea surface temperatures and available atmospheric moisture, attributable to climate

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[7] National Oceanic and Atmospheric Administration, "Another Climate Milestone on Mauna Loa" (Jun. 7, 2018), https://research.noaa.gov/article/ArtMID/587/ArticleID/2362/Another-climate-milestone-falls-at-NOAA%E2%80%99s-Mauna-Loa-observatory

[8] Fourth Assessment, Vol. I, at 10, 13, 17 (Exec. Summ.), 39, 40 (Ch. 1), 78, 80-84 (Ch. 2).

[9] *Id.* at 10, 25-27 (Exec. Summ.), 51-52 (Ch. 1).

[10] *Id.* at 10 (Exec. Summ.), 239-240 (Ch. 8).

[11] *Id.* at 28 (Exec. Summ.), 371-374 (Ch. 13).

[12] S. M. Sosdian, et al., "Constraining the evolution of Neogene ocean carbonate chemistry using the boron isotope pH proxy," in *Earth and Planetary Science Letters*, Vol. 498, 362-376 (Sept. 2018), https://doi.org/10.1016/j.epsl.2018.06.017.

[13] Fourth Assessment, Vol. I, at 258-260 (Ch. 9).

[14] Gutmann et al., "Changes in Hurricanes from a 13-Yr Convection-Permitting Pseudo-Global Warming Simulation, in *J. Climate*, Vol. 31, 3643-3657 (May 2018), https://doi.org/10.1175/JCLI-D-17-0391.1. The unprecedented rainfall totals associated Hurricane Harvey's stall of over Texas in 2017 provides a notable example of how slow-moving hurricanes impact regional rainfall amounts. Kossin, J., "A global slowdown of tropical-cyclone translation speed," in *Nature*, 558, 104-107 (June 2018), https://doi.org/10.1038/s41586-018-0158-3.

change, were expected to increase Hurricane Florence's rainfall amounts by over 50 percent.[15] On October 10, 2018, Hurricane Michael made landfall near Mexico Beach, Florida, as the strongest storm ever to hit the Florida Panhandle, and the fourth-strongest ever to landfall in the continental United States. As Hurricane Michael approached the United States, abnormally warm waters in the Gulf of Mexico fueled its rapid intensification.[16] These intensifications are consistent with scientists' prediction for increasing hurricane magnitudes in a warming world.

Human activities, especially greenhouse gas emissions, are primarily responsible for global climate change. The Fourth Assessment confirmed the established science that human-caused greenhouse gas emissions are primarily responsible for the 1.8°F of observed warming from 1901 to 2016, concluding: "observational evidence does not support any credible natural explanations for this amount of warming; instead, the evidence consistently points to human activities, especially emissions of greenhouse or heat-trapping gases, as the dominant cause."[17]

Since 2015, the National Academies of Sciences, Engineering, and Medicine have determined that scientists' ability to attribute individual extreme weather events to climate change is increasing.[18] This likelihood is "greatest for those extreme events that are related to an aspect of temperature, such as the observed long-term warming of the regional or global climate, where there is little doubt that human activities have caused an observed change."[19]

The journal of the American Meteorological Society (AMS) has published seven annual special reports describing studies evaluating the connection (or lack of connection) between specific extreme weather events and anthropogenic climate change. In 2018, for the second year in a row, scientists were able to identify extreme weather events that could not have happened without warming of the climate through human-induced climate change. In previous AMS reports, 89 studies of extreme weather events found that climate change had increased the

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[15] Reed et al., "The Human Influence on Hurricane Florence" (2018), https://crd.lbl.gov/assets/Uploads/Wehner/climate-change-Florence-0911201800Z-final.pdf. The study is based on forecasts before Florence came ashore.

[16] National Weather Service, National Hurricane Center, Hurricane Michael Discussion Number 10 (Oct. 20, 2018), https://www.nhc.noaa.gov/archive/2018/al14/al142018.discus.010.shtml; https://phys.org/news/2018-10-turbocharged-michael-percent-stronger-day.html

[17] Fourth Assessment, Vol. II, at 73 (Ch. 2). *See also* Fourth Assessment, Vol. I, at 36 ("Over the last century, there are no alternative explanations supported by the evidence that are either credible or that can contribute more than marginally to the observed patterns.").

[18] National Academies of Sciences, Engineering, and Medicine, *Attribution of Extreme Weather Events in the Context of Climate Change*. Washington, DC: The National Academies Press (2016). https://doi.org/10.17226/21852

[19] *Id.* at 7, 128.

likelihood of the event occurring.[20] However, in the 2017 AMS report, the authors found several 2016 extreme weather events that would not have been "possible without the influence of human caused climate change."[21] These extreme events included: (1) record-breaking global temperatures, (2) record-breaking regional temperatures over the Asian continent, and (3) the anomalous warm water temperatures in Alaska's Bering Sea. In the 2018 AMS report, the November 2017/18 Saman Sea marine heatwave was found to be virtually impossible without anthropogenic influence.[22] These events are beyond the bound of the "natural" climate and *would not have occurred* absent the ongoing anthropogenic alteration of Earth's climate.

Further confirming the attribution of extreme events to climate change, two independent research teams, including one from the Department of Energy's Lawrence Berkeley National Laboratory, recently released studies identifying a clear anthropogenic contribution to the torrential precipitation that inundated Houston during Hurricane Harvey, reporting the precipitation was 15 to 19 percent more intense due to climate change.[23] It is estimated that Hurricane Harvey was the second costliest natural disaster on record in U.S. history, resulting in $125 billion in total damages.[24] Similar studies indicate the intensity and frequency of such events have increased since 1901, especially in the northeastern United States.[25] For instance, in

[20] Herring, S. C., Eds., "Explaining Extreme Events of 2016 from a Climate Perspective," in *Bull. Amer. Meteor. Soc*., Vol. 98 (No. 12), p. S1 (Dec. 2017), https://extranet.gfdl.noaa.gov/~atw/yr/2018/2016_bams_eee_high_res.pdf.

[21] *Id.*

[22] Herring, S.C., N. Christidis, A. Hoell, M.P. Hoerling and Stott, P.A., eds., "Explaining Extreme Events of 2017 from a Climate Perspective," *Bull. Amer. Meteor. Soc.*, Vol. 100 (No. 1), p. S1-S117, https://journals.ametsoc.org/doi/abs/10.1175/BAMS-ExplainingExtremeEvents2017.1.

[23] Risser M. and M.F Wehner," Attributable human-induced changes in the likelihood and magnitude of the observed extreme precipitation during Hurricane Harvey," in *Geophys. Res. Ltrs*., *Lett.*, 44 (Dec. 2017), http://dx.doi.org/10.1002/2017GL075888; Geert Jan van Oldenborgh et al., "Attribution of extreme rainfall from Hurricane Harvey, August 2017, in *Environ. Res. Ltrs*., Vol. 12, 124009, 1, 9 (Dec. 2017), https://iopscience.iop.org/article/10.1088/1748-9326/aa9ef2.

[24] *Hurricane Costs*, National Oceanic and Atmospheric Administration, Office for Coastal Management, https://coast.noaa.gov/states/fast-facts/hurricane-costs.html (last visited Mar. 14, 2019).

[25] Fourth Assessment, Vol. I, at 20 (Exec. Summ.), 210-213, 214-216 (Ch. 7). For example, one study concluded anthropogenic forcing has increased the odds of an extreme, three-day rainfall event (like the Louisiana flooding in August 2016) by 40% or more. (*Id.* at 216 (citing van der Wiel, K., *et al.*, "Rapid attribution of the August 2016 flood-inducing extreme precipitation in south Louisiana to climate change," in *Hydrology & Earth Sys. Sciences*, Vol. 21, 897-921 (2017) http://dx.doi.org/10.5194/hess-21-897-2017).)

New York State, communities and infrastructure have incurred significant damage from heavy rains in recent years.[26]

Reducing greenhouse gas emissions will avert the gravest impacts to economies, ecosystems, and lives. **C**limate change projections developed by the Intergovernmental Panel on Climate Change (IPCC) explore multiple paths of various greenhouse-gas emissions levels. Consistently, projections based on lower emissions levels show less harm to ecosystems and human health, economies, agriculture, and infrastructure, than do high-emission scenarios. Relying on the IPCC standards, EPA and other federal agencies conclude in the Fourth Assessment that by 2100 "thousands of American lives could be saved and hundreds of billions of dollars in health-related economic benefits gained each year under a pathway of lower greenhouse gas emissions."[27]

Research since EPA's 2015 rulemaking confirms the enormous relative benefits of a low-emissions scenario. The Fourth Assessment's first volume (2017) projected that, under relatively low-emissions scenarios, global temperatures would increase by 0.5° to 1.3°F by the end of the century, and under high-emissions scenarios, by 4.7° to 8.6°F.[28] However, temperature changes are expected to be higher for the contiguous United States. Increases of 2.5°F are projected between 2021 and 2050 relative to the average from 1976 to 2005 in all Representative Concentration Pathway emission scenarios, but much larger rises are projected by the end of this century, as high as 5.8° to 11.9°F for the highest emission scenario.[29] According to the IPCC's October 2018 report, global warming is likely to reach 1.5°C between 2030 and 2052 if emissions continue to increase at the current rate.[30]

The difference in global temperature rises under lower- or higher-emissions scenarios translates to billions of dollars in human costs and incalculable damage to the environment. National climate response costs reached $306 billion in 2017, the most expensive year on record.[31] If emissions continue to grow at historic rates, the Fourth Assessment finds "annual

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[26] Current & Future Trends in Extreme Rainfall Across New York State, A Report from the Environmental Protection Bureau of the New York State Attorney General (Sept. 2014) https://ag.ny.gov/sites/default/files/extreme_precipitation_report9214b.pdf.

[27] Fourth Assessment, Vol. II: Report-in-Brief, at 102.

[28] Fourth Assessment, Vol. I, at 133 (Ch. 4).

[29] *Id.* at 185 (Ch. 6).

[30] Intergovernmental Panel on Climate Change, Masson-Delmotte, V., et al., Eds., "Global warming of 1.5 °C - Summary for Policymakers," at 6 (Oct. 6, 2018), http://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf (IPCC 2018 Summary).

[31] National Oceanic and Atmospheric Administration, Assessing the U.S. Climate in 2017 (December 2017), https://www.ncei.noaa.gov/news/national-climate-201712. The following year, 2018, marked the eighth consecutive year with eight or more billion-dollar climate disasters, including Hurricane Michael ($25 billion), Hurricane Florence ($24 billion), and the complex of western wildfires ($24 billion). National Oceanic and Atmospheric Administration,

losses in some economic sectors are projected to reach hundreds of billions of dollars by the end of the century—more than the current gross domestic product of many U.S. states."[32] A study of agricultural crop response to climate change indicates that, while insect pests currently consume 5 to 20 percent of major grain crops (such as wheat, rice, and corn), models show yield lost to insects will increase by 10 to 25 percent per degree Celsius of warming.[33] The IPCC projects major damage to marine ecosystems such as coral reefs, which are projected to decline 70 to 90 percent at 1.5°C of warming, while effectively disappearing worldwide at 2°C warming.[34] Under current emissions levels, self-reinforcing climate system feedbacks, including the die-off of boreal forests, Arctic sea ice loss, and the release of methane from permafrost, risk creating a "Hothouse Earth" effect, where warming continues even if greenhouse gas emissions are eventually reduced. Some of these feedbacks may not be reversible, even over the long term.[35]

Limiting climate change to the lower-emissions scenarios is an urgent task that demands a strong government commitment to emissions reductions.[36] Likewise, it is imperative the United States exercise its technology-forcing powers to advance proven and viable emissions-reducing science—such as geologic carbon capture and storage —into more effective, widespread uses.

B. Climate-change-related harms affecting States and Cities

The States and Cities are home to approximately 158 million people, or roughly 48 percent of the population of the United States. We are already suffering the deleterious impacts of global climate change caused by manmade emissions of greenhouse gases. Our residents have lost property, been displaced from homes, and even been killed as a result of severe weather events exacerbated by climate change. Our infrastructure has been damaged and our economies have been injured by more extreme heat, shorter winters, and rising sea levels. The recent Fourth Assessment projects more extreme-weather impacts for every region of the U.S.—including major damage to agriculture, coastal industries, utility grids, transportation networks, air quality, and human health—from coastal flooding, heat waves, drought, and wildfires, as well as from the spread of tree-killing and disease-carrying pests.

Appendix A to these comments contains a detailed description, with citations, of significant harms and threats each of the States and Cities is facing. Those threats are highlighted in this section.

Assessing the U.S. Climate in 2018 (Dec. 2018), https://www.ncei.noaa.gov/news/national-climate-201812.

[32] Fourth Assessment, Vol. II, at 26 (Summary Findings).

[33] Deutsch, C. et al., "Increase in crop losses to insect pests in a warming climate," in *Science*, 31 August 2018: 916-919, https://doi.org/10.1126/science.aat3466.

[34] IPCC 2018 Summary at 10.

[35] Steffen, W., et al., "Trajectories of the Earth System in the Anthropocene," in *Proceedings of the Nat'l Academy of Sciences*, Aug. 14, 2018 115 (33) 8252-8259, https://doi.org/10.1073/pnas.1810141115.

[36] IPCC 2018 Summary at 17-18.

- ***Heat waves***. Over the past fifty years, record-setting temperatures and intense heat waves have spiked in most regions of the U.S.[37] If emissions continue at their present high rate, the increase in extreme heat events is projected by 2090 to cause 2,000 additional premature deaths per year in the Midwest, and 1,300 per year in the Northeast.[38] Between the middle and end of this century Chicago could experience five days per year (low-emissions scenarios) or twenty-five days per year (high-emissions scenarios) with conditions similar to the 1995 heat wave that caused 800 deaths in the city.[39] Parts of the Southeast will face more than 100 additional warm nights (greater than 75°F) per year, leading to more heat-related illnesses and deaths.[40] In Washington, D.C., heat emergency days (when the heat index exceeds 95°F) could more than double, from the current 30 days per year to 70 days per year (low-emissions scenario) or 105 days per year (high-emissions scenario) by the 2080s.[41]

- ***Wildfires***. The number of large forest fires has significantly increased over the past three decades, with one model finding human-driven climate change responsible for doubling the area burned by forest fires over 1984-2015.[42] The Northwest's exceptionally warm 2015 led to its worst wildfire season in recorded history, with 1.6 million acres burned.[43] According to California's Fourth Climate Assessment (August 2018), "large wildfires (greater than 25,000 acres) could become 50% more frequent by end of century if emissions are not reduced."[44] More years will see extremely high areas burned, even compared to the historically destructive wildfires

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[37] Fourth Assessment, Vol. I, at 191-92 (Ch. 6). In the Southeast, 61% of major cities are currently exhibiting worsening heat waves (in timing, frequency, intensity, or duration). *Fourth Assessment, Vol. II*, at 752 (Ch. 19).

[38] Fourth Assessment, Vol. II, at 698 (Ch. 18), 898 (Ch. 21).

[39] Hayhoe, K., et al., "Climate change, heat waves, and mortality projections for Chicago," in *J. of Great Lakes Res.*, Vol. 36, Supp. 2, 65-73 (2010), https://doi.org/10.1016/j.jglr.2009.12.009.

[40] Fourth Assessment, Vol. II, at 752-753 (Ch. 19).

[41] District of Columbia Department of Energy & Environment, *Climate Projections & Scenario Development*, at 27 (June 2015), https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/150828_AREA_Research_Report_Small.pdf.

[42] Fourth Assessment, Vol. I, at 242-243 (Ch. 8).

[43] Fourth Assessment, Vol. II, at 1066-67 (Ch. 24).

[44] Thorne, James H., et al., California's Fourth Climate Change Assessment, California Natural Resources Agency, 9 (Aug. 2018), www.ClimateAssessment.ca.gov. California's Fourth Climate Change Assessment includes 33 papers from State-funded researchers and 11 papers from externally-funded researchers, as well as regional summaries and a statewide summary of climate vulnerabilities, and a key findings paper. The Statewide Summary Report (Calif. 4th Assessment) can also be found at Docket ID EPA-HQ-OAR-2017-0355-24806, Ex. 12.

of 2017 and 2018; by 2099, California wildfires could burn up to 178 percent more acres per year than current averages.[45]

- ***Severe storms***. The past three years have witnessed storms of record destructive power in the Southeast. In 2016, Hurricane Matthew caused $1.5 billion in damage.[46] In 2017, warm waters strengthened Hurricane Irma into a devastating high-intensity storm that caused flooding, mass evacuations, and $50 billion in damage.[47] In 2018, Hurricane Florence claimed 44 lives in North Carolina and caused an estimated $17 billion in damage.[48] Compared to U.S. storms of the last 70 years, Florence produced the second highest amount of rain in a concentrated land area, with four of the top seven storms having occurred in the last three years.[49] These back-to-back hurricanes, which would have once been described as extremely rare in North Carolina,[50] are projected to increase in frequency, power, and duration if greenhouse gas emissions continue to drive global warming.[51]

- ***Flooding***. Coastal flooding, exacerbated by sea-level rise, increasingly plagues the States and Cities. Ordinary rain events now cause flooding in Norfolk, Virginia; Naval Station Norfolk, the world's largest navy base, currently is "one of the most

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[45] Calif. 4th Assessment, at 30.

[46] Press Release, Federal Emergency Management Agency, Six Months Following Hurricane Matthew, Volunteers Work for North Carolina Progress (Apr. 6, 2017), https://www.fema.gov/news-release/2017/04/06/six-months-following-hurricane-matthew-government-partners-volunteers-work.

[47] Fourth Assessment, Vol. II, at 766-768 (Ch. 19).

[48] Press Release, North Carolina Governor's Office, Six Months After Florence Made Landfall, North Carolina Continues Work to Rebuild (Mar. 12, 2019), https://governor.nc.gov/news/six-months-after-florence-made-landfall-north-carolina-continues-work-rebuild; Press Release, North Carolina Governor's Office, Updated Estimates Show $17 Billion in Damage (Oct. 31, 2018), https://governor.nc.gov/news/updated-estimates-show-florence-caused-17-billion-damage.

[49] Borenstein, S., Florence Is Nation's Second Wettest Storm, Behind Harvey, WFTV (Sep. 27, 2018), https://www.wftv.com/weather/eye-on-the-tropics/florence-is-nation-s-second-wettest-storm-behind-harvey/842701535.

[50] Based on pre-climate change weather patterns, Hurricane Florence's rainfall was described as an event eastern North Carolina could expect to occur only once every 1000 years. (Risk Management Solutions, "Hurricane Florence: Rainfall up to a 1,000-Year Return Period" (Sep. 14, 2018), https://www.rms.com/blog/2018/09/14/hurricane-florence-rainfall-up-to-a-1000-year-return-period/.) Hurricane Matthew would ordinarily be a "500-year flood event." (Office of Water Prediction, National Weather Service, "Hurricane Matthew, 6-10 October 2016 Annual Exceedance Probabilities (AEPs) for the Worst Case 24-Hour Rainfall" (Oct. 18, 2016), http://www.nws.noaa.gov/ohd/hdsc/aep_storm_analysis/AEP_HurricaneMatthew_October2016.pdf.) Yet these storms hit eastern North Carolina *two years* apart.

[51] Fourth Assessment, Vol. I, at 258-260 (Ch. 9).

vulnerable to flooding" military installations in the U.S., as relative sea-level rise contributes to "more frequent nuisance flooding and increased vulnerability to coastal storms."[52] In South Florida, tidal flooding has become increasingly frequent and dramatic, and may become a daily, year-round hazard by the 2070s under high- and intermediate- emissions scenarios.[53] In Delaware, over 2,000 businesses and 17,000 homes are at risk of permanent inundation from sea-level rise by the end of the century.[54] In Maryland, catastrophic rainfall and flooding in May 2018 saw the Patapsco River rise nearly 18 feet in just two hours, while flash floods turned Ellicott City's Main Street into a river over 10 feet deep. These floods will only increase as warming ocean temperatures push sea levels higher. In New England, regional sea-level rise as high as 11 feet is projected.[55] In the Southeast, sea-level rise and extreme rainfall are projected to cause "daily high tide flooding by the end of the century" and cost up to $99 billion annually under a high-emissions scenario.[56]

- ***Diseases and pests***. In New England, warmer temperatures contribute to the spread of tick-borne diseases like Lyme disease.[57] In Pennsylvania, climate change is expected to increase the prevalence of West Nile disease in higher-elevation areas and the duration of the transmission season.[58] Climate change is likewise projected to increase insect-borne disease like dengue fever and Zika virus across the Southeast, including year-round transmission in southern Florida.[59] In the Southwest, climate change has contributed to increased forest pest infestations, a major cause of tree death. Bark beetle infestations killed 7 percent of western forest area from 1979 to 2012, driven by warming winters and drought.[60]

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[52] U.S. Dept. of Defense, Report on Effects of a Changing Climate to the Department of Defense" (Jan. 2019), https://www.documentcloud.org/documents/5689153-DoD-Final-Climate-Report.html.

[53] Sweet, W. et al., "Patterns & Projections of High Tide Flooding along the U.S. Coastline Using a Common Impact Threshold," NOAA Tech. Rep. NOS CO-OPS 086, 15, 23-25 (Feb. 2018), https://tidesandcurrents.noaa.gov/publications/techrpt86_PaP_of_HTFlooding.pdf.

[54] Del. Dept. of Nat. Res., *Preparing for Tomorrow's High Tide: Sea Level Rise Vulnerability Assessment for the State of Delaware*, 72-75, 78-81 (July 2012), http://www.dnrec.delaware.gov/coastal/Documents/SeaLevelRise/AssesmentForWeb.pdf.

[55] Fourth Assessment, Vol. II, at 692-695 (Ch. 18).

[56] *Id.* at 757-758 (Ch. 19).

[57] Dumic, I. & Severnini, E., "'Ticking Bomb': The Impact of Climate Change on the Incidence of Lyme Disease," in *Can. J. of Inf. Dis. & Med. Microbio.*, Vol. 2018, 5719081 (Oct. 2018), https://doi.org/10.1155/2018/5719081.

[58] Shortle, J., et al., Pennsylvania Climate Impacts Assessment Update, 135 (May 2015), https://www.pennfuture.org/Files/Admin/Pennsylvania-Climate-Impacts-Assessment-Update---2700-BK-DEP4494.compressed.pdf.

[59] Fourth Assessment, Vol. II, at 754-55 (Ch. 19).

[60] *Id.* at 1116-17 (Ch. 25).

- ***Droughts***. Chronic, long-duration droughts are increasingly likely under high-emissions scenarios.[61] The 2011-2016 California drought, exacerbated by extreme warmth and reduced Sierra Nevada snowpack,[62] led to losses of over 10,000 jobs and the fallowing of 540,000 acres, at a cost of $900 million in gross crop revenue in 2015.[63] In the Northwest, 2015's record high temperatures led to a "snow drought," in which low snowpack and a dry spring created shortages in irrigation, hydropower, and human consumption and caused widespread fish die-offs. Under high-emissions scenarios, the Northwest's warming winters are projected to cause more precipitation to fall as rain instead of snow, leading to flooding and landslides in the winter and reduced streamflows in spring and summer.[64] Climate change is similarly projected to increase extremes of rain and drought across the Southeast.[65]

- ***Threats to water quantity and quality***. Climate change increasingly threatens states that rely on snowpack for their drinking water. Snowpack in Washington's Cascade Mountains has already decreased by 25 percent since the mid-20th century, and is anticipated to decrease by 38 to 46 percent (relative to 1916-2006) by the 2040s.[66] New Mexico and California face similar reduced snowpack to support their cities, agriculture, and ecosystems.[67, 68] In Broward County, Florida, rising seas are driving saltwater contamination into freshwater supplies. U.S. Geologic Survey modeling in collaboration with the County reveals a predicted loss of 35 million gallons per day in water supply capacity by 2060 (40 percent of Broward's coastal well field capacity), due entirely to additional sea level rise.

- ***Threats to air quality***. Currently, more than 100 million U.S. residents live in communities where air pollution exceeds health-based air quality standards. Climate change is projected to increase ground-level ozone and other air pollution, especially

[61] Fourth Assessment, Vol. I, at 240 (Ch. 8); Calif. 4th Assessment, at 22, 24-26.

[62] Calif. 4th Assessment, at 13.

[63] Fourth Assessment, Vol. II, at 1127 (Ch. 25).

[64] *Id.* at 1054-55, 1066-67 (Ch. 24).

[65] *Id.* at 775 (Ch. 19).

[66] State of Knowledge Report, Climate Change Impacts and Adaptation in Washington State: Technical Summaries for Decision Makers, at 2-5, 6-10 (Dec. 2013), Climate Impacts Group, Univ. of Washington (Wash. State of Knowledge Report), https://cig.uw.edu/resources/special-reports/wa-sok/.

[67] Brian H. Hurd & Julie Coonrod, Climate Change and Its Implications for New Mexico's Water Resources and Economic Opportunities, NM State University, Technical Report 45, at 1, 24 (2008); https://aces.nmsu.edu/pubs/research/economics/TR45.pdf.

[68] Calif. 4th Assessment, at 27.

in already polluted areas.[69,70] For example, in the Midwest, increased ground-level ozone concentrations are projected to result in an additional 200 to 550 premature deaths per year by 2050, while lengthening pollen seasons will adversely impact children with asthma and respiratory diseases.[71] In the Northwest and Southwest, ozone and wildfire smoke are projected to increase cardiovascular and respiratory diseases.[72]

- ***Threats to utility and transportation networks***. The U.S. has over 60,000 miles of roads and bridges in coastal floodplains, all of which are vulnerable to increasing extreme storms and sea-level rise. On the East Coast alone, flooding has increased transportation disruptions by 85 percent from 2010, to 100 million vehicle-hours of delay.[73] Under a high-emissions scenario, EPA itself projects $400 million more in annual service costs for Midwestern bridges and $3.3 billion in annual damages to roads by 2050.[74]

- ***Threats to agriculture and timber***. In the Midwest, increases in warm-season humidity and precipitation "have eroded soils, created favorable conditions for pests and pathogens, and degraded the quality of stored grain."[75] Illinois faces up to 77-percent average yield loss across all crops by the end of the century, while in Iowa, absent significant adaptation, the state could suffer 18- to 77-percent declines in its corn crop, a $10 billion industry.[76] In Washington, under a moderate emissions scenario, the range for Douglas fir—a major timber tree—is expected to decline 32 percent by the 2060s.[77]

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[69] Fourth Assessment, Vol. II, at 519 (Ch. 13).

[70] Climate change likewise weakens the circulating effect of extratropical cyclones that move smog, storms, and heat waves out of cities, thereby exacerbating their damage and health impact. *See* Gertler, C. et al., "Changing available energy for extratropical cyclones and associated convention in Northern Hemisphere summer," in *Proceedings of the Nat'l Academy of Sciences* (Feb. 19, 2019) https://doi.org/10.1073/pnas.1812312116; Roston, E., "A Summer of Storms and Smog Is Coming," *Bloomberg* (Feb. 19, 2019), https://www.bloomberg.com/news/articles/2019-02-19/summer-2019-climate-change-will-bring-strong-storms-and-smog.

[71] Fourth Assessment, Vol. II, at 896 (Ch. 21); *see also id.* at 1059 (Ch. 24, Northwest); *id. at* 1130-1131 (Ch. 25, Southwest).

[72] *Id.* at 1059 (Ch. 24), 1130 (Ch. 25).

[73] *Id.* at 486-487 (Ch. 12).

[74] *Id.* at. at 900, 905 (Ch. 21).

[75] *Id.* at 880 (Ch. 21).

[76] Gordon, Kate, et al., *Heat in the Heartland: Climate Change and Economic Risk in the Midwest*, Risky Business, 33 (2015), http://riskybusiness.org/site/assets/uploads/2015/09/RBP-Midwest-Report-WEB-1-26-15.pdf.

[77] Wash. State of Knowledge Report, at 7-1.

- ***Threats to marine industries***. The 2015 snow drought in Washington led to the largest harmful algal bloom recorded on the West Coast, closing fisheries along the entire Northwest coast.[78] In Rhode Island, warmer water in Narragansett Bay are causing iconic cold-water fish (cod, winter flounder, hake, and lobster) to move north out of Rhode Island waters and warm-water southern species (scup, butterfish, and squid) to become more prevalent, and ocean acidification due to increased CO_2 severely threatens young shellfish.[79] In Maine, rising temperatures in the Gulf of Maine have led non-native green crabs to invade and adversely impact soft-shell clam flats throughout southern and mid-coast Maine, and continued warming may cause a dramatic decline in populations of the world-famous Maine lobster, similar to the declines in lobster populations that have already been observed in the southern New England states.[80]
- ***Threats to regional ecosystems***. In Northeast, "decreasing seasonality" is already harming tourism, farming, and forestry,[81] while Florida's coral reefs—which support tourist industries, coastal protection, and marine habitats—likely will be lost in the coming decades.[82] Global warming may lead to the death of 72 percent of the Southwest's evergreen forests by 2050, and nearly 100-percent mortality of these forests by 2100.[83]

The threats of climate change are stark. Framed in the reverse, however, these projections show the enormous opportunity that regulatory agencies like EPA have to save lives, ecosystems, and industries through sensible emissions controls. As described above, the States and Cities are already experiencing the severe effects of climate change, and further delay in reducing these risks is inexcusable. Meaningful federal action is urgently needed to protect the health and welfare of our country.

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[78] Fourth Assessment, Vol. II, at 1066-67 (Ch. 24).

[79] R.I. Exec. Climate Change Coord. Council Science & Technical Advisory Board Annual Report, Current State of Climate Science in Rhode Island, at 7 (May 2016), http://climatechange.ri.gov/documents/ec4-science-and-technical-advisory-board-report.pdf

[80] Woodard, C., *Mayday: Gulf of Maine in Distress*, Portland Press Herald, Oct. 25, 2015, http://www.pressherald.com/2015/10/25/climate-change-imperils-gulf-maine-people-plants-species-rely/; Wahle, R. A., et al., "American lobster nurseries of southern New England receding in the face of climate change," ICES J. of Marine Sci., 72: i69–i78 (May 2015), https://doi.org/10.1093/icesjms/fsv093; Penelope Overton, *Gulf of Maine lobster boom over as population starts to decline*, Portland Press Herald, Jan. 29, 2018, https://www.sentinelsource.com/news/environment/gulf-of-maine-lobster-boom-over-as-population-starts-to/article_cc5951cf-6f95-5195-925b-0e413ac6fb5e.html

[81] Fourth Assessment, Vol. II, at 675, 678 (Ch. 18).

[82] *Id.* at 776 (Ch. 19).

[83] McDowell, N.G., et al., "Multi-scale predictions of massive conifer mortality due to chronic temperature rise," in *Nature Climate Change* 6, 295-300 (Dec. 2015), https://doi.org/10.1038/NCLIMATE2873.

C. States' and Cities' response to the urgent need to reduce carbon dioxide emissions from the electric generating sector

The States and Cities have pursued more than a decade of litigation and regulatory efforts to limit CO_2 emissions. For instance, certain States and Cities' lawsuit to compel EPA to limit greenhouse gas emissions led the Supreme Court to rule that EPA was obliged "to regulate emissions of the deleterious pollutant" if it found that the emissions endanger public health or welfare. *Massachusetts v. EPA*, 549 U.S. 497, 528-29, 533 (2007). EPA subsequently found in 2009 that greenhouse gases, including CO_2, endanger public health and welfare by causing more intense, frequent, and long-lasting heat waves; worse smog in cities; longer and more severe droughts; more intense storms, hurricanes, and floods; the spread of disease; and a rise in sea levels.[84]

While *Massachusetts* was still pending, in the *American Electric Power v. Connecticut* case certain States and Cities also brought common law public nuisance claims directly against power plants, seeking reductions in the CO_2 pollution that was harming the health and welfare of their citizens. *Am. Elec. Power Co. v. Connecticut*, 564 U.S. 410, 418 (2011) (*AEP v. Connecticut*). When *AEP v. Connecticut* reached the Supreme Court (after *Massachusetts v. EPA*), the Court held that the Clean Air Act "directly" authorized EPA to regulate CO_2 from power plants under section 111. *Id.* at 424.

The rules EPA issued in 2015 to limit CO_2 pollution from new fossil-fueled power plants under section 111(b) and existing plants under section 111(d) (the Clean Power Plan) marked the culmination of the States' and Cities' litigation to compel the agency to act. In those rules, EPA also cited the Supreme Court's recognition of EPA authority under section 111 as part of its legal justification for the regulations. *See* Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. at 64,527, 64,759 (2015 Preamble); *see also AEP v. Connecticut*, 564 U.S. at 424.

In the nearly 10 years since EPA found that greenhouse gas pollution endangers public health and welfare, the evidence that these emissions harm humans—including particularly vulnerable populations—has only grown stronger. Our states are already experiencing harms from climate change, such as flooding from rising seas, increasingly severe storms, and prolonged droughts. Unless CO_2 emissions are significantly reduced, climate change threatens to worsen these harms.

Many states have already acted to reduce CO_2 emissions from existing and future power plants within their borders. For example, through the Regional Greenhouse Gas Initiative states limit these emissions under a trading program. Also, California, New York, Oregon, and Washington impose CO_2 emission limits on new fossil-fueled power plants that are even more stringent than the Current Standard. Further, half of the states in the country have established permitting and monitoring standards for carbon capture or storage or have provided regulatory or financial incentives to promote those technologies. *See* section III.C.3, below.

Although the Fourth Assessment credits emission reduction strategies the States and Cities and others have already put into action, it concludes that current efforts "do not yet

[84] Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66,496, 66,497, 66,524-25, 66,532-33 (Dec. 15, 2009).

approach the scale considered necessary to avoid substantial damages to the economy, environment, and human health over the coming decades."[85] Robust, nationwide emissions standards for power plants are vital to securing the health, safety, and prosperity of future generations of Americans.

II. OVERVIEW OF EPA'S NEW SOURCE PERFORMANCE STANDARDS FOR COAL-FIRED POWER PLANTS

A. Statutory framework

Section 111 of the Clean Air Act contains the New Source Performance Standards program, which requires EPA to regulate all categories of stationary (non-vehicle) sources that cause, or contribute significantly to, air pollution that may reasonably be anticipated to endanger public health or welfare. 42 U.S.C. § 7411(b)(1)(A) (section 111(b)). Section 111(b) requires EPA to establish standards of performance governing the emission of air pollutants from new sources, and to review and, if appropriate, revise, those standards at least every eight years. *Id.* § 7411(b)(1)(B). "Standard of performance" means "a standard for emissions of air pollutants which reflects the degree of 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 has been adequately demonstrated." *Id.* § 7411(a)(1). EPA sets performance standards for new sources by reference to emissions levels that can be achieved using the most up-to-date control technology or method of limiting emissions of each type of pollutant that is both feasible and achievable at a reasonable cost, but it does not mandate any specific equipment, technology, or method. *Id.* § 7411(a)(1) & (b)(5). Under the Clean Air Act, an existing source that is modified or reconstructed after regulations are proposed for new sources is also considered a new source. 42 U.S.C. § 7411(a)(2); 40 C.F.R. § 60.15.

B. Summary of current emission standards for new, modified, and reconstructed power plants and EPA's determination of the best system of emission reduction

After analyzing an exhaustive technical rulemaking record, EPA in 2015 appropriately determined that partial CCS, in which a plant captures a portion of its CO_2 emissions for underground storage, was the best system of emission reduction that had been adequately demonstrated to control CO_2 pollution from new coal-fired plants. All of the steps involved in CCS—capture of some CO_2 from a gas stream, transportation via pipeline, and permanent storage underground—have been demonstrated and are currently in use. CCS is already in full-scale, integrated operation in the energy and chemical industries. The Current Standard is a valid, careful, and necessary exercise of EPA's mandate in section 111(b) to regulate harmful CO_2 emissions from new, modified, and reconstructed coal-fired power plants.[86]

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[85] Fourth Assessment, Vol. II, at 26 (Summary Findings).

[86] The Proposed Rule does not propose any changes to the 2015 emission standards for gas-fired power plants, and EPA makes clear that it is not accepting comments on those standards. *See* Proposed Rule at 65,424/1-2 ("The EPA is not proposing to amend and is not reopening the standards of performance for newly constructed or reconstructed stationary

The Current Standard, which has now been in effect over three years, sets numerical limits on CO_2 emissions from fossil-fuel fired power plants constructed after January 8, 2014. The standard for *new* coal-fired plants—1,400 pounds of CO_2 per megawatt-hour, gross, (lb CO_2/MWh-g)—is based on the amount of CO_2, per unit of electricity, that would be emitted by a new highly efficient plant employing partial CCS. EPA determined that a new plant burning bituminous coal would need to capture approximately 16 percent of its CO_2 emissions to meet that standard, whereas a plant burning subbituminous or dried lignite coal would need to capture approximately 23 percent. 2015 Preamble at 64,513/2-3. A new plant need not use partial CCS to meet that standard, however, and EPA identified other means a source could use to meet the standard.

For *reconstructed* coal-fired plants, the emission level is "based on the performance of the most efficient generating technology for these types of units . . . , (i.e., reconstructing the boiler if necessary to use steam with higher temperature and pressure, even if the boiler was not originally designed to do so." 2015 Preamble at 64,514/3. Based on its review of emissions from plants employing the most efficient generating technology, EPA set the standard at 1,800 lb CO_2/MWh-g for large units. Thus, the Current Standard for reconstructed coal-fired plants is not based on CCS at all.

For *modified* coal-fired power plants, the Current Standard is tied to the level of CO_2 emissions the individual plant itself has already proven it can achieve through actual experience. The numerical standard is a "unit-specific emission limit determined by the unit's best historical annual CO_2 emission rate (from 2002 to the date of the modification)." 2015 Preamble at 65,428/3. However, the emission limit will be "no more stringent than" 1,800 lb CO_2/MWh-g. Like the standard for reconstructed plants, the Current Standard for modified plants is not based in any way on the plant employing CCS.

C. Summary of proposed emission standards

EPA's new Proposed Rule increases the emission limit for *new* coal-fired plants from 1,400 to 1,900 lb CO_2/MWh-g. EPA proposes this new, higher emissions level by rejecting its 2015 finding that partial CCS was the best system of emission reduction (BSER) and by rejecting its 2015 determination that "business as usual" combustion technology could not be considered BSER. *See* 2015 Preamble at 64,595/1 (rejecting proposals to use "business as usual" emissions as BSER). Instead, EPA now assumes that whatever level of CO_2 is emitted by its sample of existing coal-fired plants is the best that can be achieved. EPA now points out that "25 existing EGUs have maintained annual emission rates of 1,900 lb CO_2/MWh-gross over the past 10 years." Proposed Rule at 65,451/1. EPA admits that a level below 1,800 lb CO_2/MWh-g can be achieved at plants using a cooling tower. Proposed Rule at 65,451/3. Although the vast majority of coal-fired plants do employ cooling towers, EPA proposes a standard of 1,900 lb CO_2/MWh-g to allow a wider range of less-efficient technologies to meet the standard.

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combustion turbines."); *id.* at 65,425 n.1 ("In this proposal, in some instances, the EPA identifies an issue that the Agency has previously addressed, and states that the Agency is not reopening that issue in this proposal. The EPA will not consider such an issue as relevant to this proposal.") These comments of the States and Cities therefore only address the standards for coal-fired plants.

For *reconstructed* coal-fired plants, the EPA proposes increasing the emission limit from 1,800 to 1,900 lb CO_2/MWh-g, apparently again on the theory that a wider range of less-efficient plant types—beyond those which EPA believed in 2015 were most likely to be constructed—should serve as the reference points. Proposed Rule at 65,449/1 (explaining that EPA is applying the same analytical framework to reconstructed plant emissions as it does to new plant emissions).

For *modified* plants, EPA ostensibly uses the same BSER as it did in 2015: a "unit-specific emission limit determined by the unit's best historical annual CO_2 emission rate (from 2002 to the date of the modification)." However, now EPA would allow the unit to emit 1,900 lb CO_2/MWh-g (that is, 100 lb CO_2/MWh-g *more* that under the Current Standard), regardless of whether its actual best historical performance shows that the plant could have met the lower emission limit of the Current Standard.

D. Legal standard for reversing an existing regulation

For EPA's proposed reversal of the Current Standard to be permissible under the Clean Air Act, EPA must comply with the requirements of section 111(b). *See* 42 U.S.C. § 7411(b)(1)(B) (requiring EPA to "revise such standards following the procedures required by this subsection for promulgation of such standards"). Thus, EPA must demonstrate that the Proposed Rule "reflects the degree of emission limitation achievable through the application of the best system of emission reduction." *Id.* § 7411(a). EPA may not ignore section 111(b)'s technology-forcing mandate to consider only the emission limitations and percent reductions achieved in practice. *Id.* § 7411(b)(1)(B); *see also Portland Cement Ass'n v. Ruckelshaus*, 486 F.2d 375, 391 (D.C. Cir. 1973) (recognizing that section 111(b) "looks toward what may fairly be projected for the regulated future, rather than the state of the art at present").

EPA must also, as always, adhere to the basic tenets of rational decision-making. To justify its proposal, EPA must "examine the relevant data and articulate a satisfactory explanation for its action including a rational connection between the facts found and the choice made." *Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983) (*State Farm*); s*ee also United Food & Commercial Workers Int'l Union, Local 150-A v. NLRB*, 880 F.2d 1422, 1436 (D.C. Cir. 1989) (*United Food v. NLRB*) (explaining that agencies "must accept responsibility for clarifying and identifying the standards that are guiding its decisions"). An agency action is "arbitrary and capricious if the agency has relied on factors which Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, [or] offered an explanation for its decision that runs counter to the evidence before the agency." *State Farm*, 463 U.S. at 43.

Moreover, where, as here, an agency proposes to reverse its former views on the proper regulatory approach, the agency must display "awareness that it is changing position," show that "the new policy is permissible under the statute," "believe[]" the new policy is better, and provide "good reasons" for the new policy. *FCC v. Fox Television Stations, Inc.*, 556 U.S. 502, 515 (2009) (*Fox*). When a new policy rests on factual or legal determinations that contradict those underlying the agency's prior policy, as EPA does in this rulemaking, the agency must provide "a reasoned explanation . . . for disregarding facts and circumstances that underlay or were engendered by the prior policy." *Id.* at 515-16; *id.* at 537 (Kennedy, J., concurring) ("An agency cannot simply disregard contrary or inconvenient factual determinations that it made in the past."); *Air All. Houston v. EPA*, 906 F.3d 1049, 1067 (D.C. Cir. 2018). "Unexplained inconsistency" in agency policy is "a reason for holding an interpretation to be an arbitrary and capricious change from agency practice." *National Cable & Telecommunications Ass'n v. Brand X Internet Servs.*, 545 U.S. 967, 981 (2005) (*Brand X Internet Servs.*).

The Clean Air Act does not allow EPA to finalize a rule if it did not disclose—at the time of proposal—the rule's "major legal interpretations and policy considerations" and the factual data, information, and documents on which it is based. *See* 42 U.S.C. § 7607(d)(3). The Act, and basic administrative rulemaking principles, do not put the burden on the public to respond to every conceivable permutation of options an agency might choose in response to comments. While a final rule should be shaped and informed by public comments, EPA's requests for comment must not be so generalized and wide-ranging that they cannot be understood as requesting comments on an actual proposal at all.[87] *See Small Refiner Lead Phase-Down Task Force v. EPA*, 705 F.2d 506, 549 (D.C. Cir. 1983) ("EPA must itself provide notice of a regulatory proposal. Having failed to do so, it cannot bootstrap notice from a comment."); *Shell Oil Co. v. EPA*, 950 F.2d 741, 760 (D.C. Cir. 1991) ("[W]hen a final rule bears little resemblance to the one proposed, the parties are deprived of their [Administrative Procedure Act] rights to notice and comment.").

As described in the remainder of this comment letter, EPA's regulatory about-face in the Proposed Rule falls far short of meeting these legal standards, rendering it arbitrary and capricious and unlawful.

III. EPA'S REVISED DETERMINATION OF THE BEST SYSTEM OF EMISSION REDUCTION FOR NEW COAL-FIRED POWER PLANTS IS NOT SUPPORTED BY THE RECORD OR THE CLEAN AIR ACT.

EPA explains in the Proposed Rule that its justification for reversing its position that partial CCS is BSER is "the high cost" and the "limited geographic availability" of CCS. Proposed Rule at 65,426/2. EPA states that these two factors are the foundation of its entire rationale for proposing to directly contradict the position it took in the 2015 rulemaking. In particular, EPA "bases this revision on (1) an updated analysis of what represents reasonable costs and (2) an updated analysis of the geographic availability of CCS." *Id.* at 65,430/3. As explained below in sections III.B and III.E, each of EPA's new analyses is conclusory, inconsistent with EPA's significantly more robust 2015 analysis (and often even inconsistent with itself), and inadequate under court precedent governing when an agency can reverse a lawfully promulgated regulation. Furthermore, EPA's proposal to adopt what is effectively no regulation of CO_2 at all as the "best system of emission reduction" violates the mandate Congress gave EPA in section 111 of the Clean Air Act.

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[87] EPA asks for comment on such a wide variety of issues that, with respect to many substantive areas, the Proposed Rule is more akin to a request for information or an advanced notice of proposed rulemaking than it is to the notice of proposed rulemaking required by the Clean Air Act. See, for example, requests for comment on topics 21, 22, 23, 24, 25, 26, 27, 29, 30, 31, 32, 34, 36, 37, 38, 39, 41, 42, 45, 54, 56, 57, and 58 in the Proposed Rule. On those subjects for which EPA is not making any proposal at all, its requests for comment do not give the public the required notice and opportunity to comment on a proposed agency action.

A. EPA has no basis to conclude that its proposed standard is based on a "system of emission reduction" that is in fact the "best" under Clean Air Act section 111. (C-3)

1. EPA fails to analyze emission increases allowed by the Proposed Rule compared to the status quo in the event that new coal-fired plants are built.

In evaluating whether a system of emission reduction is "best" under section 111, EPA must consider the quantity of emissions the system would reduce. *See Sierra Club v. Costle*, 657 F.2d 298, 326 (D.C. Cir. 1981) (stating "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"); 2015 Preamble at 64,539/2 ("The fact that the purpose of a 'system of emission reduction' is to reduce emissions, and that the term itself explicitly incorporates the concept of reducing emissions, supports the [D.C. Circuit] Court's view that in determining whether a 'system of emission reduction' is the 'best,' the EPA must consider the amount of emission reductions that the system would yield."). When revising an existing standard, the baseline against which to measure the new standard is the level of emissions allowed under *current law*, not those emissions that would occur in the absence of any regulation. *See Air All. Houston v. EPA*, 906 F.3d at 1068 (explaining that "the baseline for measuring the impact of a change or rescission of a final rule is the requirements of the rule itself, not the world as it would have been had the rule never been promulgated").

To properly analyze the effect of the BSER identified in Proposed Rule, therefore, EPA must take into account the emissions allowed by the Proposed Rule compared to the emissions allowed under the Current Standard. EPA nowhere analyzes the increase in CO_2 emissions over the status quo that would result in the event that new coal-fired plants are built and operated under the Proposed Rule, however. At most, it admits that emissions would increase, explaining that "[t]o the extent that new coal-fired facilities are constructed, a BSER coal facility under the proposed standard would have higher CO_2 emissions than a BSER facility under the 2015 final standards."[88] But EPA explicitly refuses to analyze the consequences of that increase, explaining that "We do not attempt to quantify the impacts of these increased emissions or economic value of these impacts." *Id.*

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[88] U.S. EPA, Economic Impact Analysis for the Review of Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units, 2-6 (Dec. 2018), Docket ID EPA-HQ-OAR-2013-0495-11939 (2018 Economic Impact Analysis). EPA also contradicts itself within the same document. While admitting that emissions would increase under the Proposed Rule—as compared to the Current Standard—if a new coal-fired plant were to be built, the 2018 Economic Impact Analysis also claims that "This rule is designed to set emission limits for carbon dioxide (CO_2), thereby limiting potential increases in future emissions and atmospheric CO_2 concentrations." 2018 Economic Impact Analysis, at 2-5. Nowhere in the rulemaking docket does EPA even purport to supply evidence supporting the idea that the Proposed Rule would limit increases in CO_2 emissions or CO_2 atmospheric levels.

By failing to even assess the impacts of the Proposed Rule's change in the status quo, EPA did not meet its obligations under section 111, *Sierra Club v. Costle*, 657 F.2d at 326, and "entirely failed to consider an important aspect of the problem," *State Farm*, 463 U.S. at 43 (calling such a failure arbitrary and capricious).

2. By allowing more emissions from a source than current standards do, EPA misinterprets the "best" system of emission reduction required by Clean Air Act section 111.

In effect, the Proposed Rule does nothing more than attempt to codify the CO_2 emission levels that a range of coal-fired plants, employing different technologies and burning various grades of coal, would meet even without any CO_2 controls.

EPA determined in 2015, based on market trends, that a new coal-fired plant was likely to be supercritical pulverized coal plant. 2015 Preamble at 64,594/3 ("About 60 percent of new coal-fired utility boiler capacity that has come on-line since 2005 was supercritical and of the new capacity that came on-line since 2010, about 70 percent was supercritical."). EPA found that by "the early 2000s," "the power sector had already, at that point, transitioned to the selection of supercritical boiler technology as 'business as usual' for new coal-fired power plants." *Id.* at 64,595/1. Studies by the U.S. Department of Energy's National Energy Technology Laboratory (NETL), which EPA relied on in the 2015 rulemaking, showed that the emissions from a supercritical pulverized coal plant burning bituminous coal and using a wet cooling system, but *without* any CO_2 controls at all, would be 1,620 lb CO_2/MWh-g. *Id.* at 64,562 tbl.8.[89]

In the 2015 rulemaking EPA rejected the approach of setting the standard at the level supercritical units would be expected to achieve without any CO_2 controls. 2015 Preamble at 64,595/1 ("Considering the direction that the power sector has been taking and the changes that it is undergoing, identifying a new supercritical unit as the BSER and requiring an emission limitation based on the performance of such units thus would provide few, if any, additional CO_2 emission reductions beyond the sector's 'business as usual'."). But now, by setting the standard at the level new, modern plants would be expected to achieve without any CO_2 controls at all, EPA is reversing itself and proposing to enshrine the rejected "business as usual" emissions as the best that a plant can do.

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[89] Table 8 of the 2015 Preamble cites the source of the 1,620 lb CO_2/MWh-g figure as the June 22, 2015, NETL study, which lists 1,618 lb CO_2/MWh-g for "case B12A." NETL, Cost and Performance Baseline for Fossil Energy Plants Supplement: Sensitivity to CO_2 Capture Rate in Coal-Fired Power Plants, No. DOE/NETL-2015/1720 (June 22, 2015), at Ex. A-1. Case B12A assumes a supercritical pulverized coal plant operating at an 85-percent capacity factor, using wet cooling and wet scrubber, with no CO_2 capture at all. NETL, Cost and Performance Baseline for Fossil Energy Plants Volume 1a: Bituminous Coal (PC) and Natural Gas to Electricity Revision 3, No. DOE/NETL-2015/1723, at 115 & tbl.3-45 (July 6, 2015).

Note that the text of the 2015 Preamble contains a typographical error listing this emission rate as "1,720" instead of 1,620 lb CO_2/MWh-g. *Compare* 2015 Preamble at 64,594/3 *with* 2016 Reconsideration Denial, at 16 n.43 ("There is a typographical error in the final preamble at 80 FR 64594/3, stating '1,720' instead of the correct '1,620'.").

Although EPA in 2018 shirks its duty to analyze the consequences of its proposed "business as usual" level of emissions, EPA in 2015 did determine what would be gained by imposing CO_2 controls on new coal-fired power plants. EPA found that "a new highly efficient 500 MW coal-fired SCPC [supercritical pulverized coal] meeting the final standard of 1,400 lb CO_2/MWh-g will emit about 354,000 fewer metric tons of CO_2 each year than that new highly efficient unit would have emitted otherwise. That is equivalent to taking about 75,000 vehicles off the road each year and will result in over 14,000,000 fewer metric tons of CO_2 in a 40-year operating life." 2015 Preamble at 64,574/3. Because the Proposed Rule would allow CO_2 emissions to reach the "business as usual" level, these 2015 figures indicate the magnitude of the emission increases to be expected if the Proposed Rule replaces the Current Standard.

This expected emission increase shows that the Proposed Rule does not comply with Congress's command to EPA to base any section 111 standard—whether initial or, as here, revised—on the best system of emission reduction. It would require quite unusual circumstances indeed for a system that would allow emissions to *increase* to be considered the "best" system of emission *reduction*, and EPA has not attempted to show those circumstances exist now. As the D.C. Circuit Court observed in *Sierra Club v. Costle*, 657 F.2d at 326, "[c]ontrol technologies cannot be 'best' if they create greater problems than they solve." In proposing the new BSER here, EPA fails to heed the *Costle* court's warning.

B. EPA's proposed determination that the cost of partial CCS is "unreasonable" is not supported by fact or law. (C-28)

In developing the Current Standard in 2015, EPA conducted a multifaceted economic analysis of the cost of meeting that standard and found it to be reasonable. EPA analyzed the cost of complying with the standard on both source-specific and industry-wide/national bases and explained its methods and conclusions in a detailed Regulatory Impact Analysis.[90] EPA evaluated capital costs on a per-plant basis, the effect on a new plant's levelized cost of electricity[91] (LCOE), and overall cost impacts to the industry as a whole. Under all of these metrics, EPA found the cost of complying with the Current Standard to be reasonable. 2015 Preamble at 64,558-73. In its analyses EPA made various assumptions that would have tended to overestimate the cost of complying with the Current Standard. EPA included the extra cost due to high-risk financing structures, but it excluded offsets to compliance costs from enhanced oil recovery revenue and tax incentives.[92]

[90] U.S. EPA, Regulatory Impact Analysis for the Final Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units (Aug. 2015), Docket ID EPA-HQ-OAR-2013-0495-11877 (2015 Regulatory Impact Analysis).

[91] "The LCOE is a commonly used economic metric that takes into account all costs to construct and operate a new power plant over an assumed time period and an assumed capacity factor. The LCOE is a summary metric, which expresses the full cost of generating electricity on a per unit basis (i.e., megawatt-hours)." 2015 Preamble at 64,560/2-3.

[92] EPA explained in the 2015 Preamble that its cost estimates included "a number of conservative elements." "In particular, these estimates include the highest value in the projected range of potential costs for partial CCS. They do not reflect revenues which can be generated by

Linking its finding of cost-reasonableness to governing D.C. Circuit case law on consideration of costs under section 111, EPA explained in the 2015 Preamble that "[i]n this rulemaking, our determination that the costs are reasonable means that the costs meet the cost standard in the case law no matter how that standard is articulated, that is, whether the cost standard is articulated through the terms that the case law uses, *e.g.*, 'exorbitant,' 'excessive,' etc., or through the term we use for convenience, 'reasonableness.'" 2015 Preamble at 64,559 n.255. In the 2018 Proposed Rule, EPA confirmed that it was bound by the same legal standard: when it determines that the cost of required emission reduction is "reasonable," it means that the cost is "well within the bounds established by [D.C. Circuit] jurisprudence." Proposed Rule at 65,433/2. That is, the cost is not "exorbitant," *Lignite Energy Council v. EPA*, 198 F.3d 930, 933 (D.C. Cir. 1999), "greater than the industry could bear and survive," *Portland Cement Ass'n v. EPA*, 513 F.2d 506, 508 (D.C. Cir. 1975), "excessive," or "unreasonable," *Sierra Club v. Costle*, 657 F.2d at 343.

EPA now proposes to reverse its finding that the cost of compliance is reasonable on two grounds: First, after EPA applied new assumptions to the preexisting cost data it used in 2015, it feels that the *LCOE* for a plant using partial CCS is too high; second, after reversing course and adopting the industry arguments it explicitly rejected in 2015 concerning the exact same capital cost data it relied on before, it now feels those *capital costs* are too high. Proposed Rule at 65,435-41. EPA does not even suggest, however, that any coal-fired plant was not built due to the Current Standard being too expensive; indeed, EPA believes that no such plants will be built under either the current or proposed standards over the time periods analyzed. EPA's change of position on the reasonableness of the cost of the Current Standard is arbitrary and capricious as it appears to be based on improperly inflated costs and unjustified—and often even unacknowledged—reversals of its 2015 positions. Even if EPA's new approach was accurate and consistent with principles of reasoned rulemaking, however, none of EPA's new cost calculations is sufficient to support its conclusion that the cost of partial CCS is so great that it should not be considered BSER.

1. EPA improperly inflates the LCOE of a coal-fired plant employing partial CCS and fails to justify its new methodology.

One of the factors EPA used in its 2015 analysis to determine that the cost of the Current Standard was reasonable was a comparison of the LCOE of a new coal-fired plant with partial CCS to the LCOE of a new nuclear plant. EPA considered this to be a worthwhile comparison to determine the reasonableness of the cost of the Current Standard because, if a developer were to build an intermediate or base-load plant that was not gas-fired, then nuclear power would be the

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selling captured CO_2 for enhanced oil recovery, and reflect the costs of partial CCS rather than potentially less expensive alternative compliance paths such as a utility boiler co-firing with natural gas." 2015 Preamble at 64,563/2. *See also id.* at 64,564/2 ("[W]e do not . . . rely on any cost reduction opportunities to justify the costs of meeting the standard as reasonable, but again note the conservative assumptions embodied in our assessment of compliance costs."); *id.* at 64,565/1 ("The EPA thus again notes that the cost assumptions it is making in its BSER determination are conservative. That is, by costing partial CCS as BSER, the EPA may be overestimating actual compliance costs since there exist other less expensive means of meeting the promulgated standard.").

most likely alternative to coal-fired power. *See* section III.B.2.a, below. By comparing the LCOE of a coal-fired plant with partial CCS to that of a new nuclear plant, EPA concluded in 2015 that the costs of the Current Standard were reasonable. 2015 Preamble at 64,561/1.

In the Proposed Rule, however, EPA arbitrarily manipulates preexisting, reliable government cost data to artificially increase the LCOE of a coal-fired plant meeting the Current Standard, thereby making partial CCS appear relatively more costly than it did in its 2015 analysis. EPA then improperly uses this inflated LCOE to attempt to show that the cost of meeting the Current Standard is unreasonable in comparison both to a nuclear plant and to a coal-fired plant that does not meet the standard. EPA concedes that its change of position in the Proposed Rule is not based on any new cost data developed since the 2015 rulemaking. Proposed Rule at 65,437/3 ("The EPA is not aware of any more recent, detailed, or transparent costing analysis specific to coal-fired EGUs with or without carbon capture technology."). Instead, EPA merely massages the NETL data—which in 2015 and still in 2018 EPA claims to be the best available—into LCOE figures it believes support changing its position on the cost-reasonableness of partial CCS.

The cost figures EPA relied on for coal-fired plants in 2015 were based on LCOE analyses performed by NETL. EPA said that "NETL cost and performance characteristics were selected for coal-fired technologies because the NETL estimates were unique in the detail of their cost and performance estimates for a range of CO_2 capture levels" for coal-fired plants. 2015 Regulatory Impact Assessment, 4-21 to 4-22. "The EPA relied on those sources because the NETL studies are the most comprehensive and transparent of the available cost studies and NETL has a reputation in the power sector industry for producing high quality, reliable work." 2015 Preamble at 64,567/1. EPA states in *both* its 2015 Regulatory Impact Analysis (page 4-22) and its 2018 Economic Impact Analysis (page 3-21) that the "use of the NETL cost and performance characteristics allows for comparisons to be made across generating technologies using a single, internally-consistent framework." And, as EPA explains in its 2018 Economic Impact Analysis, "[t]he value of the [NETL LCOE] studies lies not in the absolute accuracy of the individual case results but in the fact that all cases were evaluated under the same set of technical and economic assumptions. This consistency of approach allows meaningful comparisons among the cases evaluated." 2018 Economic Impact Analysis, at 3-22 tbl.3-7, notes.

The NETL cost data EPA relied on in the 2015 rulemaking assumed that a new coal-fired plant would operate at an 85-percent capacity factor.[93] Indeed, even EPA's new 2018 Economic

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[93] In the Proposed Rule EPA explains that for the LCOE calculations in the 2015 rulemaking it assumed a constant capacity factor of 85 percent "consistent with the NETL LCOE calculations." Proposed Rule at 65,438/2 & n.70. *See also* 2015 Preamble at 64,573/1 ("In determining the predicted cost and performance of [partial CCS at a level sufficient to meet the Current Standard], the EPA utilized information contained in updated DOE/NETL studies that assumed use of bituminous coal and an 85 percent capacity factor."). Specifically, the 2015 Preamble also, at page 64,562, footnote 275, cites to the sources of the LCOE figures EPA relied on. For a coal-fired plant, EPA relied on "Cost and Performance Baseline for Fossil Energy Plants Supplement: Sensitivity to CO_2 Capture Rate in Coal-Fired Power Plants," No. DOE/NETL–2015/1720 (June 22, 2015), which explains on page 7 that the "plants are evaluated

Impact Analysis relies entirely on data that assumes that a new coal-fired plant will operate at an 85-percent capacity factor. 2018 Economic Impact Analysis, at 3-21 n.18 ("The LCOE calculations used in this analysis all assume an 85 percent capacity factor and do not use the adjusted capacity factor approach discussed in the preamble accompanying this action.").[94]

In the Proposed Rule, however, EPA recalculates the capital cost component of the LCOE by assuming that a coal-fired plant employing partial CCS will operate at a 76.6-percent (instead of 85-percent) capacity factor. By using this lower capacity factor, EPA inflates the capital cost component of LCOE even while ostensibly using the same capital cost data it used in 2015. EPA starts with the same NETL capital cost assumptions that it did in the 2015 rulemaking. But, holding all other factors constant, as EPA does, a power plant operating at 76.6-percent capacity generates 10 percent fewer megawatt-hours of electricity than one operating at 85-percent capacity. By spreading that same capital cost over fewer megawatt-hours of electricity, EPA now creates an artificially high capital component to the LCOE calculation.[95]

When EPA then compares the coal-fired plant's newly inflated LCOE to a new nuclear plant's LCOE, it concludes that the coal-fired plant is too expensive relative to the nuclear plant. EPA also compares the new higher LCOE to that of a coal-fired plant without CCS and finds that employing partial CCS is too expensive. *See* section III.B.2.a, below.

EPA fails to justify its change of position on assumed power plant capacity and its rejection of the NETL 85-percent assumption. For the Proposed Rule EPA assumes that a new coal-fired plant with partial CCS would not be price competitive and would only operate at a 76.6 percent capacity factor as a result. Proposed Rule at 65,438-39. EPA does not even mention this new economic assumption in its 2018 Economic Impact Analysis, and instead explicitly states that the document does not analyze changes to capacity factors. 2018 Economic Impact Analysis, at 3-21 n.18. EPA's explanation directly contradicts its 2015 understanding of the economics of building and operating a coal-fired plant, and the agency does not explain why it is rejecting its previous understanding.

EPA determined in 2015 that if new coal-fired plant were to be built in the future, it would be to supply base load electricity, not to dispatch on an as-needed basis. In both 2015 and 2018 EPA determined that low natural gas prices (compared to coal) for the foreseeable future

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at a rated net power of 550 MWe with an assumed capacity factor of 85 percent." Docket ID EPA-HQ-OAR-2013-0495-11950, Att. 2.

[94] A cursory December 2018 EPA memorandum included in the rulemaking docket alludes to the assumption of "a 100% capacity factor" in EPA's new transmission and storage cost calculations, but EPA does not explain where that assumption comes from or how it affects EPA's figures. U.S. EPA, Memorandum, EPA's approach for estimating transportation and storage (T&S) costs for various amounts of carbon capture and storage, Exs. 2, 4, 5 (Dec. 2018), Docket ID EPA-HQ-OAR-2013-0495-11949 (2018 T&S Memorandum).

[95] *See* Comments of the Electric Power Research Institute on the Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units, 9 (May 9, 2014) ("Spreading the large capital costs of coal plus CCS over many fewer hours would significantly increase its LCOE . . . ."), Docket ID EPA-HQ-OAR-2013-0495-8925.

mean that developers of new electricity generation likely would not build a new coal-fired plant at all, regardless of whether the Current Standard applied.[96] However, then and now, EPA believes that some developer may build a new coal-fired plant for non-economic reasons, such as for the purpose of so-called fuel diversification. *See* section VI.C.2, below. Like nuclear plants, coal-fired plants "have historically supplied 'base load' electricity, the portion of electricity loads which are continually present, and typically operate throughout all hours of the year. The coal units meet the part of demand that is relatively constant." 2015 Regulatory Impact Assessment, 2-5. EPA found that a new coal-fired plant "—if constructed—would, most likely, be built to serve base load power demand and would not be expected to routinely start-up or shutdown or ramp its capacity factor in order to follow load demand." 2015 Preamble at 64,573/3; *id.* at 64,614 n.535. EPA already considered comments that a new coal-fired plant with CCS would not be cost competitive in a deregulated market, and it responded that "given current and projected market conditions, any new coal-fired EGU would likely only be built in a location where it would be expected to operate at a high capacity factor (e.g., as a base load unit)." Proposed Rule at 65,438 (explaining EPA's 2015 position). Regarding the ability of new coal-fired plants to compete in a deregulated market, EPA explained there was no basis to assume that a new coal-fired plant with partial CCS would not be competitive in the market but that one without partial CCS would be competitive. Instead, EPA reiterated that a new coal-fired plant would not be able to compete on price regardless of whether the Current Standard was in place.[97]

In the 2018 Proposed Rule preamble, however, EPA reverses course and assumes that a new coal-fired plant with partial CCS would be built to compete on price with other generators. Proposed Rule at 65,438-39. But EPA never supplies any information to support the idea that anyone will build a new coal-fired plant to compete in the marketplace based on price. Instead, its position is consistent between 2015 and 2018 that coal-fired plants will not be built for economic reasons under any reasonable fuel price scenario. EPA's sole basis for even considering a reevaluation of its assumptions about capacity factors is its blithe claim that "an increasing number of coal-fired power plants are changing from base load to variable load." Proposed Rule at 65,439/1. Whether or not this is accurate, it is irrelevant because it describes the behavior of operators of *existing* power plants in response to market conditions. EPA never claims, nor provides supporting evidence, that a developer of *new* generating capacity would build a coal-fired plant to operate as a variable load source instead of as a base load source with a high capacity factor.

Instead of providing evidence or analysis to disprove its 2015 findings, EPA simply assumes its previous determination that a hypothetical new coal-fired plant would supply base

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[96] *See* 2015 Preamble at 64,563/1 ("Under current and anticipated market conditions, power providers that are considering costs alone in choosing a fuel source for new intermediate or base load generation will choose natural gas because of its competitive current and projected price."); 2018 Economic Impact Analysis, at 3-28 ("[N]atural gas price projections need to be notably higher than the highest price projection in the [U.S. Energy Information Agency's Annual Energy Outlook model for] 2018 scenarios before market dynamics would be expected to favor new coal generation over natural gas generation.").

[97] See U.S. EPA, Response to Comments on January 8, 2014 Proposed Rule, Response 3.3-3, at 3 70 (Aug. 3, 2015), Docket Nos. EPA-HQ-OAR-2013-0495-11860 through -11874 (2015 RTC).

load power was wrong, and it arbitrarily lowers the assumed capacity factor to 76.6 percent. *See Butte Cty., Cal. v. Hogen*, 613 F.3d 190, 194 (D.C. Cir. 2010) ("The agency's statement must be one of 'reasoning'; it must not be just a 'conclusion'; it must 'articulate a satisfactory explanation' for its action."). EPA should cease manipulating preexisting cost data in the manner it proposes and instead "use the NETL costs without any significant adjustments, similar to the approach used in the 2015 Rule," which EPA proposes as an alternative measure of costs. Proposed Rule at 65,437/3. At the very least, to avoid arbitrary and capricious rulemaking, EPA must not base its calculations on unexplained and inconsistent assumptions.

2. Even if correct, EPA's revised LCOE calculations are not substantially different from its 2015 calculations and therefore cannot support EPA reversing its previous finding that the cost of partial CCS is comparable to other rulemakings and is reasonable.

EPA says that the first cost-based justification for reversing its finding that partial CCS is BSER is EPA's new LCOE analysis. This analysis purports to show that—based on EPA's new inflation of LCOE cost components and other changed assumptions—the LCOE of a plant with partial CCS is higher than what it thought in 2015. Proposed Rule at 65,440/1. EPA's second cost-based justification is that—without presenting any new data or analysis—the capital cost of building a new coal-fired plant with partial CCS seems too high. *Id.* at 65,441. Even if EPA's new cost figures are correct, EPA fails to provide a reasoned explanation for reversing its position that partial CCS is BSER. *See Fox*, 556 U.S. at 515.

a. EPA's new LCOE figures do not support its new view that partial CCS is not cost-reasonable.

In the 2015 rulemaking EPA compared the LCOE of a new coal-fired plant with partial CCS to the LCOE of a new nuclear plant and found the cost of partial CCS to be reasonable. EPA considered this an appropriate comparison because both technologies would be "reasonably anticipated to be designed, constructed, and operated for a similar purpose—that is, to provide dispatchable base load power that provides fuel diversity by relying on a fuel source other than natural gas." 2015 Preamble at 64,562. EPA explained in 2015 that comparing the LCOE of two generating technologies "is appropriate when they can be assumed to provide similar services and similar values of electricity generated." *Id.* at 64,561/2. "Use of the LCOE as a comparison measure is appropriate where the facilities being compared would serve load in a similar manner." *Id.* EPA's view of when an LCOE comparison is appropriate is unchanged. *See* 2018 Economic Impact Analysis, at 3-19 ("Evaluating competitiveness based on the LCOE is particularly useful in establishing cost comparisons between generation types with similar operating characteristics but with different cost and financial characteristics.").

The LCOE ranges EPA evaluated to make this comparison in 2015 are excerpted below from Table 8 (page 64,562) of the 2015 Preamble (also reproduced in the Proposed Rule in Table 4 (pages 65,436-37)):

Predicted Cost and CO_2 Emission Levels for a Range of Potential New Generation Technologies

New generation technology	Emissions (lb CO_2/MWh-gross)	LCOE ($/MWh)
SCPC – no CCS (bit)	1,620	76-95
SCPC + ~16% CCS (bit)	1,400	92-117
Nuclear (EIA)	0	87-115
Nuclear (Lazard)	0	92-132
IGCC [coal-fired]	1,430	94-120

Since the LCOE of a new coal-fired plant with partial CCS was estimated to be $92 to $117 per megawatt-hour, while the LCOE of a new nuclear plant was estimated to be $87 to $132 per megawatt-hour (using the range of two estimates), EPA concluded that "we project the LCOE for new fossil steam [i.e., coal-fired] capacity meeting the final 1,400 lb CO_2/MWh-g standard to be substantially similar to that for a new nuclear unit, the principal other alternative to natural gas to provide new base load power." *Id.* at 64,562/1. EPA concluded that the LCOE comparison showed that cost of the Current Standard was reasonable and "in line with power sources that provide analogous services." *Id.* at 64,562/1-63/2.

In the Proposed Rule, however, EPA claims that its new, slightly higher LCOE for a coal-fired plant with partial CCS "support[s] EPA's proposal to revise the 2015 determination that partial CCS is BSER for coal-fired" plants. Proposed Rule at 65,440/1. EPA is incorrect. That conclusion is irrational and not supported by even the new figures EPA purports to rely on.

(i) EPA does not provide LCOE figures or calculations that support its claim that LCOE of a coal-fired plant with partial CCS is now 10 percent greater than that of a nuclear plant.

EPA now claims that the Current Standard is not cost-reasonable because EPA's new, higher LCOE figures for a plant using partial CCS "are over 10 percent higher than the nuclear cost metric." 2015 Preamble at 65,440/1. This statement is unsupported both because EPA never explains what "nuclear cost metric" it could be referring to and because the nuclear cost metrics it does cite show that the LCOE of partial CCS is still within the range of a nuclear plant's LCOE. Thus, the cost comparison to nuclear power does not provide EPA any basis for reversing its position that partial CCS is BSER.

As a preliminary matter, EPA does not explain of how it calculated its new $105.4 per megawatt-hour LCOE for a new coal-fired plant with partial CCS. This figure, which is the basis for all of EPA's new claims that partial CCS is unreasonably costly on the basis of LCOE comparisons, appears only a single time in the Proposed Rule, in Table 7, with no accompanying explanation. Neither the 2018 Regulatory Impact Analysis nor the cursory 2018 T&S Memorandum on revised LCOE methodology even mentions this new figure, which is the lynchpin of EPA's new rationale for reversing its finding that the Current Standard can be achieved at a reasonable cost. EPA's failure to explain the foundation of its reversal of position is a violation of the Clean Air Act's rulemaking procedures. *See* 42 U.S.C. § 7607(d)(3) (requiring EPA to publish, as part of a proposed rulemaking, "the factual data on which the proposed rule is based," and to include "in the docket on the date of publication of the proposed rule" relevant "data, information, and documents").

Second, EPA's new, higher $105.4-per-megawatt-hour LCOE for a new coal-fired plant with partial CCS is obviously within the LCOE range for nuclear power of $87 to $132 per megawatt-hour EPA relied on in 2015; indeed, it is firmly in the *center* of that range. *Compare* Proposed Rule at 65,436-37 tbl.4, *with id.* at 65,439 tbl.7. It is irrational for EPA to change its position on the reasonableness of the cost of partial CCS compared to nuclear when even its revised cost is within the range EPA said was evidence of reasonableness. *See City of Kansas City v. Dep't of Housing & Urban Dev.*, 923 F.2d 188, 194 (D.C. Cir. 1991) (agency decision "cannot survive review" when based on a factual premise contradicted by the record).

Third, if there is some other "nuclear cost metric" to which EPA is comparing its new, higher partial CCS figure, it keeps it a secret from the public, in violation of the Clean Air Act's rulemaking procedures. *See* 42 U.S.C. § 7607(d)(3). Neither the Proposed Rule nor 2018 Regulatory Impact Analysis nor the 2018 T&S Memorandum on revised LCOE methodology even mentions another nuclear LCOE figure other than the ones EPA relied on in 2015 (i.e., $87 to $132 per megawatt-hour).

Fourth, basing a cost-reasonableness analysis on a single figure (here, $105.4 per megawatt-hour) is contrary to EPA's position on how to compare LCOE estimates between nuclear and coal-fired power. In the 2015 rulemaking, EPA explained its approach to this LCOE comparison as follows:

> Other commenters noted that the NETL studies present costs as a range, and urged the EPA not to use point estimates for these figures. EPA agrees with these comments, and is using the range of cost estimates presented in its assessment of costs. See, e.g., Table 8 to the preamble to the final rule. In this regard, the EPA notes that costs for nuclear power are also presented as a range. This approach is consistent with expert advice to EPA from the EIA, and with the methodology used by leading techno-economic modelers in the field, notably Lazard Global Power and the Global CCS Institute.

2015 RTC, Response 6.3-261, at 6-173. EPA fails to explain why it is changing its methodology and does not even acknowledge that it is doing so. *See Fox*, 556 U.S. at 515 (requiring an agency to show, at a minimum, an "awareness that it is changing position"); *Brand X Internet Servs.*, 545 U.S. at 981 (explaining that "unexplained inconsistency" in agency policy is "a reason for holding an interpretation to be an arbitrary and capricious change from agency practice").

Finally, EPA's statement that "even with only the T&S [transmission and storage] adjustment, the revised LCOE are five percent higher than the nuclear metric" is similarly without support. Proposed Rule at 65,440/1. EPA's assertion that just a portion of its recalculated LCOE is higher than nuclear costs is as nonsensical as its assertion regarding its whole recalculated LCOE, for the reasons described above in this section.

(ii) EPA does not provide any justification for its conclusion that a 10-percent difference between the LCOE of a coal-fired plant with partial CCS and the LCOE of a nuclear plant renders the cost of partial CCS unreasonable.

Further, even if—arithmetic and supporting evidence to the contrary—EPA is correct that there is now a 10-percent difference between the LCOE of a new coal-fired plant with partial CCS and a nuclear plant, EPA's position has been that a difference of that magnitude is not enough to change its determination that the cost of the Current Standard is reasonable. If EPA is changing that position, it must acknowledge that it is doing so and provide a reasoned explanation for why it is doing it, *Fox*, 556 U.S. at 515, neither of which it has done in this proposal.

EPA's change of heart in the Proposed Rule, grounded on an alleged 10-percent cost difference between the LCOE of a nuclear plant and a plant with partial CCS, is contrary to the position it took just a year-and-a-half earlier when it denied petitions to reconsider this rule on the same grounds.[98] In December 2015 a power industry trade association, the Utility Air Regulatory Group (UARG), petitioned EPA to reconsider the Current Standard on the ground that EPA had failed to properly consider the reasonableness of the capital costs of building a coal-fired plant with partial CCS.[99] In its petition, UARG argued that the range of capital costs for a coal-fired plant with partial CCS should be higher than the range that EPA had analyzed in the 2015 rulemaking and determined was reasonable. UARG's projection of LCOE for a new coal-fired plant with partial CCS was $98 to $123 per megawatt-hour, an increase over EPA's projection of $92 to $117 per megawatt-hour. 2016 Reconsideration Denial, at 25 n.57. EPA concluded that even if UARG's numbers were right, EPA's LCOE analysis still showed that the cost of a new coal-fired plant with partial CCS was reasonable as compared to a new nuclear plant. Specifically, EPA pointed out that UARG's $98-to-$123 figure was within the LCOE range for a nuclear plant in the Lazard analysis ($92 to $132), which EPA relies on in both the 2015 Preamble and in the Proposed Rule,[100] and therefore the LCOE was "reasonable using the rationale applied in both the proposal and the final rule." *Id.* at 25. "[E]ven if the EPA were to accept UARG's alternative analysis—which we do not—we would not reach the conclusion that

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[98] *See* U.S. EPA, Basis for Denial of Petitions to Reconsider the CAA Section 111(b) Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Fossil Fuel-Fired Electric Utility Generating Units (Apr. 2016), Docket ID EPA-HQ-OAR-2013-0495-11918 (2016 Reconsideration Denial).

[99] UARG describes itself as "a voluntary group of electric generating companies and national trade associations. The vast majority of electric energy in the United States is generated by individual members of UARG or other members of UARG's trade association members." Utility Air Regulatory Group Petition for Reconsideration of EPA's "Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units," 80 Fed. Reg. 64,510 (Oct. 23, 2015), December 22, 2015, at 1, Docket ID EPA-HQ-OAR-2013-0495-11894.

[100] *See* 2015 Preamble at 64,562 tbl.8 (line item "Nuclear (Lazard)"); Proposed Rule at 65,436 tbl.4 (same).

the resulting re-estimated costs are unreasonable." 2016 Reconsideration Denial, at 25. Moreover, EPA explained that its cost-reasonableness analysis does not include a "break point" beyond which a coal-fired plant's LCOE would render the cost to meet the Current Standard per se unreasonable. Instead, "EPA promulgated a final standard of performance with a projected cost range that is consistent with projected cost ranges for other competing generation technologies. However, the EPA did not find—nor ever suggest—that costs above those ranges are unreasonable or exorbitant." *Id.*

For EPA now to claim that that a 10-percent difference in LCOE renders the cost of the Current Standard unreasonable, it has necessarily rejected, *sub silento*, the position it held as recently as 2016. This it cannot do. *Fox*, 556 U.S. at 515 (requiring an agency to show, at a minimum, an "awareness that it is changing position").

In addition, EPA seems to contradict itself just within the four corners of the Proposed Rule as to whether nuclear power is cheaper than a coal-fired plant employing partial CCS. While it tries to justify reversing itself on the reasonableness of the cost of partial CCS on the ground that it is now slightly more expensive than nuclear power, EPA also claims that the LCOE of nuclear power may be so expensive that it might not be appropriate to compare it to partial CCS. EPA says that "more recent information, since the 2015 Rule, indicates that the LCOE of a new nuclear EGU is in fact higher than what developers may be willing to accept." Proposed Rule at 65,437/2. The only "more recent information" EPA cites is claims that some nuclear reactors under construction are "over budget and behind schedule" and some projects have been abandoned; EPA provides no new LCOE analysis for nuclear plants. It is irrational for EPA to base its conclusion that a new coal-fired plant with partial CCS costs more than a nuclear plant while simultaneously saying that a nuclear plant may be even more expensive than it thinks.[101] *See Sierra Club v. EPA*, 884 F.3d 1185, 1195 (D.C. Cir. 2018) (finding arbitrary and capricious EPA's decision to revise an existing standard based on data it said was unreliable).

Finally, EPA has not demonstrated that it is proper to use the LCOE metric to compare the cost of two types of plants that are operating at different capacity factors. In the preamble to the 2015 rule, EPA stated that "[u]se of the LCOE as a comparison measure is appropriate where the facilities being compared would serve load in a similar manner." 2015 Preamble at 64561/2. Because EPA is now assuming, for some purposes, a lower 76.6-percent capacity factor for coal-fired plants with partial CCS and a 90-percent capacity factor for nuclear plants, *see* Proposed Rule at 65437 n.64, the two hypothetical plants would be providing different levels of electricity and provide different value to the electrical grid, rendering a direct comparison of the LCOE figures of questionable relevance. EPA errs in grounding its new cost-reasonableness analysis on this comparison without providing a justification for the change.

[101] EPA also requests comment on whether nuclear power should even be compared to coal-fired partial CCS for a developer seeking "fuel diversity." Proposed Rule at 65,437 (requests for comment C-6 and C-7.) The States and Cities are not aware of any reason EPA should change from its 2015 position that nuclear power plants can serve as a comparison point for new coal-fired plants.

(iii) EPA does not provide any justification for concluding that an increase in the difference between LCOE of a coal-fired plant with partial CCS and one without renders the cost of partial CCS unreasonable.

EPA also now claims that a second new LCOE comparison supports it reversing its 2015 position that the cost of partial CCS is reasonable. In the Proposed Rule EPA compares its newly revealed LCOE for a coal-fired plant with partial CCS ($105.4 per megawatt-hour) with the LCOE of a coal-fired plant without CCS ($81.7 per megawatt-hour). This 29-percent difference, along with its LCOE comparison to nuclear, described above, "support[s] the EPA's proposal to revise the 2015 determination that partial CCS is BSER for coal-fired EGUs." Proposed Rule at 65,439 tbl.7 & 65,440/1. This comparison suffers from many of the same failures as EPA's nuclear cost comparison and renders EPA's reversal of position on the reasonableness of the cost of partial CCS arbitrary and capricious.

Even accepting EPA's new opaque LCOE calculation as correct, EPA does not show how it supports reversing its position that the cost of implementing partial CCS is reasonable. EPA never explains why its new $105.4-per-megawatt-hour figure is so different from its previous range for partial CCS ($92 to $117 per megawatt hour)[102] that it should change its mind on the reasonableness of the cost of partial CCS. Indeed, as with the nuclear cost comparison, the new $105.4 figure is right in the center of the $92-to-$117 range EPA still cites.

To the extent that EPA believes it should reject the NETL cost ranges it previously relied on—a view EPA never expresses—even the single-figure cost comparison EPA now promotes does not support its reversal of position. According to the Proposed Rule's Table 7[103] (page 65,439-40), EPA previously believed that adding partial CCS to a new coal plant would increase its LCOE by 18 percent (from $81.7/MWh to $96.2/MWh) but that with its new $105.4 figure, it now believes the resulting increase in LCOE to be 29 percent (from $81.7/MWh to $105.4/MWh).[104] EPA says this increase above its previous understanding renders the cost of partial CCS unreasonable. Proposed Rule at 65,440. Nowhere, however, does EPA explain why or how it determined that, while an 18-percent increase in LCOE was reasonable, a 29-percent increase is so unreasonable that it must scrap the Current Standard. EPA fails to provide any metric or methodology to guide its decision making here. *See United Food v. NLRB*, 880 F.2d at

[102] 2015 Preamble at 64,562 tbl.8; Proposed Rule at 65,436-37 tbl.4.

[103] The table is oddly entitled "Predicted Cost and CO_2 Emission Levels for a Range of Potential New Generation Technologies," although CO_2 emission levels are not shown.

[104] EPA's reporting that it previously assumed $96.2 per megawatt hour is itself suspect. Instead, it appears that in 2015 EPA believed that one way to express the LCOE for a coal-fired plant with partial CCS was $99 per megawatt hour. *See* 2015 Preamble at 64,565 tbl.9 (citing to Cost and Performance Baseline for Fossil Energy Plants Supplement: Sensitivity to CO_2 Capture Rate in Coal-Fired Power Plants, DOE/NETL–2015/1720 (June 2015), which shows $82 and $99 figures in Exhibit 3-3 on page 11). Comparing $81.7 to $99 per megawatt-hour yields an increase of 21 percent, not the 18 percent EPA reports in the Proposed Rule. Of course, EPA also does not explain how to reconcile its assumption that a 21-percent increase is reasonable with its new conclusion that a 29-percent increase is unreasonable.

1436 (agencies "must accept responsibility for clarifying and identifying the standards that are guiding its decisions"). EPA also fails to even acknowledge that it is in effect rejecting its position, reaffirmed in 2016, that cost comparisons should not be based on a bright-line numerical cut-off. *See Fox*, 556 U.S. at 515 (requiring an agency to show, at a minimum, an "awareness that it is changing position").

b. EPA does not justify changing its position on the reasonableness of the capital cost of partial CCS.

In addition to the analysis of LCOE of a new coal-fired plant with partial CCS, in 2015 EPA also considered the effect of the Current Standard on the capital cost alone.[105] EPA performed this analysis at the request of the electricity generating industry. 2015 Preamble at 64,559/3 ("[E]xtensive comment from industry representatives and others noted persuasively that fossil-steam units are very capital-intensive projects and recommended that a separate metric, solely of capital costs, be considered by the EPA in evaluating the final standard's costs.").

EPA determined that the partial CCS on which the Current Standard is based would increase the capital costs of a new coal-fired plant by 21 to 22 percent. 2015 Preamble at 64,560 & tbl.7. After analyzing the cost increases of previous Clean Air Act regulations that courts had found to be reasonable, EPA concluded that the "capital cost impacts incurred under these prior standards are comparable in magnitude on an individual unit basis to those projected for the present standard." *Id.* at 64,560. "The EPA has determined that the incremental capital costs of the final standard are reasonable because they are comparable to those in prior regulations and to industry experience, and because the fossil steam electric power industry has been shown to be able to successfully absorb capital costs of this magnitude in the past." 2015 Preamble at 64,559/3; *see also id.* at 64,558/2 ("The EPA found that the anticipated cost impacts are similar to those in other promulgated NSPS—including for this industry—that have been upheld by the D.C. Circuit.").

In the Proposed Rule, however, EPA reverses course and concludes that the exact same capital cost increase it previously calculated—21 to 22 percent—is "not reasonable." Proposed Rule at 65,441/1. In contrast to its 2015 rulemaking, where EPA used DOE NETL studies to calculate specific capital costs with and without CCS,[106] in the Proposed Rule EPA does no new cost analysis and does nothing new to quantify capital costs. EPA now simply uses the same figures it looked at before and comes up with a completely different answer. EPA fails to provide a reasoned explanation for why it is changing its mind, given the absence of any new information. *See Brand X Internet Servs.*, 545 U.S. at 981 (stating that "unexplained inconsistency" in agency policy is "a reason for holding an interpretation to be an arbitrary and capricious change from agency practice.").

[105] The LCOE also, by definition, incorporates capital costs. *See* 2015 Preamble at 64,560/2 ("While capital cost is a useful and relevant metric for capital-intensive fossil-steam units, the LCOE can serve as a useful complement because it takes into account all specified costs (operation and maintenance, fuel—as well as capital costs), over the whole lifetime of the project.").

[106] *See* 2015 Preamble at 64,560 tbl.7 (listing capital costs in dollars per kilowatt).

EPA suggests a handful of ideas for reversing its position that the 21-to-22-percent increase in capital costs due to partial CCS is reasonable, Proposed Rule at 65,440/1-41/1, but none of them is a rational reason for the change, and it is not even clear why EPA mentions them. Although these ideas about capital costs are completely devoid of substance, they are the only rationale EPA provides for rejecting its previous economic analysis. *Id.* at 65,441/1 ("Based on these assessments, the EPA is proposing that the increase in capital costs due to partial CCS are not reasonable.").

First, EPA points out that it is more expensive to build a coal-fired power plant now than it was in 1971 because of environmental controls that have been imposed over the ensuing five decades. Proposed Rule at 65,440/3. Then, EPA states that because it is now more expensive to build a coal-fired power plant than it was in 1971, "at the same percentage increase in capital costs, absolute costs are much higher." *Id.* EPA fails to explain what new revelation it has derived from the obvious mathematical property that increasing a larger number by a given percentage will produce a larger result than increasing a smaller number by that same percentage. EPA then "notes" that the "absolute increase in capital costs" for a power plant to implement the Current Standard is larger than previous section 111(b) new source performance standards for these sources. *Id.* EPA was aware of this information previously, and it does not explain if, how, or why this would lead the agency to reverse its position that the cost of the Current Standard is reasonable. Further, EPA does not perform any calculation of this absolute increase in costs, nor does it consider to what degree inflation affects the relevance of comparing absolute cost changes. EPA also fails to explain why an absolute cost threshold is appropriate here or supported by the Clean Air Act or court precedent.

Second, EPA "notes" that previous NSPS rulemakings "generally concerned multiple pollutants and adopted multiple requirements based on multiple control technologies," which makes it "more challenging" to compare these rulemakings with the "current rulemaking." Proposed Rule at 65,440/3. EPA does not explain what conclusion it draws from it its greater challenge in comparing the Proposed Rule to these previous performance standards or how this has any bearing on its reversal of its position that capital cost of the Current Standard is reasonable. If EPA is unable to evaluate the capital cost of the Proposed Rule, as it suggests, it should not finalize it. To the extent that what EPA actually means is that it is "more challenging" to compare previous rulemakings with the Current Standard, it also fails to explain what is the result of its difficulty in making a comparison or why it discovered this difficulty for the first time in 2018. EPA also does not explain what the comparison is "more challenging" than. EPA's statements about this "challenge" are simply nonsensical.

Finally, EPA alleges that "the fact that the utility industry was able to absorb 20 percent increases in cost due to pollution control in the past does not necessarily mean the industry could do so today." Proposed Rule at 65,440/3. EPA supplies no evidence that this is true. Since in its new proposal EPA provides no quantitative analysis of the capital cost of complying with the Current Standard, the opposite conclusion—that the utility industry is now *better* able to absorb a 20-percent increase in cost—could just as easily be true. EPA cannot base its reversal of its 2015 economic analysis based on simple conclusory observations such as that the "utility sector is markedly different today." *Id. See AEP Texas North Co. v. Surface Transp. Bd.*, 609 F.2d 432, 440-41 (D.C. Cir. 2010) (calling agency action arbitrary and capricious when agency relied on "generalized conclusions" and ignored evidence that the generalized conclusions might not hold in specific circumstances at issue).

Indeed, when EPA relied on an actual quantitative economic analysis in 2015, it rejected the same argument it now suggests requires it to change its mind. A commenter on the 2014 proposal claimed to EPA that the proposed standards "are the 'straw that breaks the camel's back' and that EPA failed to also consider the costs of other pollution control standards for this industry." EPA responded, "This is incorrect." 2015 RTC, Response 6.3-281, at 6-190. "In assessing costs, the EPA relied on the NETL studies which assume a coal-burning steam generating unit in compliance with applicable environmental standards, including MATS for hazardous air pollution emissions, and the most recent NSPS for criteria pollutant emissions." *Id*. Similarly, while EPA now suggests that coal-fired plants will not be able to pass on "higher operating costs" "without affecting coal-fired generation's competitiveness with alternate forms of energy generation," Proposed Rule at 65,441/1, EPA's previous analysis found that no one would build a new coal-fired plant to be cost competitive in the first place. *See* section III.B.1, above; 2015 RTC, Response 3.3-3, at 3-70 (explaining that a new coal-fired plant would not be able to compete on price regardless of whether the Current Standard was in place).

EPA's unsupported and unanalyzed reversal of its determination that the capital cost of partial CCS is reasonable is arbitrary and capricious and must be withdrawn. *See Fox*, 556 U.S. at 516 (stating that an agency must offer "a reasoned explanation . . . for disregarding facts and circumstances that underlay or were engendered by the prior policy").

3. If EPA revises its analysis of the reasonableness of the cost of partial CCS, it should take into account offsets to that cost, including revenue from enhanced oil recovery and new 45Q tax credits. (C-28)

In conservatively finding the cost of partial CCS to be reasonable even without considering potential revenue streams, EPA's cost analysis in the 2015 rulemaking was adequate and complied with the requirement in section 111(a) to take costs into consideration in determining the BSER. And, as discussed above, EPA's new attempt in the Proposed Rule to reverse its previous determination by concluding that the cost is unreasonable is arbitrary and capricious. Nevertheless, if EPA does revise its analysis of the cost of employing partial CCS at a new coal-fired plant, it should take into account opportunities for the plant operator to offset that cost. Specifically, EPA should quantify the benefit to the plant operator from revenue from sale of captured CO_2, such as for enhanced oil recovery[107] (EOR), and from increased tax credits for CCS.

EPA described its cost calculations for the 2015 rulemaking as "conservative" in part because they did not include any offsetting sources of revenue.[108] In particular, EPA's 2015 estimates did not "reflect revenues which can be generated by selling captured CO_2 for enhanced oil recovery," 2015 Preamble at 64,563/2, nor did they include "grants or other benefits provided

[107] EPA describes enhanced oil recovery as "the injection of fluids into a reservoir after production yields have decreased from primary production in order to increase oil production efficiency." 2015 Preamble at 64,566/1. "EOR has been successfully used at numerous production fields throughout the United States to increase oil recovery. The oil industry in the United States has over 40 years of experience with EOR. An oil industry study in 2014 identified more than 125 EOR projects in 98 fields in the United States." *Id.* at 64,579/3.

[108] *See* footnote 92, above.

by federal or state governments" to defray the cost of CCS, *id.* at 64,564/2. If EPA decides to continue with its unnecessary and unsupported proposal to recalculate the cost of partial CCS to achieve a higher cost figure, it must include in its calculation the real-world opportunities to offset that cost.

First, EPA should include in any cost recalculation the revenue a plant operator would receive from EOR. EPA believes that "new units that capture CO_2 will likely be built in areas where there are opportunities to sell the captured CO_2 for some useful purpose prior to (or concomitant with) permanent storage. . . . In particular, the ability to sell captured CO_2 for use in enhanced oil recovery operations offers the most opportunity to reduce costs." 2015 Preamble at 64,564/2. EPA explains that the "use of CO_2 for EOR can significantly lower the net cost of implementing CCS. The opportunity to sell the captured CO_2 for EOR, rather than paying directly for its long-term storage, improves the overall economics of the new generating unit." *Id.* at 64,566. Since the 2015 rulemaking, EPA has determined that EOR is even more widely used than it previously thought. Proposed Rule at 65,441/3. Even in the Proposed Rule EPA acknowledges that if a plant owner sold captured CO_2, "variable operating costs could be reduced relative to an EGU without partial CCS and electric sales would be expected to increase, offsetting some of the control costs." Proposed Rule at 65,440/1. Given that EPA considers EOR opportunities likely to reduce the cost of employing partial CCS, it should include EOR revenue in a future cost recalculation.

Second, newly expanded federal tax credits will help to offset the cost of partial CCS and should be incorporated into any future cost analysis EPA undertakes. The tax credits Congress expanded in 2018 in section 45Q of the Internal Revenue Code significantly reduce the cost of employing partial CCS.[109] Economic modeling performed this year by the Clean Air Task Force indicates that the 45Q credit will incentivize the storage of millions of tons of CO_2 annually.[110] Because Congress designed this tax credit specifically to lower the cost of employing CCS, EPA should take those cost savings into account in any future analysis of BSER.

4. EPA fails to demonstrate that the cost of the Current Standard is unreasonable under the legal criteria EPA says govern its analysis: whether the cost of partial CCS is "exorbitant," "greater than the industry could bear and survive," or "excessive."

Even if EPA's revised cost calculations are accurate, they do not show that a developer of a new coal-fired power plant would find the cost of implementing partial CCS to be "exorbitant," "greater than the industry could bear and survive," or "excessive." EPA does not even claim that they are, leaving the public to wonder what standard EPA is actually proposing to use to reverse the status quo. *See United Food v. NLRB*, 880 F.2d at 1436 (agencies "must accept responsibility for clarifying and identifying the standards that are guiding its decisions").

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[109] *See* Bipartisan Budget Act of 2018, H.R. 1892, § 41119. Pub. L. No. 115-123 (Feb. 9, 2018).

[110] Clean Air Task Force, Carbon Capture & Storage in the United States Power Sector: The Impact of 45Q Federal Tax Credits (Feb. 2019), https://www.catf.us/wp-content/uploads/2019/02/CATF_CCS_United_States_Power_Sector.pdf.

EPA explained in the 2015 Preamble that "our determination that the costs are reasonable means that the costs meet the cost standard in the case law no matter how that standard is articulated, that is, whether the cost standard is articulated through the terms that the case law uses, *e.g.*, 'exorbitant,' 'excessive,' etc., or through the term we use for convenience, 'reasonableness.'" 2015 Preamble at 64,559 n.255. EPA acknowledges that it continues to be bound by the same legal standard: when it determines that the cost of required emission reduction is "reasonable," it means that the cost is "well within the bounds established by [D.C. Circuit] jurisprudence." Proposed Rule at 65,433/2. And yet, even though EPA nowhere makes the finding that the cost is "exorbitant," "greater than the industry could bear and survive," or "excessive," EPA concludes that the cost of meeting the Current Standard is not reasonable based on its new 2018 beliefs about preexisting cost figures. EPA has not, therefore, met its obligation to show an awareness that it is reversing its finding that the cost of the Current Standard comports with D.C. Circuit precedent and to provide a reasoned explanation for changing its previous determination that such costs are reasonable. *Fox*, 556 U.S. at 515. Furthermore, EPA's failure to explain what criteria it is using to determine that the cost of the Current Standard is unreasonable violates the Clean Air Act's rulemaking requirements. *See* 42 U.S.C. § 7607(d)(3) (requiring a proposed rulemaking to include "the major legal interpretations and policy considerations underlying the proposed rule").

C. EPA lacks a reasonable basis for its proposed reversal of its determination that partial CCS is adequately demonstrated.

1. EPA's suggestion that it no longer believes CCS is technically feasible defies overwhelming evidence, ignores precedent, and relies on new, baseless legal theories.

EPA's previous determination that the technical feasibility of partial CCS is adequately demonstrated was based on extensive evidence and adhered to well-established precedent. EPA's proposal to reverse that determination depends in large part on unacknowledged changes in the agency's evaluation of the record and approach to determining BSER. Moreover, EPA's BSER determination has been reconfirmed by the performance of partial CCS since 2015.

a. EPA's 2015 determination was supported by extensive evidence and decades of precedent. (C-13)

EPA's 2015 determination that the technical feasibility of partial CCS is adequately demonstrated was based on a mountain of evidence, as detailed in the 2015 Preamble at pages 64,548 through 64,558. First and foremost, EPA relied on SaskPower's Boundary Dam project in Saskatchewan, Canada, a "commercial-scale fully integrated post-combustion CCS project at a coal-fired power plant." 2015 Preamble at 64,549/2. EPA observed that the Boundary Dam facility

> is capturing 90% of the unit's CO_2 emissions using commercially available carbon capture technology . . . . The facility's emissions are well below the 1,400 lb CO_2/MWh-gross standard [established by the rule]. Actually the emissions at the Boundary Dam facility must be below 1,400 lb CO_2/MWh as Canada's emission standard is 0.42 tonnes CO_2/MWh, which is roughly equivalent to about 925 lb CO_2/MWh.

2015 RTC, Response 6.3-26, at 6-18. In addition, Boundary Dam, while selling some CO_2 for use in enhanced oil recovery, had also separately stored excess CO_2, fulfilling the "storage" aspect of CCS. *See* 2015 RTC, Response 6.3-85, at 6-53 ("Boundary Dam is in fact sequestering the excess CO_2 which it is not selling for EOR in a deep saline formation.").

Moreover, Boundary Dam was not the only demonstration of the feasibility of partial CCS. As EPA noted in the preamble to its 2014 proposed rule, "capture of CO_2 from industrial gas streams has occurred since the 1930s, through use of a variety of approaches to separate CO_2 from other gases."[111] In its February 2017 brief in *North Dakota v. EPA*, EPA summarized a number of other examples EPA had relied on in the 2015 rulemaking:

> EPA also considered other coal-fired plants employing post-combustion capture technology, including AES Warrior Run in Cumberland, Maryland; Shady Point in Panama, Oklahoma; and Searles Valley Minerals in Trona, California. *Id.* at [80 Fed. Reg.] 64,550-51. Each of these plants has been operating for multiple years and employs the same carbon capture method on which EPA's Best System determination is based—post-combustion amine scrubbing. *Id.* . . . .
>
> These plants provide additional evidence that post-combustion carbon capture is adequately demonstrated. *Id.* These three plants capture slightly smaller amounts of CO_2 than the standard contemplates—up to nearly 80 percent of what a 500 MW plant meeting the standard by using partial CCS would capture. *Id.* at 64,574 (Table 12). Petitioners are incorrect, however, to suggest that EPA "presented no evidence" that these projects "could be scaled up to commercial-scale units while being reasonably reliable, efficient, and not unreasonably costly." Non-State Br. 34. On the contrary, the record is replete with information explaining how small- or pilot-scale carbon capture systems could be successfully scaled up. 80 Fed. Reg. at 64,550, 64,557; RTC 6.3-23, 6.3-44. Notably, much of this detailed how-to comes from studies by steam electric utilities. 80 Fed. Reg. at 64,557 (discussing studies by American Electric Power and Tenaska Trailblazer Partners); *see also* RTC – Chapter 2, 2.1-37, EPA-HQ-OAR-2013-0495-11861.

Respondent EPA's Brief (ECF #1659737), at 26-27, *North Dakota v. EPA*, No. 15-1381 (D.C. Cir. Feb. 6, 2017) (joint appendix citations omitted) (attached hereto as Exhibit C).

EPA also noted in the 2015 Preamble that American Electric Power (AEP) and Alstom Power conducted a "pilot-scale demonstration at [AEP's] Mountaineer Plant in West Virginia," which "achieved capture rates from 75 percent . . . to as high as 90 percent." 2015 Preamble at 64,552/1. EPA further observed that "AEP also proposed a Front End Engineering & Design (FEED) Report, explaining how its pilot-scale work could be scaled up top successful full-scale operation …" *Id.* at 64,552/1-2. EPA noted that high-ranking executives of both AEP and Alstom concluded that the pilot demonstrated the feasibility of CCS. It quoted Mike Morris, the Chairman and CEO of AEP, as saying in 2011: "we feel that we have demonstrated to a certainty that the carbon capture and storage is in fact viable technology for the United States and quite

[111] Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units, Proposed Rule, 79 Fed. Reg. 79 Fed. Reg. 1,430, 1,471/3 (proposed Jan. 8, 2014).

honestly for the rest of the world going forward." *Id.* at 64,556/1.[112] And it quoted Alstom's senior Vice President Joan McNaughton as saying: "[t]he Validation Plant at Mountaineer demonstrated the ability to capture up to 90% of the carbon dioxide from a stream of the plant's emissions. The technology works . . . ." 2015 RTC, Response 6.3-107, at 6-69.

In the 2015 Preamble, EPA also cited the Southern Company/MHI Plant Barry demonstration project in Alabama, which achieved a "CO_2 capture rate of over 90 percent," transported the captured CO_2, and injected it into a saline reservoir for storage. 2015 Preamble at 64,552/2. It also cited vendors' performance guarantees for CCS technology, noting that the D.C. Circuit Court has relied on vendor guarantees and expectations as confirmation of technical feasibility. *Id.* at 64,555/1 (citing *Sierra Club v. Costle*, 657 F.2d at 364, and *Essex Chemical v. Ruckelshaus*, 486 F.2d 427 (D.C. Cir. 1973)).

The record before EPA makes CCS more "adequately demonstrated" than other technologies previously approved as BSER by EPA and the courts.[113] In *Sierra Club v. Costle*, in evaluating EPA's choice of flue gas desulfurization (FGD) scrubbing technology as BSER, the Court characterized EPA's data on the prior performance of the technology as "evidence that only one commercial scale plant and one small pilot unit can almost but not quite meet the standard." 657 F.2d at 363. But the Court upheld EPA's choice based on its acceptance of "EPA's documentation on the potential for improved performance of scrubbers to achieve [the standard]." *Id.* at 364. In *Lignite Energy Council v. EPA*, 198 F.3d at 933-34, the court held that EPA reasonably set a performance standard for coal-fired industrial boilers by extrapolating from the performance of technology used on utility boilers. The absence of data for industrial boilers was "not surprising" because of the newness of the technology; as such, EPA could compensate for the lack of data by using other qualitative methods, "including the reasonable extrapolation of a technology's performance in other industries." *Id.* at 934.

And in *Essex Chemical v. Ruckelshaus*, 486 F.2d 427, the court upheld an EPA rule requiring that sulfuric acid plants meet an emissions standard of 4 pounds per ton by using "dual absorption" technology, although prior tests showed that the technology had an inconsistent track

[112] AEP subsequently took the position that the Mountaineer project did not adequately demonstrate that partial CCS could be adopted at commercial scale. Comments of AEP, 80-83 (May 8, 2014), Docket ID EPA-HQ-OAR-2013-0495-10618. As EPA noted in the 2016 Reconsideration Denial, "EPA responded to all of those comments, noting among other things that both AEP's own FEED study and the NETL studies set out in point-by-point, system-by-system detail how the capture technology could be scaled up to full-scale, why the costs at the project were not indicative of costs at a new facility (for example, since the project was a retrofit, the project presented siting issues (including siting for monitoring wells) that could be avoided for a new plant), and generally why partial CCS is not exorbitantly costly." 2016 Reconsideration Denial, at 31 (citing 2015 RTC, Responses 6.3-23, 6.3-93, 6.3-247, 6.3-257, and 6.3-272).

[113] EPA itself made this point in response to comments on the proposed rule. "CCS is actually further developed than were FGD scrubbers when selected as BSER in the 1971 NSPS for the same industry." 2015 RTC, Response 6.3-17, at 6-14.

record of meeting that standard. Tests at one plant showed that "the average of the nineteen readings taken when the plant was near full capacity is approximately 4.6 lbs./ton. In sum, the proposed standard was exceeded on two occasions, equalled on another, and nearly equalled on the average of nineteen different readings." *Id.* at 437. And yet the Court concluded: "Keeping in mind Congress' intent that new plants be controlled to the 'maximum practicable degree,' we find that the 4.0 lbs./ton standard based on a dual absorption system for new elemental sulfur burning plants is the result of the exercise of reasoned discretion by the Administrator and cannot be upset by this court." *Id*.

It is hard to overstate what a drastic departure from precedent it would be for EPA to conclude, based on this record, that CCS is not technically feasible. Rejecting CCS and adopting a less effective technology as BSER would wholly disregard Congress's intent that "new plants be controlled to the 'maximum practicable degree.'" *Id.*

b. EPA's proposal fails to acknowledge the ways it is inconsistent with EPA's previous positions. (C-10)

Historically, both EPA and the courts have taken the position that a technology can be considered "adequately demonstrated" for purposes of section 111 even if the technology has not yet actually been used to meet the adopted standard. "Recognizing that the Clean Air Act is a technology-forcing statute," the D.C. Circuit Court in *Sierra Club v. Costle* upheld EPA's "authority to hold the industry to a standard of improved design and operational advances, so long as there is substantial evidence that such improvements are feasible and will produce the improved performance necessary to meet the standard." 657 F.2d at 364. "Section 111 looks toward what may fairly be projected for the regulated future, rather than the state of the art at present." *Portland Cement Ass'n v. Ruckelshaus*, 486 F.2d at 391.

EPA fails to contend with these precedents or acknowledge that it is departing from its long-held positions following them. This in itself renders EPA's proposed action arbitrary and capricious. *Fox*, 556 U.S. at 515 ("[T]he requirement that an agency provide reasoned explanation for its action would ordinarily demand that it display awareness that it *is* changing position.").

For instance, despite acknowledging that CCS is currently operating at Boundary Dam, EPA "requests comment on whether Boundary Dam's first-year operational problems cast doubt on the technical feasibility of fully integrated CCS (Comment C–10)." Proposed Rule at 65,444/2. In other words, although the technology underlying the BSER is feasible now and "may fairly be projected for the regulated future," EPA suggests the fact that partial CCS has encountered some problem in the past means it is not adequately demonstrated. This backwards-looking approach to BSER is inconsistent with D.C. Circuit precedent and longstanding EPA practice, but EPA fails to address or even acknowledge that inconsistency.

Nor does EPA acknowledge that EPA itself has thoroughly refuted the argument that "Boundary Dam's first-year operational problems cast doubt on the technical feasibility of fully integrated CCS." In its 2016 Reconsideration Denial, EPA referred to this argument as "greatly exaggerated and essentially incorrect." EPA said:

> [T]he CO_2 capture system at BD3 is operating successfully, the unit meets the Canadian performance standard for CO_2 emissions (which is more stringent than the U.S. standard), and it is producing more CO_2 for enhanced oil recovery than

> called for by contract. Operational issues in the first year of operation were related largely to ancillary systems and not to the carbon capture system, and appear to have been successfully resolved.

2016 Reconsideration Denial, at 7. EPA went on to explain in detail why the first year operational issues did not undermine the conclusion that CCS is technically feasible:

> It is not unusual for plants to experience operational issues after first installing and operating a complex technical system. See, e.g., 79 FR 1482. However, according to SaskPower, most of the technical issues experienced by the unit in its initial year of operation involved ancillary equipment and control systems rather than technical issues that are directly attributable to the carbon capture system itself. For example, there were idiosyncratic issues associated with the design or misplacement of ordinary components – such as exhaust valves being installed too near intake valves. There was also a delay associated with the need to install a new, larger storage tank for the amine solvent and then to fix the tank, which the company described as being delivered with visible hairline cracks in the tank floor. In addition, in the initial months of operation, the unit experienced some operational difficulties associated with SaskPower's ability to control the amine regeneration temperature because of a leaky steam valve. This resulted in overheating and subsequent degradation of the amine solvent. While the leaky steam valve resulted in an overall degradation of the performance of the carbon capture system, few would characterize steam valve technology as "not adequately demonstrated" or "first-of-a-kind". Nor is a cracked storage tank the type of development that raises issues regarding the feasibility of carbon capture technology.

2016 Reconsideration Denial, at 8. EPA then observed that even with its first-year operational problems, Boundary Dam was meeting the standard set by the 2015 Preamble:

> Over the one-year operating period from October 2014 through September 2015, even considering the facility downtime, BD3 captured approximately 415,000 tons of CO_2. This is a capture rate exceeding 40 percent, which is significantly more efficient than the 12-month annual capture rate (reflecting partial carbon capture at an annual rate of approximately 16 to 23 percent depending on coal type) on which the section 111(b) new source standard is predicated. See 80 FR 64573-74. Indeed, the plant's capture amount would have comfortably satisfied the standard for a plant with five times the volume of CO_2 emissions (i.e., a 500 MW SCPC plant). From February 2015 through January 2016, the plant captured 625,000 tons of CO_2, a capture rate exceeding 60 percent, which is, as noted, well in excess of what the NSPS requires (notwithstanding downtime for the system in June, September, and October). The initial capture rates for the months immediately following the two month maintenance period also greatly exceed those on which the NSPS are predicated, as does the plant's projected 2016 capture rate. Equally important is that the plant's initial operational issues appear to be resolved, and that most of these operational issues were related, in any case, to ancillary systems at the plant, not to the carbon capture system.

2016 Reconsideration Denial, at 9-10.

EPA cannot reverse its position on the conclusions to be drawn from Boundary Dam's first year of operation without explaining why it has determined that its previous position was wrong. "[A] reasoned explanation is needed for disregarding facts and circumstances that underlay or were engendered by the prior policy." *Fox*, 556 U.S. at 516.

c. Boundary Dam's and Petra Nova's most recent performance, along with numerous other examples of the successful operation of CCS, and the Department of Energy's continuing embrace of CCS technology, further demonstrate the technical feasibility of CCS. (C-13)

As noted above, EPA concluded in 2016 that Boundary Dam's performance demonstrated the feasibility of CCS. Boundary Dam's more recent performance reaffirms that conclusion. SaskPower issues monthly reports on the progress of the Boundary Dam project. Its report for December 2018 states:

> The Carbon Capture and Storage (CCS) facility at Boundary Dam Power Station captured 70,395 tonnes of CO_2 in December, which is the equivalent of taking 17,599 vehicles off the road. The facility was online 86.3 per cent of the month coming offline for 102 hours due to a boiler tube leak on Boundary Dam Unit 3. The CCS facility achieved a high capture rate including a peak one-day capture rate of 2,807 tonnes.
>
> In 2018, the CCS facility captured a total of 625,996 tonnes—a vast improvement compared to the previous year. The overall availability of the facility in 2018 was 69 per cent. However, if you exclude the days when the CCS facility was available but offline because of issues at the power plant (for example – the days when the power plant was down due to storm damage this summer) that increases to 94 per cent availability. This positive result can be attributed to the improvements made during the 2017 planned maintenance outage. Amine usage for 2018 was also lower compared to previous years.[114]

Further recent proof of the feasibility of CCS is provided by the success of the Petra Nova project near Houston, Texas. In March 2018, EPA prepared a memorandum on the status of the CCS projects referenced in the 2015 rulemaking.[115] This CCS Status Memorandum described an article written by the Department of Energy in October 2017, regarding the Petra Nova project, "reported to be the world's largest post-combustion carbon capture system":

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[114] SaskPower, *BD3 Status Update: December 2018* (Jan. 11, 2019), https://www.saskpower.com/about-us/our-company/blog/bd3-status-update-december-2018.

[115] U.S. EPA, Memorandum, Review of the current status of the Carbon Capture and Sequestration projects referenced in the Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units 2015 rulemaking (Mar. 2018), Docket ID EPA-HQ-OAR-2013-0495-11947 (CCS Status Memorandum).

> The Petra Nova project reached a major milestone, capturing more than 1 million tons of CO_2 for use in enhanced oil recovery (EOR). The project has been successfully demonstrating an advanced amine-based CO_2-capture technology that removes 90 percent of the CO_2 emitted from a flue gas stream. The project began commercial operations on January 10, 2017. On April 13, 2017 Secretary of Energy Rick Perry attended a ribbon cutting ceremony for the project, where he noted that Petra Nova "demonstrates that clean coal technologies can have a meaningful and positive impact on the Nation's energy security and economic growth."

CCS Status Memorandum, at 21-22.[116] The project was built on time and on budget[117] and is capturing 4,776 MT/day.[118]

EPA now suggests that the performance of Petra Nova is irrelevant, because "it has not demonstrated that the integration of the thermal load of the capture technology into the EU steam generating unit (*i.e.*, boiler) steam cycle. Rather, the parasitic electrical and steam load are supplied by a new 75 MW co-located natural gas fired facility." Proposed Rule at 65,444/2. But this in no way undermines EPA's previous conclusion that Petra Nova is evidence of the feasibility of CCS.[119] The question of how the "parasitic and electrical steam load" is supplied is separate from the question of whether a facility is successfully demonstrating carbon capture and storage as an effective system of emissions reduction. A group of experts who evaluated the different technologies employed at Boundary Dam and Petra Nova concluded that a Petra Nova-style plant could capture 65.6 percent of emissions.[120] EPA determined that a carbon capture rate of just 16 percent (for a facility burning bituminous coal) or 23 percent (for a facility burning subbituminous coal or dry lignite) will be sufficient to meet the Current Standard. 2015 Preamble

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[116] *See* U.S. Dep't of Energy, Office of Fossil Energy, *DOE-Supported Petra Nova Captures More Than 1 Million Tons of CO_2*, Oct. 23, 2017, https://www.energy.gov/fe/articles/doe-supported-petra-nova-captures-more-1-million-tons-co2.

[117] David Greeson, NRG, PowerPoint, "What Do Updated 45Q Tax Credits Mean for Carbon Capture," (Apr. 10, 2018), https://www.naruc.org/default/assets/File/CCS45Q_041018.pdf.

[118] Sonal Patel, "Japanese Conglomerates Rejigger Power Sector Strategies," Power (Feb. 21, 2019), https://www.powermag.com/japanese-conglomerates-rejigger-power-sector-strategies/?pagenum=3.

[119] EPA cited Petra Nova both in the 2015 Preamble at pages 64,551-52 and at page 4 of "Appendix 3 — Non-BSER CPP Flexibilities," an appendix to the January 11, 2017 "Basis for Denial of Petitions to Reconsider and Petitions to Stay the CAA section 111(d) Emission Guidelines for Greenhouse Gas Emissions and Compliance Times for Electric Utility Generating Units," Docket ID EPA-HQ-OAR-2013-0602-37338 (also submitted as Attachment J to Docket ID EPA-HQ-OAR-2017-0355-24423).

[120] H. Mantripragada, H. Zhai and E. Rubin, *Boundary Dam or Petra Nova – Which is a better model for CCS energy supply?*, International Journal of Greenhouse Gas Control, Mar. 2019, at 63.

at 64,513/2-3. If a Petra Nova-style system can meet the 2015 standard, it is clearly a better "system of emissions reduction" than the "system" EPA is currently proposing to meet a weaker standard.

The experts who recently compared Boundary Dam and Petra Nova also concluded that "under most design . . . market . . . and policy . . . scenarios, using an advanced gas-fired combined cycle co-generation plant to supply CCS regeneration steam and electricity has both performance and cost benefits compared to the case where steam and electricity are supplied from the primary power plant steam cycle." *Id.* at 66. EPA's newfound disdain for the Petra Nova model is unsupported and arbitrary.[121]

EPA recently received an updated and extensive list of numerous other examples of the successful operation of carbon capture and storage, in comments submitted by the Natural Resources Defense Council and the Clean Air Task Force on the proposal to replace the Clean Power Plan.[122]

The Department of Energy's conclusion that CCS is technically feasible is also compelling. The Department of Energy has endorsed the feasibility of CCS, not only in the context of Petra Nova, but repeatedly for the power industry as a whole. A January 29, 2019, *E&E News* article reported:

> The United States is "more involved than ever" in carbon capture technologies and intends to announce funding in the coming months to support two commercial-scale systems that could be used on gas and coal plants, a senior Department of Energy official said yesterday.
>
> Speaking at the Atlantic Council in Washington, D.C., DOE Assistant Secretary of Fossil Energy Steven Winberg said the not-yet-released funding announcement would support at least two front-end engineering design (FEED) studies for

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[121] Even if one accepted the idea that "integration of the thermal load" is an essential aspect of a CCS system, EPA has already rejected the idea that "a system cannot be adequately demonstrated unless all of its component parts are operating together. Courts have, in fact, accepted that EPA can legitimately infer that a technology is demonstrated as a whole based on operation of component parts which have not, as yet, been fully integrated." 2015 Preamble at 64,556/3 (citing *Sur Contra la Contaminacion v. EPA*, 202 F.3d 443, 448 (1st Cir. 2000); *Native Village of Point Hope v. Salazar*, 680 F.3d 1123, 1133). Once again, EPA is reversing its previous position without even demonstrating awareness that it is changing position, let alone explaining the change. *Fox*, 556 U.S. at 515 ("[T]he requirement that an agency provide reasoned explanation for its action would ordinarily demand that it display awareness that it is changing position.").

[122] Natural Resources Defense Council and Clean Air Task Force, Comment, Re: Emission Guidelines for Greenhouse Gas Emissions from Existing Electric Utility Generating Units; Revisions to Emission Guideline Implementing Regulations; Revision to New Source Review Program, 83 Fed. Reg. 44,746 (Aug. 31, 2018), (Oct. 31, 2018), Docket ID EPA-HQ-OAR-2017-0355-24266; *see* appendix B thereto.

> commercial-scale carbon capture, utilization and storage (CCUS). There would be additional funding announcements from DOE to support "transformational" technologies that can provide real-time sensing of carbon dioxide below the Earth's surface, he said.
>
> "The United States will remain a strong global voice for CCS," Winberg said. "I expect that we will be more involved than ever . . . and develop and broadly deploy these critical technologies." . . . .
>
> He said there needed to be more "robust" policies supporting the technology, adding officials were "excited" about the upcoming Clean Energy Ministerial, an international forum of energy leaders.[123]

As the Supreme Court stated in *State Farm*, an agency action is "arbitrary and capricious if the agency . . . entirely failed to consider an important aspect of the problem, [or] offered an explanation for its decision that runs counter to the evidence before the agency." *State Farm*, 463 U.S. at 43. Given the Department of Energy's expertise on energy technology, its embrace of the feasibility of CCS, which EPA is undoubtedly aware of, is important "evidence before the agency," which EPA must address.

d. EPA's suggestion that projects receiving public funds cannot provide evidence of technical feasibility unless industry is already voluntarily using that technology commercially has no basis in the statute. (C-11)

Another EPA rationale for questioning the technical feasibility of CCS has no actual relationship to technical feasibility at all. EPA states: "Because no independent commercial CCS projects are in operation, EPA solicits comments on whether the fact that Boundary Dam and Petra Nova were dependent on government support casts doubt on the technical feasibility of CCS, e.g., whether it raises concerns as to the extent to which developers are willing to accept the risks associated with the operation and long-term reliability of CCS technology." Proposed Rule at 65,444/2.

EPA addressed the argument about government support in the 2015 Preamble, making the obvious point that "the availability of – or the lack of – external financial assistance does not affect the technical feasibility of the technology." 2015 Preamble at 64,550/2. EPA further observed, in the context of its discussion of cost:

> The need for subsidies to support emerging energy systems and new control technologies is not unusual. Each of the major types of energy used to generate electricity has been or is currently being supported by some type of government subsidy such as tax benefits, loan guarantees, low-cost leases, or direct expenditures for some aspect of development and utilization, ranging from exploration to control installation. This is true for fossil fuel-fired, as well as

[123] Christa Marshall, *DOE to fund 'transformational' projects*, E&E News, Jan. 29, 2019, https://www.eenews.net/energywire/stories/1060118817.

> nuclear-, geothermal-, wind-, and solar-generated electricity. As stated earlier, the EPA considers the costs of partial CCS at a level to meet the final standard of performance to be reasonable even without considering these opportunities to further reduce implementation and compliance costs.

2015 Preamble at 64,564/2. EPA addressed the argument again just two years ago in its brief in *North Dakota v. EPA*:

> Finally, the fact that Boundary Dam was partially subsidized by the Canadian government does not render it inappropriate to support the determination that the carbon capture technology it utilizes is adequately demonstrated. Non-State Br. 31. Nothing in the text of Section 111(a)(1) or this Court's jurisprudence suggests that such subsidies automatically disqualify a plant's operational experience from consideration in determining the Best System.[124]

EPA now fails to acknowledge or explain its apparent change of position, as it is required to do. *See Fox*, 556 U.S. at 515.

EPA's new interpretation is contrary to Congress's intent to limit harmful emissions from new sources to the maximum possible degree and to encourage the development and deployment of new technology. Given the ubiquity of subsidies from federal and state governments, this interpretation could extend well beyond this rulemaking to hamstring EPA's ability to use section 111 to achieve emission reductions from new and existing sources. For example, municipal solid waste landfills—often owned by public entities—have historically received a variety of state tax credits and other incentives to capture methane and other gases, leading to controls that have long formed the basis of the best system of emissions reduction for that source category. Moreover, EPA's new interpretation would limit the benefits of state efforts to support emerging control measures, thus reducing opportunities for federal action to amplify the benefits of successful state innovation. For example, state efforts to achieve greater use of CCS through tax exemptions and financial assistance can lead to much greater climate benefits if those technologies ultimately inform nationwide standards. Adopting the position that the existence of public support for a technology is evidence that the technology is not technically feasible would diminish the value of—and potentially discourage—these state efforts. EPA provides no reason to believe that Congress intended this perverse result.

EPA's statement that the absence of "independent commercial CCS projects" is an indication of non-feasibility could have far-reaching implications that go beyond the question of whether or how to factor in the issue of government support for prior projects. A position that the only technologies that can be considered adequately demonstrated are the ones that the regulated industry has developed on its own solely due to market forces is contrary to EPA's own 2018 analysis of the need for regulation of CO_2 emissions:

> Many regulations are promulgated to correct market failures, which otherwise lead to a suboptimal allocation of resources within the free market. Air quality and pollution control regulations address "negative externalities" whereby the

[124] Respondent EPA's Brief (ECF #1659737) at 25, *North Dakota v. EPA*, No. 15-1381 (D.C. Cir. Feb. 6, 2017).

> market does not internalize the full opportunity cost of production borne by society as public goods such as air quality are unpriced.
>
> While recognizing that optimal social level of pollution may not be zero, GHG emissions impose costs on society, such as negative health and welfare impacts, that are not reflected in the market price of the goods produced through the polluting process. For this regulatory action the good produced is electricity. If a fossil fuel-fired electricity producer pollutes the atmosphere when it generates electricity, this cost will be borne not by the polluting firm but by society as a whole, thus the producer is imposing a negative externality, or a social cost of emissions. The equilibrium market price of electricity may fail to incorporate the full opportunity cost to society of generating electricity. Consequently, absent a regulation on emissions, the EGUs will not internalize the social cost of emissions and social costs will be higher as a result.

2018 Economic Impact Analysis, at 1-2.

Such a position would also contradict EPA's statement in the 2015 Preamble that "[t]here is no requirement, as part of the BSER determination, that the EPA finds that the technology is 'commercially available.'" 2015 Preamble at 64,556/2. Indeed, the suggestion that a technology cannot be considered technically feasible unless the industry has already adopted it as a result of market forces runs counter to the whole idea that "Section 111 looks toward what may fairly be projected for the regulated future, rather than the state of the art at present." *Portland Cement Ass'n v. Ruckelshaus*, 486 F.2d at 391. And it would undermine the intent of Congress in enacting section 111(b) that "new plants be controlled to the 'maximum possible degree.'" *Essex Chemical,* 486 F.2d at 437.

In fact, consistent with EPA's own economic understanding quoted above, a major reason industry actors have not launched more commercial CCS projects may be the *absence of regulation*. In the 2014 proposed rule, EPA said:

> In 2011, AEP deferred construction of a large-scale CCS retrofit demonstration project on one of their coal-fired power plants because the state's utility regulators would not approve cost recovery for CCS investments without a regulatory requirement to reduce CO_2 emissions.

79 Fed. Reg. at 1,469/1. EPA elaborated on this point in the 2015 Preamble, saying:

> [W]e note that the Administration's CCS Task Force report recognized that CCS would not become more widely available without the advent of a regulatory framework that promoted CCS or provided a strong price signal for CO_2. In this regard, we note American Electric Power's statements regarding the need for federal requirement for GHG control to aid in cost recovery for CCS projects, to attract other investment partners, and thereby promote advancement and deployment of CCS technology: "as a regulated utility, it is impossible to gain regulatory approval to recover our share of the costs for validating and deploying the technology without federal requirements to reduce greenhouse gas emissions already in place. The uncertainty also makes it difficult to attract partners to help fund the industry's share."

2015 Preamble at 64,572 (quoting a July 14, 2011 AEP press release). Making the same point in its 2015 Responses to Comments, EPA cited a similar statement by AEP's partner Alstom:

> "AEP's decision to put Mountaineer II on-hold (sic) is a bellwether to our leaders on the consequences of uncertain climate policy. The Validation Plant at Mountaineer demonstrated the ability to capture up to 90% of the carbon dioxide from a stream of the plant's emissions. The technology works. But without clear policies in place outlining options for cost recovery, power generators are hard pressed to invest in its continued refinement."

2015 RTC, Response 6.3-107, at 6-69.

Thus, EPA's suggestion that the rarity of 100-percent privately funded commercial CCS projects is a reason to reject CCS as BSER is contradicted by industry actors' own statements. Rather, adopting CCS as BSER may be a step needed to generate more private commercial investment in CCS.

As the Supreme Court has instructed, "a reasoned explanation is needed for disregarding facts and circumstances that underlay or were engendered by the prior policy." *Fox*, 556 U.S. at 516. The evidence that regulation is needed to *promote* commercial adoption was among the "facts and circumstances" that underlay the Current Standard. But now, EPA fails to even acknowledge that evidence and its previous conclusion, let alone provide a reasoned explanation for disregarding them.

2. The proposed weakening of BSER cannot be supported on the theory that it would drive technological adoption in other countries.

As noted above, courts have previously explained what it means to say the Clean Air Act is a "technology-forcing" statute: EPA can "hold the industry to a standard of improved design and operational advances." *Sierra Club v. Costle*, 657 F.2d at 364. EPA does acknowledge that it is required to "consider the effect of its selection of BSER on technological innovation or development." Proposed Rule at 65,448/2. But EPA's own statements make it clear that its Proposed Rule will not force any technological innovation.

Specifically, EPA acknowledges that any new coal-fired plant built in the United States would already meet the proposed standard anyway because, even without the Proposed Rule, a developer would use compliant technology. 2018 Economic Impact Analysis, at 3-5 ("modeling demonstrates that all new sources covered by this proposal that are currently planned or projected to be constructed are capable of meeting the proposed standard without taking any additional action"). Thus, if finalized, the Proposed Rule would not compel or even encourage the developers of new coal-fired power in the U.S. to do anything at all.

EPA nonetheless suggests, nonsensically, that the proposed rule would improve technology in other countries. In conclusory fashion, EPA says that "establishing [the proposed BSER] as the basis for control requirements in the U.S. for new and reconstructed sources would help establish it in other nations, resulting in a reduction in global CO_2 emissions." Proposed Rule at 65,448/3. EPA provides no evidence to support these statements. Since new coal-fired plants will use technology complying with this Proposed Rule regardless of whether the rule exists, it is illogical for EPA to conclude that it is the rule itself that will affect other nations, let alone "force" the adoption of technology in those countries or "hold" industry in those countries to any standard at all. Further, EPA supplies no evidence that global CO_2 emissions will be reduced if the rule is finalized. In fact, EPA's only analysis is directly to the contrary. It claims that under the Proposed Rule, if a new coal-fired plant is built, CO_2 emissions will increase, but EPA is unwilling to try to quantify them:

> To the extent that new coal-fired facilities are constructed, a BSER coal facility under the proposed standard would have higher CO_2 emissions than a BSER facility under the 2015 final standards. We do not attempt to quantify the impacts of these increased emissions or economic value of these impacts.

2018 Economic Impact Analysis, at 2-6.

And, once again, EPA is completely ignoring its own prior conclusion that requirements like those in the Proposed Rule are *not* technology forcing. In 2014, EPA explained:

> Identifying highly efficient generation technology as the BSER would not achieve another purpose of CAA section 111, to encourage the development and implementation of control technology. At present, CCS technologies are the most promising options to achieve significant reductions in CO_2 emissions from fossil-fuel boilers and IGCC units. A standard based on the performance of highly efficient coal-fired generation does not advance the development and implementation of control technologies that reduce CO_2 emissions.

79 Fed. Reg. at 1,468-69. EPA has failed to properly consider the effect of the rule on technological innovation and development, as required in a section 111 rulemaking, and EPA's proposed rationale for weakening the current standard is illogical and unsupported. *State Farm*, 463 U.S. at 43 (requiring an agency to "examine the relevant data and articulate a satisfactory explanation for its action including a rational connection between the facts found and the choice made").

3. The actions of 32 states support a finding that CCS technology is adequately demonstrated.

A majority of states recognize that CCS is a demonstrated system of emissions reduction or that CCS adds value to businesses, or both. For example, the Oklahoma Legislature has declared, "Storage of carbon dioxide in geological formations is an effective and feasible strategy to deposit, store or sequester large volumes of carbon dioxide over long periods of time," while Kentucky identifies CCS as an "economic development priority" that "will create jobs . . . and favorably position the Commonwealth for future leadership and growth in the field."[125] Starting as early as 1999, 32 states have enacted statutes or adopted regulations to support and promote local use of CCS technology.[126]

- Eighteen states have established permitting and monitoring rules and procedures for CCS components, including injection wells and CO_2 pipelines. Pipelines to carry carbon dioxide to EOR operations or geologic storage sites have existed since Texas oil fields

[125] Okla. Stat. tit. 27A, § 3-5-101(B)(6) (emphasis added); Ky. Rev. Stat. Ann. § 353.802(5).

[126] *See* "Carbon Sequestration in State Statutes and Regulations," attached hereto as Appendix B. The following breakdown summarizes the detail in Appendix B.

piloted EOR in 1972,[127] and regulatory frameworks supporting such pipelines are almost as old.[128] Many state laws build upon federal regulations for Class VI underground injection wells (i.e., injection wells exclusively for geologic CO_2 storage) in 40 C.F.R. Parts 144 and 146.[129] In short, 18 states have put regulatory frameworks in place to manage the use of CCS in their jurisdictions. These actions underscore that CCS is either in use or fully anticipated in these states.

- Twelve states recognize power plants using CCS as renewable energy resources and/or make plants with CCS eligible for credit under a state renewable portfolio standard. In doing so, these states prioritize CCS over other fossil-fueled generation, indicating that many states have concluded that power plants with CCS are safe, reliable and affordable sources of power.

- Similarly, eight states expressly allow utilities deploying CCS to recover their costs from ratepayers through service surcharges. Because utility regulators must ensure ratepayers only pay for prudent investments and are charged reasonable electricity rates, in effect, these states have concluded CCS is adequately demonstrated and reasonably cost-effective.

- Fifteen states provide financial incentives for CCS projects, including research grants, tax credits or deductions for facilities and equipment, and even outright waivers of property or sales taxes. Five such states have targeted these incentives to encourage the construction of new CCS facilities or pipelines, and three have directly invested public dollars in building CCS projects. In all cases, the public money dedicated to attracting or facilitating CCS projects in their state again underscores the demonstrated economic and environmental benefits of widespread CCS.

Many of the states' CCS laws indicate the CO_2 emissions limit that EPA adopted in 2015, 1,400 lb CO_2/MWh, is achievable with adequately demonstrated technology or methods. Two states use a lower benchmark—1,100 lb CO_2/MWh—to qualify power plants to recover CCS

[127] Expanding & Accelerating the Deployment & Use of Carbon Capture, Utilization, and Sequestration, Hearings before Sen. Comm. on Envir. & Public Works, 115th Cong., 1st Sess., 74 (2017), https://www.govinfo.gov/content/pkg/CHRG-115shrg27318/pdf/CHRG-115shrg27318.pdf (CCS Sen. Hrg.); *see* Western Gov. Ass'n Policy Res. 2015-06, "Enhanced Oil Recovery," ¶1, *id*. at 21-23.

[128] *See* Miss. Code Ann. § 11-27-47 (1984); N.D. Cent. Code § 57-06-17.1 (1991) (amended 1997).

[129] Ill. Admin Code tit. 35, § 730, subpart H; Mich. Admin. Code. r. 299.9204; N.D. Admin. Code 43-05-01-01; Ohio Admin. Code r. 3745-51-04(H); Tenn. Comp. R. & Regs. 0400-12-01-.02; Utah Admin. Code r. R315-261-1; Vermont Admin. Code r. 16-3-303:11-201; Wyo. R. & Regs. 020.0011.24. North Dakota's regulations and its "Carbon Dioxide and Underground Storage" statutes formed the basis of EPA's approval in April 2018 of its state-administered Class VI underground injection control program. 83 Fed. Reg. 17,758, 17,761 (Apr. 24, 2018).

costs through rates,[130] to receive tax credits,[131] or to operate at all.[132] Similarly, six states require power plants to capture a certain percentage of CO_2 emissions to receive tax incentives, recover costs, or operate: North Dakota (20 to 80 percent), Montana (50 percent), Texas (70 percent), Michigan (85 percent), and Kansas and Minnesota (100 percent).[133] Compared to these capture rate requirements, the 16-to-23-percent partial CCS rate assumed in the Current Standard is conservative.

The number of states adopting laws on CCS has only grown since the 2015 rulemaking, reflecting the global recognition that CCS can be an important technology for limiting CO_2 emissions as part of a climate change mitigation strategy.[134] In this sense, EPA's failure to encourage the state of the art in CCS disserves American utility companies in the long run, as their international counterparts take the lead in advancing promising technology. As the Chairman of the U.S. Senate's Environment and Public Works Committee remarked in 2017, "America is currently a leader in [CCS] technology, and we want to keep it that way."[135] Senator Barrasso continued:

> Encouraging American innovation is the right approach to continuing American leadership, leadership in the development of technologies to lower the emissions associated with fossil fuel use. Through American leadership we create opportunities to export our innovations around the world. . . . Now is the time to see what more we could do to encourage and remove impediments to the use and deployment of [CCS]. We need to make sure our laws and regulations accelerate, not hinder, our environmental goals.[136]

Thirty-two states, pursuing a wide range of energy and environmental policies, have created a regulatory environment conducive to CCS deployment. Not only is CCS adequately demonstrated, it is actively encouraged by a majority of states in anticipation of federal requirements that reasonably require its use, such as the Current Standard.

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[130] N.M. Stat. Ann. § 7-9G-2.

[131] N.M. Stat. Ann. § 62-6-28.

[132] Wash. Rev. Code Ann. § 80.80.040. As of March 2018, Washington fossil-fueled plants of 25-350 MW capacity must meet an even *lower* emissions limit, 970 lb CO_2/MWh. Wash. Admin. Code § 173-407-130.

[133] N.D. Cent. Code § 57-60-02.1; Mont. Code Ann. § 69-8-421; Tex. Tax Code Ann. § 171.602; Mich. Comp. L. Ann. § 460.1047; Kan. Stat. Ann. § 79-233; Minn. Stat. Ann. § 216H.03. Montana's law outright bans new coal-fired plants, unless the plant uses CCS to capture at least 50 percent of CO_2 emissions. In Minnesota, plants using 100-percent CCS do not fall under the State's coal-fired plant ban and offset exemption process.

[134] *See, e.g.*, IPCC 2018 Summary at 17.

[135] CCS Sen. Hrg. at 2, opening stmt. of Sen. Barrasso (R-Wyo.).

[136] *Id.*

D. The history of the Clean Air Act and court precedent allow for a power plant emission standard that may be more expensive to meet in some locations than others.

EPA's new, *de facto* understanding that Clean Air Act section 111(b) mandates that any performance standard provide all potential sources in each category an equal economic opportunity everywhere in the country is incorrect. EPA now rejects partial CCS technology in large part on its unsupported claim that "it could be prohibitively expensive for developers to secure sufficient quantities of water in arid regions of the country." Proposed Rule at 65,443/3. But section 111(b) was not intended to equalize compliance costs nationwide so as to ensure that new sources could be built and operated in every conceivable location in the country for the same price. Instead, Congress designed section 111(b) so as to prevent states with cleaner air from using that to gain an advantage over other states and thereby allowing their own air quality to deteriorate. *ASARCO Inc. v. EPA*, 578 F.2d 319, 328 n.25 (D.C. Cir. 1978) (explaining that Congress sought to dis-incentivize "states with presently low levels of pollution [from] adopting lenient State Implementation Plans to attract industry until pollution reached the national limits" and to prevent industry from "forum shopping" on that basis). That is, Congress knew that section 111(b) standards would influence geographical patterns of industrial development.

As the record EPA assembled during the 2015 rulemaking shows, in the event that an electricity supplier chooses to build a new coal-fired plant, the captured CO_2 can be sent out of state for storage; alternatively, economically reasonable compliance options besides CCS are available, such as co-firing with gas or employing integrated gasification. 2015 Preamble at 64,545. Under the Current Standard, a future developer of new generation in an area lacking known CO_2 storage capacity has several options and would naturally evaluate whether it was more economical to first ship coal into the state for burning and then ship CO_2 back out for storage, or to co-fire the coal plant with gas to meet the standard, or to build a plant that is not powered by coal. These choices are similar to location-specific considerations power plant developers always face.

From its inception, section 111(b) has allowed EPA to set emission standards that affect the relative cost of operating a new power plant in different areas of the country. *See Sierra Club*, 657 F.2d at 339 (discussing changes in economic incentives in different regions of the country due to evolution of section 111(b) controls on new coal plants); *Alliance for Clean Coal v. Miller*, 44 F.3d 591, 593 (7th Cir. 1995) (same). Congress has been fully aware that section 111(b) performance standards set by EPA affect economic incentives for where plants are built and what fuel they burn. As Congress directed, in 2015 EPA took costs into consideration in setting the Current Standards. *See* 42 U.S.C. § 7411(a)(1). EPA performed this analysis and determined that the costs of meeting the Current Standards would be reasonable and that they would not cause adverse economic impacts. 2015 Preamble at 64,558-73, 64,592-94. As explained below, the Proposed Rule fails to provide sufficient information to show that the ability to comply with the Current Standard is so geographically constrained that its cost should now be deemed unreasonable. *Fox*, 556 U.S. at 515-16.

E. EPA lacks a reasoned basis for reversing its determination that geographic availability of CCS is sufficient for CCS to be considered BSER.

In the 2015 rulemaking EPA examined the volume and suitability of CO_2 geologic storage (GS) capacity in each state as well as nationwide, and presented its calculations in a detailed Geographic Availability Technical Support Document.[137] Based on Department of Energy data, EPA found that "areas of the United States with appropriate geology have a sequestration potential of at least 2,035 billion metric tons of CO_2 in deep saline formations." 2015 Preamble at 64,578/3-79/1. These saline formations thus have the potential to store as much CO_2 as all existing coal-fired plants in the county would emit if they operated for another 1,000 years.[138] EPA explained that it relied on "a conservative outlook of potential areas available for the development of CO_2 storage in that we include only areas that have been assessed to date." *Id.* at 64,583. Based on this state-by-state analysis, EPA also determined that "[s]ubsurface formations suitable for GS of CO_2 captured from affected EGUs are geographically widespread throughout most parts of the United States." *Id.* at 64,575/3.

Even in most of those areas where there was no already-identified CO_2 storage capacity, EPA found that a coal-fired plant could locate there and transport captured CO_2 via pipeline a reasonable distance to a geological storage area. 2015 Preamble at 64,583/1 ("[T]he vast majority of the country has existing or planned CO_2 pipeline, active CO_2-EOR operations, the necessary geology for CO_2 storage, or is within 100 kilometers of areas with geologic sequestration. A review of Figure 1 indicates limited areas that do not fall into these categories."). Moreover, EPA found that, due to the interconnected nature of the electric grid, a new coal-fired plant could be built closer to an area with geological storage capacity and supply electricity to areas that do not have that capacity. *Id.* at 64,541/1 (explaining that "geologic sequestration sites are widely available, and a steam-generating plant with partial CCS that is sited near an area that is suitable for geologic sequestration can serve demand in a large area that may not have sequestration sites available").

Given the widespread availability of and access to geological storage capacity, as well as alternative compliance options other than partial CCS, EPA concluded that partial CCS was adequately demonstrated for the purposes of section 111(a). 2015 Preamble at 64,597/1. Indeed, EPA concluded that considering all available options, a new coal-fired plant could theoretically be built anywhere in the country.[139]

EPA now proposes to reverse all of these conclusions for two reasons: First, by referring to studies it already had during the 2015 rulemaking, it now thinks a specific geological

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[137] *See* U.S. EPA, Technical Support Document: Geographic Availability, 6-7 (July 31, 2015), Docket ID EPA-HQ-OAR-2013-0495-11772 (tabulating state-by-state CO_2 storage resources).

[138] *See* 2015 Preamble at 64,523 tbl.4.

[139] *See*, *e.g.*, 2015 RTC, Response 6.3-88, at 6-55 ("[T]he EPA believes that a new steam generating affected source could meet the promulgated standard and be located anywhere in the country. There is available sequestration capacity in most areas of the country, and there are alternative ways a new EGU could meet the standard, not involving sequestration, should a new source decide to locate in an area where these sequestration opportunities are unavailable.").

formation—unmineable coal seams—that it did *not* rely on in 2015 should not be relied on. Second, because it rains less in some parts of the United States than it does in others, "many sequestration sites might not have sufficient water resources to operate CO_2 capture equipment." *See* Proposed Rule at 65,444/1 (stating that the "combination" of these two factors leads EPA now to reject its 2015 finding that the geographical availability of CCS was adequate). Neither of these factors is sufficient to support EPA reversing its well-considered determination in 2015 that partial CCS was sufficiently geographically available that it could serve as the BSER. *See Fox*, 556 U.S. at 515-16.

1. EPA fails to justify reversing its finding that CO_2 storage capacity is adequate.

EPA bases its reversal of its determination that CO_2 storage capacity is adequate on its decision to exclude unmineable coal seams as possible areas for geological sequestration, which it says reduces the acreage of the United States that possesses access to known CO_2 storage capacity by 4 percent. But EPA was clear in 2015 that it never based the Current Standard on the availability of CO_2 storage in unmineable coal seams anyway. EPA cannot reverse its finding on the geographical availability of CCS by rejecting a fact it never even relied on to make its earlier determination. Further, EPA has no new basis for rejecting unmineable coal seams, and even if it did, national CO_2 storage capacity is more than adequate and is available to the vast majority of the country. EPA's justifications fail.

a. EPA lacks a reasonable basis for reversing its position that unmineable coal seams can be used for geologic storage.

EPA says in the Proposed Rule that it no longer believes unmineable coal seams have the potential to store CO_2, and "EPA has excluded this type of formation from potential GS areas," in part because there have been no large-scale demonstrations of CO_2 storage in those formations. Proposed Rule at 65,442/1-/2. "The elimination of unmineable coal seams reduces the geographic availability of sequestration areas by approximately 4 percent. [¶] For these reasons, GS may not be as widely geographically available as assumed in the 2015 analysis." *Id.* at 65,442/3.

Excluding storage in unmineable coal seams cannot support EPA changing its position that partial CCS is adequately demonstrated because EPA never based its 2015 BSER determination on the use of unmineable coal seams anyway. Instead, in the 2015 rulemaking EPA explicitly grounded its analysis only on the availability of CO_2 storage in deep saline formations. EPA explained this in 2015 in response to a criticism that there was little experience injecting CO_2 into coal seams for permanent storage because of various setbacks: "The BSER analysis and RIA rely on GS in deep saline formations. Current estimates of storage capacity indicate that coal seams provide only a small percentage of total US storage capacity." 2015 RTC, Response 6.3-96, at 6-62; *see also* 2015 Preamble at 64,588/2 ("The BSER determination and regulatory impact analysis for this rule relies on GS in deep saline formations."); *id.* at 64,579/2 ("[T]he determination that the BSER is adequately demonstrated and the regulatory impact analysis for this rule relies on GS in deep saline formations."); *id.* at 64,590/3 ("[T]he BSER determination and regulatory impact analysis for this rule relies on GS in deep saline formations, not on EOR.").

In addition, the studies EPA says now, "upon further review," make it doubt the viability of storage in unmineable coal seams were already in its possession during the 2015 rulemaking. *See* Proposed Rule at 65,442 nn.79-82 (citing to studies from 2013 and 2014). While EPA now says that the possibility of "coal swelling" mentioned in these pre-2105 reports "raises doubts regarding the feasibility of larger-scale GS in unmineable coal seams at this time," *id.* at 65,442/2, one report EPA cites in this same discussion states that although "[c]oal swelling . . . is often cited as the major technical concern relative to CO_2 storage in coal seams . . . . this concern is based on very limited and often conflicting laboratory and field data."[140]

EPA unacceptably fails to explain why it interprets preexisting data from 2014 and earlier differently than it did before. *See Pub. Citizen v. Steed*, 733 F.2d 93, 101 (D.C. Cir. 1984) ("In any event, NHTSA has not shown that these flaws were different in kind or quantity from those that have been pressed on the agency for the past ten years. They were old and known problems that had been found insufficient to preclude use of the procedures in the past, and the evidence in the record does not warrant NHTSA's dramatic change of position.").

b. Even under EPA's new measurement of 4 percent less acreage with access to storage, national and regional capacity is adequate.

EPA now claims that a 4-percent reduction in the acreage of the country convenient to geological sequestration (due to the elimination of unmineable coal seams) means that geological storage "may not be" as widely available as it believed in 2015. As explained above, this cannot logically support EPA changing its position that partial CCS is BSER. Moreover, it does not support a finding that geological storage is inadequate, as the evidence shows storage capacity is even more available than EPA assumed in 2015.

As EPA itself points out in the Proposed Rule, its "updated" analysis of geographic availability shows that estimates of storage capacity in deep saline formations—the formations EPA relied on in 2015 to find that partial CCS is BSER—actually *increased* since the 2015 rulemaking. Proposed Rule at 65,441 n.77 ("For deep saline formations, the low-end estimate of storage resource increased from 2,100 billion metric tons to 2,379 billion metric tons, and the high-end estimate increased from 20,014 billion metric tons to 21,633 billion metric tons."). EPA does not disagree with its 2015 determination that CO_2 storage in deep saline formations should serve as the basis of its BSER analysis.[141] Thus, the capacity to store CO_2 in the type of formation EPA says is relevant is even greater now than it was in 2015.

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[140] J. Litynski et al., Using CO_2 for enhanced coalbed methane recovery and storage, CBM Review, 2, June 2014, Docket ID EPA-HQ-OAR-2013-0495-11941, Attachment 2, *cited in* Proposed Rule at 65,442 n.81.

[141] Some language in the Proposed Rule could be read to suggest that EPA is reversing its position and contradicting NETL's conclusion that saline formations are suitable for CO_2 storage. *See* Proposed Rule at 65,442/1 (observing that saline storage has not been demonstrated "at all locations"); *but see id.* at 65,442,3 (explaining that updated information on saline formations and EOR "do not significantly change the EPA's understanding of which areas are amendable to GS"). EPA explicitly says, however, that its new determination that the geographical availability of CCS is too limited to be BSER is based *only* on two factors: the

This increase in storage capacity cannot support EPA changing its mind on the availability of storage capacity, one of the two factors that underlie its proposed finding that CCS is not geographical available.[142] *See Kansas City v. Dep't of Housing & Urban Dev.*, 923 F.2d at 194 (agency decision "cannot survive review" when based on a factual premise contradicted by the record).

c. Any reduction in access to storage is insufficient to justify EPA's change of position because many areas EPA says have limited storage access are unlikely to be chosen by developers for new coal-fired plants.

EPA also fails to refute its 2015 conclusion that a developer of new coal-fired energy would be unlikely to locate in certain areas of the country, which renders the small alleged reduction in acres of the country with known storage capacity of uncertain relevance to an analysis of geographical availability. EPA observed in the 2015 rulemaking that "[s]ome states have emission standards that effectively prohibit new uncontrolled coal-burning electricity generating units from locating within their borders, so the issue of geographic availability is moot as to such states." 2015 RTC, Response 2.1-29, at 2-12 to 2-13; *see also* 2015 Preamble at 64,576/3 ("[A] few states do not have geologic conditions suitable for GS, or may not be located in proximity to these areas. However, in some cases, demand in those states can be served by coal-fired power plants located in areas suitable for GS, and in other cases, coal-fired power

reduction in estimated storage areas by 4 percent (due to elimination of unmineable coal seams) and the lack of rainfall in some areas. *Id.* at 65,444/1 (reversing its former position due to the "combination" of these two factors). To the extent that EPA is basing its proposed determination that CCS is not adequately available on some new interpretation of the suitability of saline formations for storing CO_2, it improperly fails to provide notice of this rationale to the public, as it never states on what ground it would be reversing its previous findings on saline storage. *See United Food v. NLRB*, 880 F.2d at 1436 (agencies "must accept responsibility for clarifying and identifying the standards that are guiding its decisions"). Moreover, that saline storage may not be available "at all locations" or may be easier to use in some areas compared to others does not mean that EPA cannot consider it in its BSER analysis, as described in section III.D, above.

[142] EPA also completely ignores the fact that the Department of Energy has determined that the total potential CO_2 sequestration capacity across all formations is actually at least 9 percent greater than EPA assumed at the time the Current Standard was finalized in 2015. The 2015 rulemaking relied on the Fourth Edition of the *Carbon Storage Atlas* (2012) (Docket ID EPA-HQ-OAR-2013-0495-11410). *See* 2015 Preamble at 64,578 n.379. As the Proposed Rule acknowledges, after the 2015 rulemaking NETL published an updated Fifth Edition (2015) (Docket ID EPA-HQ-OAR-2013-0495-11941 [attachment]). *See* Proposed Rule at 65,441/2. The 2012 Fourth Edition of the *Atlas* reports a "low" estimate of total storage capacity as approximately 2,380 billion metric tons (at page 125), whereas the updated 2015 Fifth Edition has a "low" total estimate of 2,618 billion metric tons (at page 111). *See also* Press Release, U.S. Department of Energy, NETL's 2015 Carbon Storage Atlas Shows Increase in U.S. CO_2 Storage Potential (Sep. 28, 2015), https://www.energy.gov/fe/articles/netl-s-2015-carbon-storage-atlas-shows-increase-us-co2-storage-potential.

plants are unlikely to be built in those areas for other reasons, such as the lack of available coal or state law prohibitions and restrictions against coal-fired power plants.").

EPA's 2018 economic analysis agrees, noting that various states have created disincentives for new coal-fired construction through state initiatives or actual limits on power plant emissions. *See* 2018 Economic Impact Analysis, at 3-17 to 3-18. Yet EPA's revised analysis of geological storage availability does nothing to correlate the 4 percent of acres it now says have no access to known storage capacity with areas in which a new coal-fired plant is likely to be built. This failure to determine whether the alleged 4-percent reduction in acreage actually changes ability of developers to find a suitable site for a new coal-fired plant makes EPA's new conclusion that geological storage "may not be" as widely available arbitrary and capricious.

d. EPA improperly ignores its previous determination that the interconnected nature of the electricity grid means that developers of new coal-fired power continue to have the option to build a plant anywhere in the country.

EPA has recognized that a system of emission reduction can be BSER even though it might not be economical to implement that system on every acre of the country. In the proposal underlying the Current Standard, EPA stated that a technology can be the basis of a section 111 emission standard even if it is not practical in every location: "if the EPA promulgates section 111 emission limits based on a particular type of technology, and for economic or technical reasons, sources are able to utilize that technology in only certain parts of the country and not other parts, that result should not be viewed as inconsistent with congressional intent for CAA section 111." 79 Fed. Reg. at 1,467. EPA reaffirmed that position in the final rule in 2015. 2015 Preamble at 64,540/3-41/1. This is especially true in the electric power sector, where demand can be served by suppliers hundreds of miles away. EPA explained that:

> [E]lectricity demand in states that may not have geologic sequestration sites may be served by coal-fired electricity generation built in nearby areas with geologic sequestration, and this electricity can be delivered through transmission lines. This method, known as 'coal-by-wire,' has long been used in the electricity sector because siting a coal-fired power plant near the coal mine and transmitting the generation long distances to the load area is generally less expensive than siting the plant near the load area and shipping the coal long distances.

2015 Preamble at 64,582/3-82/1.

EPA fails to clarify in the Proposed Rule whether it is (a) reversing its position on that issue, or (b) adopting a rule that the technology has to be economically implementable in a certain percentage of the acres of the country, and that the alleged 4-percent reduction in areas with storage capacity pushes the percentage below that new, unspecified threshold. This is indicative of arbitrary and capricious rulemaking.

First, EPA ignores and does not dispute the region-by-region analysis in its 2015 Geographic Availability Technical Support Document, which found that the current rule "does not negatively impact the ability of these regions to access new coal generation to the extent that coal is needed to supply demand and/or those regions want to include new coal-fired generation in their resource mix." 2015 Preamble at 64,582/3-83/2. *See Fox*, 556 U.S. at 516 ("a reasoned explanation is needed for disregarding facts and circumstances that underlay or were engendered by the prior policy").

Second, if EPA is changing its position that a system of emission reduction need not be available everywhere in the country, it displays no awareness of that fact. *Id.* at 515 ("[T]he requirement that an agency provide reasoned explanation for its action would ordinarily demand that it display awareness that it is changing position."). If, instead, EPA still believes that a system of emission reduction can form the basis of BSER even if it is not economically achievable on every acre of the country, but is now for the first-time adopting a "percentage of the acres in the country" standard, it must explain what the standard is and why the Current Standard does not meet it. *See*, *e.g.*, *United Food v. NLRB*, 880 F.2d at 1435-36 ("As it is now, we are at a loss to know what kind of standard it is applying or how it is applying that standard to this record . . . the Board must accept responsibility for clarifying and identifying the standards that are guiding its decisions.").

2. EPA fails to justify its new position that partial CCS cannot be BSER because it requires water.

The second pillar[143] of EPA's new opinion that partial CCS is not available in enough areas of the country to be BSER is based solely on its observations that a plant employing CCS uses more water than one that does not and that some areas of the country do not receive as much rainfall as others. Even accepting both of these things as true, both apply to many pollution control technologies mandated by federal law—they require water, and rainfall is not uniform throughout the United States. EPA's rationale in the Proposed Rule amounts to a new legal interpretation of section 111(a): because some parts of the country have less rainfall than others, no system of emission of emission reduction can be BSER if it increases the amount of water a source would use. That position finds no support in the Clean Air Act or court precedent. Moreover, EPA was well aware that CCS required water and that some areas of the country have less water resources available than others, but it nevertheless concluded that partial CCS was reasonably available throughout the United States and was BSER. EPA proposes to reverse its position without any new facts and without justifying its change on any factor it is required to consider under section 111(a) in determining BSER.

a. EPA does not explain why it alters its calculation of water increase due to CCS or why its new calculation renders its previous findings invalid.

In finalizing the Current Standard, EPA analyzed the increase in water usage for various levels of CCS. 2015 Preamble at 64,592-93. EPA recognized that "[s]imilar to other air pollution controls—such as a wet flue gas desulfurization scrubber—utilization of post-combustion amine-based capture systems results in increased consumption of water." *Id.* at 64,593/1. EPA analyzed NETL studies and calculated that a new coal-fired plant implementing partial CCS to meet the Current Standard "would see an increase in water consumption (the difference between the

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[143] The other prong of EPA's attack on its own 2015 geographical availability findings is based on eliminating unmineable coal seams as a CO_2 storage option. *See* section III.D.1, above.

predicted water withdraw and discharge) of about 6.4 percent[144] "compared to the same plant without CCS. *Id.* at 64,592. Although it well understood that partial CCS would increase water usage somewhat, EPA determined that the increase was reasonable. 2015 RTC, Response 6.3-12, at 6-11 ("The EPA is aware that the use of CCS can increase water usage/consumption at a new facility. The EPA has carefully evaluated this issue in preamble section V.O.2 [pages 64,592-93] and finds the water use impacts of the final standard of performance to be reasonable.").

The Proposed Rule does not contain any analysis that undermines EPA's 2015 conclusion that water availability did not preclude a finding that partial CCS is BSER. At most, EPA now says that the relevant type of plant for water availability analysis should be changed to one that operates with less water and emits a higher amount of CO_2, so that when a greater level of CCS is applied, the percentage increase in water use is greater (28-percent increase compared to 7.7-percent increase). Specifically, EPA explains that while the water usage analysis it used in 2015 was based on NETL studies of a "bituminous-fired EGU with a wet scrubber and a cooling tower," a "more appropriate percentage increase comparison for arid western markets and other locations in water-scarce environments is a subbituminous-fired PC unit with spray drying or a fluidized bed unit and a cooling tower." Proposed Rule at 65,443/1-2. That is, EPA now says that to determine what percent increase in water use partial CCS requires, it should make the comparison using a plant that uses less water without CCS (dry scrubbing instead of wet scrubbing) but will require more water to implement a higher level of CCS (23 percent for subbituminous-fired instead of 16 percent for bituminous-fired). EPA thereby inflates the numerator and deflates the denominator in order to make the percentage increase in water use seem greater.

EPA provides no justification for changing the way it calculates water usage. It does not explain why a bituminous-fired unit with wet scrubbing is no longer relevant to the analysis, even though it acknowledges that is "one common configuration for an EGU and associated air pollution control device," Proposed Rule at 65,443/2, and it in fact bases its 2018 LCOE and capital cost analysis on that type of plant, *id.* at 65,438/1. EPA does not explain why the only point of comparison should be a plant that consumes less water without CCS and would have to consume even more water with it. EPA does not explain why the only relevant point of comparison is a plant built in "arid western markets" and "water scarce environments."

Even if EPA could demonstrate that that type of plant is a more relevant comparison point, EPA never explains why a 7.7-percent increase in water usage is reasonable but a 28-percent increase is unreasonable. If EPA is applying some new particular test of water-consumption-percentage-increase reasonableness, it does not reveal that to the public.

Further, EPA never analyzes the cost increase this additional water consumption would cause. Whether that additional cost is minor, reasonable, or exorbitant remains a mystery. Its failure to perform any financial calculations whatsoever related to water did not stop EPA from concluding, however, that "this increase in water requirements is so great that it could be *prohibitively expensive* for developers to secure sufficient quantities of water in arid regions of the country." Proposed Rule at 65,443/1 (emphasis added). Or, in the absence of any evidence, it also could not be too expensive at all. EPA's opaque reasoning and unsupported conclusions

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[144] As EPA points out in the Proposed Rule, the 6.4 percent figure is a mathematical error found in the 2015 Preamble. The correct figure is 7.7 percent. *See* Proposed Rule at 65,443 n.87.

demonstrate that its reversal of position on the reasonableness of CCS water usage is arbitrary and capricious.

b. The previously known fact that the western U.S. receives less rainfall than the eastern U.S. does not justify EPA rejecting its determination that partial CCS is BSER.

Even in the context of the cursory analyses underlying EPA's Proposed Rule, its Water Review Memorandum stands apart.[145] EPA's Water Review Memorandum contains approximately two pages of new text, much of it irrelevant, and two maps showing the locations of coal- and gas-fired plants, superimposed over a map of annual rainfall. Boiled down to its essence, the Memorandum amounts to a non sequitur: it rains less in the western United States than it does in the East, and a coal-fired plant using partial CCS requires more water than one that does not use partial CCS, therefore it is too hard to use partial CCS where it does not rain as much.

EPA says that the only thing it did to support its water availability analysis was to "review[] annual average rainfall totals as an estimation of water availability." Water Review Memorandum, 4. "This approach indicates that the Western U.S. (i.e., areas west of a line running from central Texas to North Dakota), excluding the Pacific Northwest, has lower amounts of water available for EGUs." *Id.* This observation, to say the least, is not a new revelation.

More importantly, it does not support EPA's reversal of position. First, EPA does not explain why annual rainfall totals are a good proxy for the ability of an industry to access water in general or the ability of a coal-fired plant to operate in a region in particular. There is good reason to think rainfall is not determinative, however. The map EPA provides in Figure 1 of the Memorandum in fact shows many existing, water-consuming coal-fired plants located in areas EPA considers too arid. Figure 1 also shows that plants tend to be located on river systems, where a plant can utilize water other than the amount of water that happens to fall on the plant as rain. EPA has presented no facts showing that lower rainfall totals on a regional basis prevent construction of power plants near surface or groundwater sources.

Second, EPA's observation that the western half of the country "has lower amounts of water available for EGUs" is meaningless in a BSER analysis. By EPA's reasoning, the western half of the country has less water available for *everything*; and yet tens of millions of people live there, engaging in productive water-using industry and agriculture. If EPA is correct that CCS cannot be BSER because there is less rainfall in one half of the country than in the other, then no pollution control technology that requires any amount of water could ever be BSER, as there will always be regional variation in rainfall. EPA's sole reliance on simply dividing the country into a dry half and a wet half is insufficient to overcome its previous finding that water availability does not prevent a finding that partial CCS is BSER.

EPA next concludes that "many sequestration sites might not have sufficient water resources to operate CO_2 capture equipment" because "a comparison of areas of the country with

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[145] U.S. EPA, Review of the Water Consumption and Availability Impacts on the Viability of Carbon Capture and Storage Projects (Dec. 2018), Docket ID EPA-HQ-OAR-2013-0495-11942 (Water Review Memorandum).

lower rainfall amounts shows considerable overlap with areas the county with sequestration sites." Water Review Memorandum, at 4. EPA never explains what this "comparison" consists of, so the public has no way to evaluate its methodology. A simple visual comparison, however, of the rainfall map in Figure 1 of the Water Availability Memorandum to Figure 1 of EPA's contemporaneous Geographic Availability of Geologic Sequestration Memorandum[146] shows that potential sequestration sites exist throughout the country, in both those areas with more rain and those with less. EPA's unexplained conclusion is wrong.

EPA also speculates about the motivations of future power plant developers, without any evidence to back up its assertions. For instance, in the Water Review Memorandum EPA concludes that, in addition to arid regions, "water use concerns are likely applicable to areas with larger amounts of rainfall as well." Water Review Memorandum, at 5. EPA's sole data point for this conclusion is that one coal-fired power plant with dry cooling exists in Virginia. EPA does not analyze what could be the myriad other reasons this one plant in Virginia employs dry cooling, does not support its conclusion with any evidence, and does not reconcile its conclusion with the fact that the other three coal-fired plants using dry cooling are located in what EPA considers an arid region. Furthermore, despite lower rainfall amounts, almost all coal-fired plants in the West use wet cooling, not dry cooling, as shown in Figure 1 of the Memorandum.

Similarly, EPA determined that a developer of a new coal-fired plant would likely want to use dry cooling because 15 percent of *gas*-fired plants use dry cooling, and they are "located throughout the U.S., further indicating that water use concerns are more widespread than just arid locations with limited rainfall." *Id.* EPA does not explain why the data supports that inference more than a more obvious alternative, such as the fact that 85 percent of gas-fired plants use wet cooling (*see* Water Review Memorandum, Fig. 2)—even the vast majority of those plants in the "arid" West—shows that water concerns do not prevent power plant development in areas with less rainfall.

EPA's revised conclusions about water availability fail basic tenets of rational decision-making. EPA utterly failed "examine the relevant data and articulate a satisfactory explanation for its action including a rational connection between the facts found and the choice made," *State Farm*, 463 U.S. at 43, and failed to provide "a reasoned explanation . . . for disregarding facts and circumstances that underlay or were engendered by the prior policy," *Fox*, 556 U.S. at 515-16.

3. EPA misinterprets the Clean Air Act as preventing EPA from determining that BSER can be a technology that is more expensive to use in some areas of the country than others.

EPA previously concluded that, although CCS was not available in a few areas, it is available in vast areas of the country and therefore any geographic limitations were not enough to prevent CCS from being considered to be adequately demonstrated. *See* 2015 RTC, Response 3.3-39, at 3-106 ("The EPA recognizes that the cost of CCS may vary depending upon the proposed location of the EGU based on geographic and other factors including locations of

[146] U.S. EPA, Geographic Availability of Geologic Sequestration, 5 (Dec. 2018), Docket ID EPA-HQ-OAR-2013-0495-11941.

potential sequestration sites; however the EPA carefully reviewed the assumptions on which the transport and storage cost estimates are based and continues to find them reasonable.").

EPA's new interpretation that CCS is not adequately demonstrated because there are a few areas of the country in which it may cost more to employ CCS (due to water availability or CO_2 transmission costs) is in effect the adoption of a new legal position: a system of emission reduction can only be adequately demonstrated if it can be profitably employed on all types of sources in all areas of the country. This is not a requirement of the Clean Air Act, and EPA has not attempted to justify its change of position. *See Pub. Citizen v. Steed*, 733 F.2d 93, 101 (D.C. Cir. 1984) (finding agency reversal of regulation arbitrary and capricious where alleged problems with test procedure were not "different in kind or quantity from those that have been pressed on the agency for the past ten years. They were old and known problems that had been found insufficient to preclude use of the procedures in the past, and the evidence in the record does not warrant [agency's] dramatic change of position.").

F. EPA cannot issue a lowest-common-denominator standard like this when it has the option to subcategorize based on geographic factors. (C-15)

EPA developed the new BSER in the Proposed Rule by looking at the emissions from existing coal-fired plants that are less efficient (using dry cooling), that burn dirtier coal (subbituminous), and that it expects will operate in areas of the country with the most limited water supplies (even though most plants in these areas use wet cooling). Then—to allow them to emit more CO_2 than necessary—EPA would apply the resulting less-stringent emission standard to even those new plants using more efficient technology, burning coal with less CO_2 output, in areas where water is abundant. Nothing in the Clean Air Act permits EPA to weaken a legally promulgated section 111(b) standard just so that it can be met by a higher-emitting type of source—which may or may not ever be built. *See Portland Cement Ass'n v. EPA*, 665 F.3d 177, 191 (D.C. Cir. 2011) (holding that EPA could adopt section 111 standards of performance based on the performance of a kiln type that kilns of older design would have great difficulty satisfying). Instead, if warranted after a thorough analysis of facts, EPA may subcategorize within the source category based on geographical location of the source where it is warranted. 42 U.S.C. § 7411(b)(2).

To the extent that in the future EPA may wish to present facts supporting different BSER for subcategories of coal-fired power plants based on geography (e.g., water availability, CO2 storage capacity, or offsetting costs by enhanced oil recovery), it may propose a new rule at that time; but it may not now adopt such subcategorization in a final rule given the lack of notice and opportunity to comment on any such subcategorization. *See* 42 U.S.C. § 7607(d)(3) (requiring disclosure, at the time of proposal, a rule's "major legal interpretations and policy considerations").

IV. IT IS IRRATIONAL FOR EPA TO ESTABLISH A STANDARD FOR RECONSTRUCTED PLANTS THAT ALLOWS A PLANT TO RECONSTRUCT IN SUCH A WAY THAT IT EMITS MORE CO_2 THAN IT DID BEFORE. (C-19, C-20)

After reviewing the record of the actual performance of modern coal-fired plants, EPA determined in 2015 that "the BSER for reconstructed steam generating units should be based on the performance of a well operated and maintained EGU using the most efficient generation technology available." 2015 Preamble at 64,600/3. EPA concluded that this technology was a supercritical pulverized coal or supercritical circulating fluidized bed boiler. It established the reconstructed plant standard at 1,800 lb CO_2/MWh-g after determining that this level of emission was "achievable by all the primary coal types." *Id.*

In the Proposed Rule EPA rejects its previous determination that a *new* coal-fired plant could limit its emissions to 1,800 lb CO_2/MWh-g with modern upgrades, and instead says that a new a plant could at best achieve 1,900 lb CO_2/MWh-g. EPA changes its expected plant performance by including a wider variety of existing coal-fired plants in its consideration of BSER, including plants using dry cooling and burning subbituminous coal. (As described in section III.E.2.a, above, EPA fails to provide a rational explanation for that choice, since it does not expect that to be a likely configuration for new plants.) EPA describes the CO_2 emissions from these plants as exhibiting a "minimum level of control, since to date no operating coal-fired EGUs have had a federal regulatory driver to minimize the CO_2 emission rate."[147] EPA then proceeds to make that unsupported, minimum level of control the emission standard for *reconstructed* plants as well.

EPA lacks a reasoned basis to replace the Current Standard with the proposed higher 1,900-lb-CO_2/MWh-g standard, based on the "minimum level of control" exhibited by plants employing technologies and burning coal types not likely to be used at a reconstructed plant. For example, EPA provides no evidence or reason to believe that a plant undergoing reconstruction would switch from wet cooling to less efficient dry cooling or would switch from burning bituminous coal to burning higher-emitting subbituminous coal. And yet, the new emission standard EPA proposes to apply to such plants, 1,900 lb CO_2/MWh-g, is based on these other technologies and fuel types. In any event, it is irrational for EPA to allow a plant to adopt technology producing greater CO_2 emissions when it undergoes reconstruction when EPA previously found that the 1,800-lb-CO_2/MWh-g was achievable for a range of coal types. EPA may not reverse its previous position when it fails to provide a reasonable explanation. *Fox*, 556 U.S. at 515.

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[147] U.S. EPA, Memorandum, Best System of Emission Reduction (BSER) for Steam Generating Units and Integrated Gasification Combined Cycle (IGCC) Facilities, 9 (Dec. 2018), Docket ID EPA-HQ-OAR-2013-0495-11954.

V. IT IS ARBITRARY AND CAPRICIOUS FOR EPA TO WEAKEN THE EMISSION STANDARD TO ALLOW A PLANT TO MODIFY IN SUCH A WAY THAT IT EMITS MORE CO_2 THAN ITS OWN BEST HISTORICAL PERFORMANCE.

The Current Standard for modified plants is based on the individual plant's best historical annual CO_2 emission rate (not the partial CCS-based standard for new plants), with a floor on how low the plant's emissions must go after modification. EPA proposes to retain this individualized description of the BSER for a modified plant. Illogically, however, it proposes to raise the floor by 100 lb CO_2/MWh-g so that the same modified plant undergoing the same modification would be allowed to emit more CO_2, even if its operating history shows that it is capable of meeting the Current Standard. EPA has identified no reason this change is rational or in accord with the Clean Air Act.

To the extent EPA bases the new modified plant emission limit on its analysis of what a new plant could achieve, taking into consideration the same higher-emitting technologies and fuels, its decision is also arbitrary and capricious for the reasons described above regarding reconstructed plants. *See* section IV, above. Specifically, it is irrational for EPA to set the CO_2 emission limit of a plant burning bituminous coal and using wet cooling on the emissions achieved by a different kind of plant burning subbituminous coal and using dry cooling and emitting more CO_2. EPA provides no evidence that a plant undergoing a modification should be allowed to switch to a higher-emitting fuel source or technology. If a plant's operating history shows that it can achieve the Current Standard, there is no reason EPA should enable it to emit more CO_2 after it undergoes a modification.

To the extent that EPA is changing the maximally allowable emission rate of modified units simply to create numerical equivalence between its proposed new and modified standards, its proposal is invalid under the Clean Air Act. Congress told EPA to consider various things in setting a "standard of performance" under section 111(a)(1), but numerical equivalence with some other standard is not one of them. *State Farm*, 463 U.S. at 43 ("Normally, an agency rule would be arbitrary and capricious if the agency has relied on factors which Congress has not intended it to consider . . . .").

VI. EPA HAD RATIONAL BASES AND LEGAL AUTHORITY TO ISSUE THE CURRENT STANDARDS, AND EPA CANNOT REVERSE THOSE POSITIONS DUE TO COMMENTS IT IS SOLICITING FOR THE FIRST TIME IN FOOTNOTE 25. (C-3, C-28)

EPA correctly determined in the 2015 rulemaking that it had legal authority to regulate CO_2 from power plants under section 111(b)(1)(B). 2015 Preamble at 64,530/2 ("In this rulemaking, the EPA has a rational basis for concluding that emissions of CO_2 from fossil fuel-fired power plants, which are the major U.S. source of GHG air pollution, merit regulation under CAA section 111."). The record contains overwhelming evidence showing that EPA had a rational basis to regulate this pollutant from these sources; indeed, any other finding would be irrational. EPA summarized that record in the 2015 Preamble:

> The EPA's rational basis for regulating CO_2 under CAA section 111 is based primarily on the analysis and conclusions in the EPA's 2009 Endangerment Finding and 2010 denial of petitions to reconsider that Finding, coupled with the

> subsequent assessments from the IPCC and NRC that describe scientific developments since those EPA actions. In addition, we have reviewed comments presenting other scientific information to determine whether that information has any meaningful impact on our analysis and conclusions.

Id. at 64,530/3-31/1. "The facts, unfortunately, have only grown stronger and the potential adverse consequences to public health and the environment more dire in the interim." *Id.* at 64,531/1; *cf. Coalition for Responsible Regulation, Inc. v. EPA*, 684 F.3d 102, 120 (D.C. Cir. 2012) ("The body of scientific evidence marshaled by EPA in support of the [2009] Endangerment Finding is substantial.").

EPA also determined that, in addition to supporting that rational basis, the facts in the record for the Current Standard would also be sufficient to support section 111(b)(1)(A) endangerment and cause-and-contribute findings, if they were required. 2015 Preamble at 64,530 (justifying the Current Standard as based on "analysis and conclusions in the EPA's 2009 Endangerment Finding" coupled with subsequent scientific assessments); *id.* at 64,531/2 (finding that cited facts, including that fossil fuel-fired power plants "are responsible for almost three times as much [greenhouse gas pollution] as the emissions from the next ten stationary source categories combined," support "a cause-or-contribute-significantly finding for CO_2" from these sources). The record before the agency provides ample support for its authority to regulate power plant CO_2 emissions under section 111(b), and there is no reason for EPA now to ignore that evidence and reach a different conclusion.

In footnote 25 of the Proposed Rule (page 65,432), however, EPA oddly requests comments on legal interpretations it is explicitly rejecting and not proposing. After summarizing the legal justifications it relied on in the 2015 rulemaking to regulate CO_2 from these sources, EPA reaffirms that it "is proposing to retain the statutory interpretations and record determinations" supporting its authority to promulgate the Current Standard. Proposed Rule at 65,432/1 & n.25. Nevertheless, in footnote 25 EPA invites comment on whether, in fact, it lacks the authority to regulate CO_2 from coal-fired plants, the very thing it is proposing to continue doing in this rulemaking.

A. EPA cannot reverse its position merely by asking for comments on whether it should adopt a new position diametrically opposed to both current law and the position it maintains in the Proposed Rule.

Section 307(d)(3) of the Clean Air Act requires EPA to issue a specific "proposed rule" as a focal point for public comments. In the Proposed Rule, however, EPA takes the highly unusual step of asking for comment on legal positions it explicitly claims it is *not* proposing to adopt. Proposed Rule at 65,432 n.25. EPA's use of footnote 25 to solicit comments supporting legal interpretations it says it is not proposing raises the suspicion that the agency is simply fishing for grounds on which it can reverse these legal positions in the final agency action, and thereafter claim that the public had sufficient notice of that outcome in this Proposed Rule. This would violate bedrock principles of administrative rulemaking and the Clean Air Act.

In *Environmental Integrity Project v. EPA*, 425 F.3d 992 (D.C. Cir. 2005), the D.C. Circuit Court rejected a similar attempt by EPA. There, EPA proposed to codify its interpretation of the rules through an amendment of regulatory text, but wound up adopting a conflicting interpretation in the final action. In finding that EPA violated the Administrative Procedure Act, the court observed that "[w]hatever a 'logical outgrowth' of this proposal may include, it certainly does not include the Agency's decision to repudiate its proposed interpretation and adopt its inverse." *Id.* at 998. The court explained that mentioning in the proposal the converse of the Agency's proposed position—as EPA does here in footnote 25—does not satisfy basic administrative rulemaking requirements:

> EPA argues that it met its notice-and-comment obligations because its final interpretation was also mentioned (albeit negatively) in the Agency's proposal. However, this argument proves too much. If the APA's notice requirements mean anything, they require that a reasonable commenter must be able to trust an agency's representations about *which particular* aspects of its proposal are open for consideration. A contrary rule would allow an agency to reject innumerable alternatives in its Notice of Proposed Rulemaking only to justify any final rule it might be able to devise by whimsically picking and choosing within the four corners of a lengthy "notice." Such an exercise in "looking over a crowd and picking out your friends," does not advise interested parties how to direct their comments and does not comprise adequate notice . . . .

Id. at 998 (citations omitted); *see also Small Refiner Lead Phase-Down Task Force v. EPA*, 705 F.2d at 549; *Shell Oil Co. v. EPA*, 950 F.2d at 760.

EPA must not attempt to revoke the legal justifications for its Proposed Rule and the Current Standard based on comments it receives in response to its proposal *not* to change those justifications, as doing so would serve as a boundless exception to Clean Air Act rulemaking requirements.

B. There is no reason EPA should reverse its interpretation of section 111, which is that an endangerment finding need only be made once for each source category at the time that EPA lists that source category.

EPA is correct that it need not make a new endangerment finding each time it regulates an additional pollutant by a source category that is already listed under section 111(b)(1)(A), and it should not reverse its position. *See*, *e.g.*, 2015 Preamble at 64,529/3 ("[B]ecause the EPA is not listing a new source category in this rule, the EPA is not required to make a new endangerment finding with regard to affected EGUs in order to establish standards of performance for the CO_2 emissions from those sources."). Many years ago EPA found coal-fired power plants to be significant contributors to air pollution that endangers public health and welfare, and it listed them pursuant to section 111(b)(1)(A).[148] Based on the fact that these sources were already listed, EPA's legal position has been that it may establish additional standards of performance for the source category—such as the CO_2 standards it issued in 2015—so long as it demonstrates

[148] EPA listed coal-fired power plants as a source category for regulation under section 111 in 1971, finding that the category "causes, or contributes significantly to, air pollution which may reasonably be anticipated to endanger public health or welfare." List of Categories of Stationary Sources, 36 Fed. Reg. 5,931 (Mar. 31, 1971).

that it has acted reasonably (i.e., with a "rational basis") in setting the additional standards of performance under section 111(b)(1)(B).[149]

In addition, there are no differences between greenhouse gases (such as CO_2) and other pollutants that would support EPA creating an exception to its current position that a separate endangerment finding is not required each time it regulates an additional pollutant by an already-listed source category. Such a change in position would be especially unwarranted where EPA already found the pollutant to endanger public health and welfare.[150] Furthermore, as EPA itself acknowledged in the 2015 rulemaking, the U.S. Supreme Court ruled in *Massachusetts v. EPA*, 549 U.S. 497, 520 (2007), that greenhouse gases meet the definition of "air pollutant" under the Clean Air Act and premised its decision in *AEP v. Connecticut*, 564 U.S. 410, 424 (2011), on its view that section 111 applies to greenhouse gas emissions. 2015 Preamble at 64,527/1.

C. EPA would not have a reasoned basis for reversing its current position that control of GHG emissions from new power plants is warranted under section 111(b).

1. The trend of lower CO_2 emissions from the power sector does not provide a rational basis for EPA to eliminate regulation of CO_2 emissions from these sources.

Although recent years have seen a welcome downward trend in CO_2 emissions from the power sector, this trend is not new since 2015, and nothing about it would support EPA reversing its position that it should impose CO_2 emission controls on new coal-fired plants. Congress created the Clean Air Act to protect the public health and welfare. EPA was correct to observe in the 2015 rulemaking that "a variety of factors may come into play in a decision to build new power generation, and we want to ensure that there are standards in place to make sure that whatever fuel is utilized is done so in a way that minimizes CO_2 emissions, as Congress intended with CAA section 111." 2015 Preamble at 64,526/1. EPA may not assume that trends will continue nor ignore its statutory obligations in favor of letting trends in the marketplace provide the protections Congress directed EPA to provide the public.

The trend of decreasing CO_2 emissions from the power sector existed at the time EPA finalized the Current Standard, and thus it is not new evidence that could support EPA changing its rationale for regulating these emissions. EPA observed in 2015 that in recent years, "the nation has seen a sizeable increase in renewable generation such as wind and solar, as well as a shift from coal to natural gas. . . . From 2007 to 2014, use of lower- and zero-carbon energy sources has grown, while other major energy sources such as coal and oil have experienced declines." 2015 Preamble at 64,524/1. EPA's own data have reflected this trend for some time.[151]

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[149] EPA's legal interpretation is explained in Respondent EPA's Brief (ECF #1659737), at 108-116, *North Dakota v. EPA*, No. 15-1381 (D.C. Cir. Feb. 6, 2017).

[150] *See* Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66,496 (Dec. 15, 2009).

[151] U.S. EPA, "Carbon Dioxide Emissions, 1995-2018" (providing table of CO_2 emissions showing that downward trend existed in 2015), https://www.epa.gov/sites/production/files/2019-02/ec_co2_2018_1.png, link available at U.S.

EPA also reiterates that a shift from coal to natural gas has been taking place within the power sector for a decade. 2018 Economic Impact Analysis, at 3-16 to 3-17 & tbl.3-6 (explaining that "consistent with current trends, . . . natural gas-fired capacity has been the technology of choice for base load and intermediate load power generation. Table 3-6 illustrates this trend: from 2006 to 2016 net generation from coal decreased by 37.7%, while net generation from natural gas increased by 68.8%.").[152]

Furthermore, this source category, fossil fuel-fired power plants, and coal-fired plants in particular, continues to contribute a large amount of CO_2 to the atmosphere, in both absolute and relative terms. Given the harms produced by increasing atmospheric concentrations of CO_2,[153] it would be irrational for EPA to decide to remove existing emissions controls. In the 2015 rulemaking EPA presented data through 2013 showing that "fossil fuel combustion by the utility power sector—entities that burn fossil fuel and whose primary business is the generation of electricity—accounted for 38.3 percent of all energy-related CO_2 emissions," and that "the utility power sector emits far greater CO_2 emissions than any other industrial sector," specifically noting that "CO_2 emissions from fossil fuel-fired EGUs are nearly three times as large as the total reported GHG emissions from the next ten largest emitting industrial sectors in the GHGRP [Greenhouse Gas Reporting Program] database combined." 2015 Preamble at 64,523. "Fossil fuel-fired EGUs are by far the largest emitters of GHGs among stationary sources in the U.S., primarily in the form of CO_2. Among fossil fuel-fired EGUs, coal-fired units are by far the largest emitters." *Id.* at 64,522/3. And, in April 2018 EPA published its annual inventory of greenhouse gas sources in the U.S., which provided updated information about sources of CO_2 through 2016.[154] The updated emissions data confirm that CO_2 emissions from fossil fuel-fired power plants continue to dominate over all other industrial sectors and that coal-fired power plants in particular are by far the largest stationary source of greenhouse gases.[155]

Regardless of whether CO_2 emissions from the power sector continue their slow decline or begin to increase, those emissions are too enormous to ignore. As EPA itself has observed, "the CO_2 emissions from even a single new coal-fired power plant may amount to millions of tons each year." 2015 Preamble at 64,530/3. EPA had and still has a rational basis to control CO_2

EPA, Power Plant Emission Trends, https://www.epa.gov/airmarkets/power-plant-emission-trends (last visited Mar. 18, 2019).

[152] Recent evidence shows that the trend of declining CO_2 emissions cannot be assumed to continue in perpetuity. Data EPA released on February 20, 2019, show that CO_2 emissions from power plants increased by 0.6 percent in 2018, the first such annual increase since 2013. https://www.epa.gov/sites/production/files/2019-02/view_2018_camd_emissions_data_1.xlsx. To the extent a downward trend in emissions could justify abstaining from regulation (which it cannot), that justification would of course be eliminated if the trend has stopped.

[153] *See* sections I.A. and I.B., above.

[154] U.S. EPA, U.S. Greenhouse Gas Emissions and Sinks: 1990–2016 (Apr. 2018), available at https://www.epa.gov/sites/production/files/2018-01/documents/2018_complete_report.pdf.

[155] *See id.* at 1-16 tbl.1-4 (Key Categories for the United States (1990-2016)).

emissions from these sources. Moreover, it would have no rational basis to reverse its position and alter the regulatory status quo. *See Fox*, 556 U.S. at 515.

2. EPA could not lawfully eliminate emission standards for coal-fired plants on the basis of its projection that few or no new plants are likely to be built.

The fact that EPA estimates that "no more than a few new coal-fired EGUs can be expected to be built," Proposed Rule at 65,432, does not provide EPA a rational basis for repealing its CO_2 emission standards for new coal-fired plants. The evidence continues to support EPA's current position that regulation of new, modified, and reconstructed coal-fired plants is appropriate and, indeed, compelled by the Clean Air Act.

EPA's expectations about the construction rate of new coal-fired plants are "[c]onsistent with the 2015 Rule" and therefore could not provide a rational basis for repeal. *Id.* at 65,436. As EPA recognizes in the Proposed Rule, it anticipated when it finalized the Current Standard that "few, if any, fossil-fuel-fired steam-generating EGUs will be built in the foreseeable future" due to the availability of cheaper generation options and other power-sector trends. *Id.* at 65,427 (citing 2015 Preamble at 64,515). The Proposed Rule confirms that those projections "remain generally correct." *Id.*

Notwithstanding its assumptions about construction of new coal-fired plants, EPA's decision to adopt the Current Standard was reasonable and consistent with the Clean Air Act. And there have been no relevant changes to EPA's analyses or understanding since the 2015 rulemaking that would justify a change of course. EPA's promulgation of the Current Standard correctly recognized that developers may prefer to invest in a new coal-fired plant despite the availability of cheaper generation options. "EPA has not received information since the 2015 Rule that would cause it to rule out that possibility." Proposed Rule at 65,426. EPA's regulation of new coal-fired plants also remains reasonable to manage plausible, even if unlikely, health and environmental risks.

a. EPA has already reasonably considered that industry may choose to invest in new coal-fired plants notwithstanding prevailing cost trends.

EPA explained in both the 2015 Preamble and Proposed Rule that a developer may prefer to build a new coal-fired plant even if cheaper generation options are available. *See* 2015 Preamble at 64,513; Proposed Rule at 65,436. That conclusion is consistent with how the industry operates in practice. Notably, developers are not all equally exposed to market pressures. A majority of the country's coal-fired plants are publicly or cooperatively owned, or located in states where traditional cost-of-service regulation dominates.[156] Compared to

[156] Susan Tierney, Ph.D., Initial Evaluation: Operational and Investment Incentives of Different Owners of Coal-Fired Power Plants in Light of EPA's Proposed Changes in the New Source Review Program, at 13 (Oct. 30, 2018) (citing EIA, Electric Power Annual, Table 4.1. Count of Electric Power Industry Power Plants, by Sector, by Predominant Energy Sources within Plant, 2007 through 2017, https://www.eia.gov/electricity/annual/html/epa_04_01.html), attached as Exhibit E to Comments of the Attorneys General of New York [et al.] on the Environmental Protection Agency's Proposed Emission Guidelines for Greenhouse Gas

competitive or restructured power markets, investment decision making in those non-market settings is more likely to be driven by non-financial considerations.[157] For instance, EPA received public comments on the proposal that became the Current Standard that argued that developers may value coal-fired plants for purposes such as "stable fuel prices," "fuel diversification," and "site-specific jobs and economic development considerations."[158] Additionally, EPA reviewed several utility resource plans that included coal-fired plants and other less cost-competitive generation options for the stated purpose of maintaining "fuel diversity." Proposed Rule at 65,436; *see also* 2015 Preamble at 64,526, 64,563.

Non-economic considerations are not captured in EPA's power-system forecast modeling, however. *See* Proposed Rule at 65,436. EPA reasonably "assumed that developers . . . were therefore willing to pay a premium" for baseload generators other than gas-fired plants, and designed the Current Standard such that "new coal-fired EGUs can still be part of the future fuel diversity mix." *Id.* at 65,436. As confirmed in the Proposed Rule, nothing has changed since the 2015 rulemaking that should cause EPA to rule out the possibility of future investments in new, modified, or reconstructed coal-fired plants for "fuel diversity" or other reasons. *See id.* at 65,436.

In fact, since the 2015 rulemaking, the federal government has continued to anticipate and contemplate the construction of new coal-fired plants. For example, on November 13, 2018, the Department of Energy announced its intent to fund research to develop and promote "the coal plant of the future."[159] The Department of Energy not only anticipates "[d]eployment of new coal plants" but also is actively soliciting proposals that "may ultimately culminate in the design,

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Emissions from Existing Electric Utility Generating Units; Revisions to Emission Guideline Implementing Regulations; Revisions to New Source Review Program (Oct. 31, 2018), Docket ID EPA-HQ-OAR-2017-0355-24817.

[157] *Cf. id.* at 3-8, 13-17 (explaining that coal-fired plants that are publicly or cooperatively owned or governed by traditional cost-of-service regulation are more likely to undertake investments to prolong the plant's life than merchant generators).

[158] Proposed Rule at 65,436. In 2015 EPA explained that the "affected industry itself urged the EPA to withdraw its original standard for all new fossil fuel-fired units in order to provide for the possibility of some additional new coal-fired generation capacity, See 79 FR at 1434. If such new sources were to be constructed, the promulgated standard would significantly reduce CO_2 emissions from such a source in comparison with a source (even an ultrasupercritical boiler) not meeting the standard." 2015 RTC, Response 2.1-34, at 2-14. *See*, *e.g.*, Comments of National Mining Association to EPA, EPA-HQ-OAR-2011-0660-9952, at 17–18 (June 25, 2012) ("[U]tilities maintain resource diversity to ensure they are not overly exposed to the type of unforeseen and unforeseeable market changes that are inherent in the energy sector. For EPA to exclude coal . . . from utility resource portfolios . . . is imprudent in the extreme.").

[159] *See* Off. of Fossil Energy, U.S. Dep't of Energy, Energy Department Announces Intent to Fund Research that Advances the Coal Plants of the Future, Nov. 13, 2018, https://www.energy.gov/fe/articles/energy-department-announces-intent-fund-research-advances-coal-plants-future.

construction, and operation of a coal-based pilot-scale power plant."[160] And in February 2018, President Trump signed into law a bipartisan budget bill that expanded a tax credit for carbon dioxide sequestration technology. *See* Bipartisan Budget Act of 2018, Pub. L. No. 115-123, § 41119, 132 Stat. 64, 120 (2018). EPA has no reasonable basis to change its assumption supporting the Current Standard and the Proposed Rule that industry may choose to invest in new coal-fired plants.

b. EPA acted reasonably to regulate the significant, plausible health and environmental risks of power plant CO_2 emissions.

As the Proposed Rule recognizes, even EPA's best projections about the future cost-competitiveness of coal-fired plants rely on uncertain assumptions and estimates. Proposed Rule at 65,427. Although EPA expects it is unlikely developers would opt to construct a new coal-fired plant, there are nonetheless plausible future scenarios in which a new coal-fired plant could be cost-competitive with other generation options in the absence of an emission standard (for example, assuming unexpectedly high natural gas prices). *See* 2015 Regulatory Impact Analysis, 5-14 to 5-16. Comments that EPA received from industry and other stakeholders in the course of developing the Current Standard affirmed that it is prudent for EPA to consider those plausible, even if improbable, scenarios.[161]

Furthermore, considering less likely future scenarios that favor construction of new coal plants is consistent with administrative best practices and the protective goals of the Clean Air Act. "[T]he CO_2 emissions from even a single new coal-fired power plant may amount to millions of tons each year," imposing considerable public health and environmental risks. Proposed Rule at 65,432. Regulation is a rational response to those significant risks. The risk-management rationale underlying EPA's Current Standard continues to support EPA's position that regulation of new coal-fired plants is warranted. Indeed, since EPA adopted the Current Standard, new research on climate trends and increasing evidence of the harmful impacts of climate change have further solidified the need for regulatory action to prevent and mitigate dangerous carbon emissions. *See* sections I.A and I.B, above. It is more urgent than ever that

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[160] *Id.*; *see also* Off. of Fossil Energy, U.S. Dep't of Energy, Energy Department Issues Request for Proposal for Conceptual Designs That Advance the Coal Plants of the Future, Dec. 7, 2018, https://www.energy.gov/fe/articles/energy-department-issues-request-proposal-conceptual-designs-advance-coal-plants-2.

[161] *See, e.g.*, Comments of Edison Electric Institute to EPA, 7-8, 10-11, Docket ID EPA-HQ-OAR-2011-0660-9933 (June 25, 2012) (arguing that "there is no way to know with certainty that natural gas prices will not increase in the future" and it "could make economic and business sense to build new coal units in the future"); Comments of National Mining Association to EPA, 18, Docket ID EPA-HQ-OAR-2011-0660-9952 (June 25, 2012) (noting that "markets change, natural gas prices may increase, incentives to build new coal plants may return"); Comments of Alstom to EPA, Docket ID EPA-HQ-OAR-2013-0495-9033 (May 9, 2014) ("[R]eliance on EIA forecasts that no coal plants will be built in any event is precarious. EIA forecasts are a snapshot based on a set of assumptions and have consistently failed to see market fluctuations and interruptions.").

EPA continues to protect human health and the environment from the risks of power-plant carbon emissions.

c. EPA has no basis for changing its interpretation of section 111 that significant contribution is based on the source category as a whole, not a particular number of new sources that may exist in the future.

EPA's current position that significance under section 111(b)(1)(A)'s listing criteria is determined by looking at the source category as a whole, not just expected future sources, is correct. EPA would have no reasonable basis for reversing this legal position. As EPA explained in the 2015 rulemaking, "The cause or contribute criterion [of section 111(b)(1)(A)] relates to the amounts of pollutant a source category emits to the air pollutant which endangers public health or welfare. Fossil-fuel fired electricity generating units emit more CO_2 than any other source category – by a very wide margin. By any objective measure, this is a substantial contribution." 2015 RTC, Response 2.1-35, at 2-15. As described above in this section VI.C, nothing about this source category has materially changed since EPA issued the Current Standard.

Considering the source category as a whole under section 111(b)(1)(A) is the only rational approach under the Clean Air Act because a listing must occur before existing sources can be regulated at all under section 111(d). If, contrary to EPA's interpretation, the agency would only make a listing decision on the basis of whether pollution from *new* sources in that category were expected to endanger public health or welfare, then EPA might deprive itself (and states) of the ability to regulate *existing* sources under section 111(d), regardless of how much of a danger pollution from those existing sources posed. There is no reason to believe that Congress would have structured section 111 to achieve this absurd result. Furthermore, some existing sources would become subject to new source performance standards due to modification or reconstruction. It makes no sense to ignore those sources to focus exclusively on projected new sources.

In sum, there is no reason EPA should change its existing interpretations on the above questions in response to comments it solicits in footnote 25.

VII. EPA'S ECONOMIC ANALYSIS FAILS TO CONSIDER INCREASED ENVIRONMENTAL HARMS THAT WOULD RESULT FROM CHANGING THE EMISSION STANDARD IN THE EVENT THAT NEW COAL-FIRED PLANTS ARE BUILT. (C-28)

A. The proposed standard is arbitrary and capricious because EPA failed to consider an important aspect of the problem: the harms from increased CO_2 emissions under the Proposed Rule compared to the Current Standard.

In contrast to its previous efforts to quantify the harms the Current Standard would avoid in the event that new coal-fired powers plant are built,[162] EPA does nothing at all to analyze or quantify what harms would result from emissions of those plants operating under the Proposed Rule. EPA admits that the costs it does consider "do not account for any of the potential benefits

[162] *See* 2015 Regulatory Impact Analysis, ch. 5.

of reduced criteria and GHG emissions due to the use of partial CCS." Proposed Rule at 65,440/1.

In place of actual analysis, EPA makes the sweeping projection that the Proposed Rule "will work towards addressing this market failure by causing affected EGUs to begin to internalize the negative externality associated with CO_2 emissions." 2018 Economic Impact Analysis, at 1-2. EPA provides no reason to believe that this is true, especially since later in the same document EPA contradicts itself, explaining that it proposes to set the emission standard at the level that it expects any new coal-fired plant to achieve even in the absence of Proposed Rule. *Id.* at 3-5 (explaining that "modeling demonstrates that all new sources covered by this proposal that are currently planned or projected to be constructed are capable of meeting the proposed standard without taking any additional action").

Accordingly, EPA's economic analysis avoids quantifying the potential harms from changing from the Current Standard to the Proposed Rule in the event that new coal-fired plants are built, ignoring a crucial aspect of the problem of climate change (discussed in sections I.A-I.B, above). *See American Lung Ass'n*, 134 F.3d 388, 392 (D.C. Cir. 1998) (failure to consider public health effects of rulemaking rendered EPA Administrator unable to fulfill duty under Clean Air Act); *State Farm*, 463 U.S. at 43.

B. In any future analysis, EPA should account for the actual harms of increased CO_2 emissions resulting from replacing the Current Standard with the Proposed Rule. (C-8)

As many of the States and Cities explained to EPA in their October 31, 2018, comment letter to EPA opposing its proposal to replace the Clean Power Plan, a proper evaluation of economic impacts of a regulation affecting CO_2 emissions must use an appropriate discount rate and properly take into account the social cost of carbon and co-benefits of CO_2 reduction.[163] EPA already developed very conservative metrics for these benefits in its 2015 Regulatory Impact Analysis, which could serve as a starting point for analysis of this proposal. The analysis should also take into account a discount rate below 3 percent and evaluate climate damages not captured by previous models.

In a calculation of the economic harms from replacing the Current Standard with the Proposed Rule, EPA must take into account a realistic quantitative assessment of the social cost of carbon, including international impacts, developed by the federal Interagency Working Group.[164] Using the best available methodologies and data, the Interagency Working Group

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[163] Comments of the Attorneys General of New York [et al.] on the Environmental Protection Agency's Proposed Emission Guidelines for Greenhouse Gas Emissions from Existing Electric Utility Generating Units; Revisions to Emission Guideline Implementing Regulations; Revisions to New Source Review Program, 127-38 (Oct. 31, 2018), Docket ID EPA-HQ-OAR-2017-0355-24817.

[164] In 2009 an interagency workgroup composed of members from six federal agencies and various White House offices was convened to improve the accuracy and consistency in how agencies value reductions in CO_2 emissions in regulatory impact analyses. The resulting range of values was based on estimates from three integrated assessment models applied to five socioeconomic and emissions scenarios, all given equal weight. To reflect differing expert

included impacts outside of the United States that affect our country in its calculations.[165] The Seventh Circuit Court of Appeals upheld this metric against the argument that impacts outside of the United States should be ignored, reasoning that the Department of Energy had reasonably identified carbon pollution as a "global externality," and appropriately concluded that because "national energy conservation has global effects, . . . those global effects are an appropriate consideration when looking at national policy." *Zero Zone, Inc. v. Dep't of Energy*, 832 F.3d 654, 679 (7th Cir. 2016). Including international impacts is also in accord with the National Academy of Sciences' recent conclusion that "[c]limate damages to the United States cannot be accurately characterized without accounting for consequences outside U.S. borders."[166] EPA itself has long supported including these impacts in assessing the costs of climate change.[167]

Furthermore, EPA must also consider the non-monetized costs of climate change that are not incorporated in the social cost of carbon models. Office of Management and Budget (OMB) Circular A-4 specifically requires that "[w]hen there are important non-monetary values at stake,

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opinions about discounting, the present value of the time path of global damages in each model-scenario combination was calculated using discount rates of 5 percent, 3 percent, and 2.5 percent. National Center for Environmental Economics, Office of Policy, U.S. Environmental Protection Agency, "Guidelines for Preparing Economic Analysis," (Dec. 17, 2010) Section 7-2.

[165] *See* 2016 Technical Support Document Update of the Social Cost of Carbon for Regulatory Impact Analysis, available at: https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/scc_tsd_final_clean_8_26_16.pdf.

[166] Nat'l Academy of Sciences, Engineering, & Medicine, Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide (2017), at 53.

[167] Regulating Greenhouse Gas Emissions Under the Clean Air Act. 73 Fed. Reg. 44,354, 44,415-16 (2008):

> GHGs are global pollutants. Economic principles suggest that the full costs to society of emissions should be considered in order to identify the policy that maximizes the net benefits to society, i.e., achieves an efficient outcome . . . . Estimates of global benefits capture more of the full value to society than domestic estimates and can therefore help guide policies towards higher global net benefits for GHG reductions. Furthermore, international effects of climate change may also affect domestic benefits directly and indirectly to the extent U.S. citizens value international impacts (e.g., for tourism reasons, concerns for the existence of ecosystems, and/or concern for others); U.S. international interests are affected (e.g., risks to U.S. national security, or the U.S. economy from potential disruptions in other nations); and/or domestic mitigation decisions affect the level of mitigation and emissions changes in general in other countries (i.e., the benefits realized in the U.S. will depend on emissions changes in the U.S. and internationally). The economics literature also suggests that policies based on direct domestic benefits will result in little appreciable reduction in global GHGs (e.g., Nordhaus, 1995).

you should also identify them in your analysis,"[168] and instructs that agencies must "include a summary table that lists all the unquantified benefits and costs, and use your professional judgment to highlight (e.g., with categories or rank ordering) those that you believe are most important."[169] In addition, OMB warned that "the most efficient alternative will not necessarily be the one with the largest quantified and monetized cost-benefit estimate."[170]

Social cost of carbon models do not account for various costs of climate change, including climate impacts on the following market sectors: agriculture, forestry and fisheries (including pests, pathogens and weeds, erosion, fires, and ocean acidification); ecosystem services (including biodiversity and habitat loss)); health impacts (including Lyme disease and respiratory illness from increased ozone pollution, pollen, and wildfire smoke). EPA's neglect of these omitted damages, and its disregard of OMB Circular A-4, is arbitrary and capricious.

When EPA does calculate the economic harm from replacing the Current Standard with the Proposed Rule in the event that new coal-fired power plants are built, EPA should use a discount rate below 3 percent. In the context of climate change, where emissions today will have impacts for many centuries, an analysis that assumes 3 percent is the lowest discount rate that should be meaningfully considered is not rational. Using even a 3-percent discount rate leads to inequitable results when calculating the costs of potentially catastrophic events hundreds of years in the future. EPA made the case for why it should consider lower discount rates a decade ago:

> There are reasons to consider even lower discount rates in discounting the costs of benefits of policy that affect climate change. First, changes in GHG emissions—both increases and reductions—are essentially long-run investments in changes in climate and the potential impacts from climate change. When considering climate change investments, they should be compared to similar alternative investments (via the discount rate). Investments in climate change are investments in infrastructure and technologies associated with mitigation; however, they yield returns in terms of avoided impacts over a period of one hundred years and longer. Furthermore, there is a potential for significant impacts from climate change, where the exact timing and magnitude of these impacts are unknown. These factors imply a highly uncertain investment environment that spans multiple generations. When there are important benefits or costs that affect multiple generations of the population, EPA and OMB allow for low but positive discount rates (e.g., 0.5–3% noted by U.S. EPA, 1–3% by OMB).

73 Fed. Reg. at 44,414. Also, a recent survey of experts showed that 62 percent believed that the appropriate discount rate should be lower than 2.5 percent.[171]

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[168] OMB Circular A-4 at 3.

[169] *Id.* at 27.

[170] *Id.* at 2.

[171] Expert Report, The Use of the Social Cost of Carbon in the Federal Proposal "Safer Affordable Fuel- Efficiency (SAFE) Vehicles Rule," (attached to comments of California Air Resources Board, Docket ID EPA-HQ-OAR-2018-0283-5481) Maximilian Auffhammer, October 24, 2018, at 12. Also, the Office of Management and Budget has concluded that a

If and when EPA does analyze the economic impacts, in the event that a new coal-fired plant is built, of replacing the Current Standard with the Proposed Rule, it should include the above recommendations in its analysis.

VIII. CONCLUSION

EPA was correct to promulgate the Current Standard in 2015 to address the climate change crisis, and it should continue to leave those emission limits in place. EPA relied on a thorough factual record and proper legal analysis in that 2015 rulemaking. EPA fails in the Proposed Rule to justify reversing its well-considered 2015 findings, rendering the new proposal arbitrary and capricious and in violation of the Clean Air Act. The States and Cities urge EPA to withdraw the Proposed Rule and not finalize it.

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Enclosures: Appendix A: Climate Change Impacts
Appendix B: Carbon Sequestration in State Statutes and Regulations

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discount rate of 7 percent is not appropriate for effects experienced on a long time horizon, such as climate change. *See* Guidelines for Preparing Economic Analysis, Section 6-15.

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