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

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," 83 Fed. Reg. 44,746 (Aug. 31, 2018)

October 31, 2018

Table of Contents

EXECUTIVE SUMMARY 1

I. INTRODUCTION 4

A. Recent Evidence of Climate Change 4

B. Climate Change-Related Harms Impacting States and Cities 6

C. States' and Cities' Response to the Urgent Need to Reduce Carbon Dioxide Emissions from the Electric Generating Sector 8

1. Litigation against EPA and power companies to compel emission reductions 9

2. Implementing programs to reduce CO_2 emissions from the power sector 9

II. EPA'S FAILURE TO ADEQUATELY PROVIDE FOR PUBLIC INPUT IN THE RULEMAKING PROCESS 10

III. EPA'S REVISED DETERMINATIONS OF THE BEST SYSTEM OF EMISSION REDUCTION FOR EXISTING FOSSIL-FUELED POWER PLANTS 12

A. Overview Comparison of EPA's Determination of the Best System of Emission Reduction in the Clean Power Plan and the Proposed Rule 12

B. EPA Misinterprets Section 111 of the Clean Air Act to Unlawfully Support Its Revised Determination of BSER for Coal-fired Plants, as It Did in the Repeal Proposal 14

1. EPA has no basis for changing position and determining that generation shifting cannot be considered a system of emission reduction (C-2) 14

2. The legislative history of section 111 does not support EPA's revised determination (C-2) 19

3. EPA's new "additional legal rationales" do not provide a reasonable basis for it to change its interpretation of section 111 20

4. EPA's legal analysis of BSER is arbitrary, unreasonable, and contrary to Congressional intent because it makes an illogical distinction between off-site coal cleaning (i.e., not "at the source") measures EPA previously considered to be part of a "system of emission reduction" 28

C. EPA's Revised Determination of the Best System of Emission Reduction for Coal Plants is Arbitrary and Capricious because EPA Failed to Consider Relevant Evidence 29

1. EPA has ignored relevant evidence in the record regarding additional proven systems of emission reduction 30

2. EPA erred in its analysis of what heat rate improvements are feasible and cost effective 52

D. EPA's Proposal to Stop Regulating Gas Plants and IGCC units as "Affected Units" Is Contrary to Section 111 and Is Arbitrary and Capricious and Contrary to Law 55

1. EPA fails to comply with its obligations under section 111(d) to issue emissions guidelines for sources that have been regulated under 111(b) for three years 55

2. EPA's conclusion that it lacks sufficient information to determine BSER for gas plants is contradicted by the record in the Clean Power Plan rulemaking (C-3, C-5) 57

IV. EPA'S PROPOSED CHANGES TO THE SECTION 111(D) IMPLEMENTING REGULATIONS 60

A. The Proposed Rule 60

B. States' and Cities' Comments 64

1. The proposed rule would improperly remove the requirement that emission guidelines provide information to states on the endangerment caused by the pollutant 66

2. The proposed revisions to the regulations would effectively turn section 111(d) into a toothless program that requires few, if any, emissions reductions, would result in significant inequities between states, and would undermine the integrity of the process of determining whether state plans are "satisfactory," as required by the Act 66

3. Other proposed changes to the implementing regulations are not legally or factually supported 73

4. EPA's proposed variance provisions appear designed to maximize source flexibility to obtain

the least degree of emission reduction, thereby undercutting section 111(d)'s purpose to address endangerment from existing sources 77

V. POLLUTION IMPACTS OF THE PROPOSED RULE 81

A. EPA Admits that Air Pollution Under the Proposed Rule Would Be Higher Compared to Under the Clean Power Plan 81

B. EPA's Illustrative Modeling Fails to Accurately Reflect the Realities of the Proposed Rule, Thereby Likely Overstating Any Emission Benefits from It 83

C. The Proposed Rule Could Increase Emissions in Several States Compared to a No Replacement Scenario 85

D. Increased Air Pollution Will Result in Numerous Harms to the States and Cities 86

1. More pollution will harm public health by causing more premature deaths and illnesses compared to the Clean Power Plan 86

2. More pollution will cause disproportionate harm to environmental justice communities 87

3. More pollution will harm public welfare in the States and Cities in myriad ways 87

4. The paltry emission reductions (if any) from implementation of the proposed rule cannot be squared with EPA's findings in the Clean Power Plan and other current EPA rulemakings regarding the urgent threat climate change poses and the need to demonstrate international leadership to facilitate other countries' committments to reduce greenhouse gas emissions 92

VI. EPA'S PROPOSED WEAKENING OF THE NEW SOURCE REVIEW PROGRAM 94

A. The Proposed Rule 94

B. States and Cities' Comments 96

1. The proposed changes weakening NSR are inconsistent with the Clean Air Act 97

2. The proposed changes weakening NSR will lead to more air pollution 111

3. The proposed NSR changes would improperly exempt projects that are not required for compliance with the proposed rule 123

4. The *UARG* decision does not support EPA's attempts to weaken the NSR program 126

VII. ECONOMIC IMPACTS OF THE PROPOSAL 127

A. The RIA Underestimates the Foregone Benefits of Reducing Carbon Pollution 128

1. EPA erroneously failed to consider international costs of climate change in calculating the social cost of carbon 128

2. EPA inappropriately used a 7-percent discount rate to evaluate climate change costs 132

3. EPA failed to meaningfully consider the non-monetized costs of climate change that are not incorporated in the social cost of carbon models, as required by OMB Circular A-4 and Supreme Court precedent 136

B. The RIA for the Proposed Rule Underestimates the Foregone Co-Benefits of the Clean Power Plan 139

C. EPA's Air Quality Analysis is Flawed Because It Assumes that Important Regulations the Agency Is in the Process of Rescinding or Weakening Will be in Effect in the Future 139

D. Requiring State Agencies to Analyze Heat Rate Improvements for Each of the Candidate Technologies at Each Power Plant Will Burden Agency Resources While Providing, Little, if Any, Benefit in Terms of Pollution Reductions 140

CONCLUSION 142

EXECUTIVE SUMMARY

The Attorneys General of New York, California, Connecticut, Delaware, Illinois, Iowa, Maine, Maryland, Massachusetts, Minnesota (by and through its Minnesota Pollution Control Agency), New Mexico, North Carolina, Oregon, Pennsylvania, Rhode Island, Vermont, Virginia, and Washington, the District of Columbia, and the cities of Boulder (CO), Chicago, Los Angeles, New York, Philadelphia, and South Miami (FL), and the county of Broward (FL) (together, "States and Cities") submit these comments in strong opposition to the Environmental Protection Agency's (EPA) 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," 83 Fed. Reg. 44,746 (Aug. 31, 2018) (proposed rule). EPA intends that the proposed rule will replace the Clean Power Plan, 80 Fed. Reg. 64,662 (Oct. 23, 2015), which established the first nationwide emission limits on one of our country's largest sources of harmful greenhouse gases—existing fossil-fueled electric generating power plants.

The proposed rule, which EPA calls the "Affordable Clean Energy" rule, neither promotes "clean energy" generation nor does it implement a policy that Americans can "afford" given the need to aggressively cut carbon pollution from power plants and other sources to adequately confront the dangers of climate change. The agency told the D.C. Circuit Court of Appeals in 2016 that "[n]o serious effort to address the monumental problem of climate change can succeed without meaningfully limiting [power] plants' CO_2 emissions." EPA Final Brief in *West Virginia v. EPA*, D.C. Cir. No. 15-1363 (Doc. #1609995, filed April 22, 2016) (hereinafter "EPA Br."), at 61. The proposed rule fails this test; indeed, it displays a lack of seriousness toward both the climate change harms the United States is facing and the need to address that threat by meaningfully reducing emissions from one of the largest sources of greenhouse gases: fossil-fueled power plants. At its core, rule represents a fundamental abdication of EPA's critical role in curbing greenhouse gas pollution from large sources of those emissions, which the Supreme Court recognized both in *Massachusetts v. EPA*, 549 U.S. 497 (2007) and *Am. Elec. Power v. Connecticut*, 564 U.S. 410 (2011).

Not only would the proposed rule fail to require significant reductions in carbon pollution, EPA's own analysis shows that the increase in conventional pollutants under the proposed rule would result in hundreds or thousands more deaths and illnesses every year versus the Clean Power Plan. To the extent that EPA contends that the Clean Air Act requires it to discard the Clean Power Plan in

favor of this proposal, it is wrong on the law. And if EPA's position is that it simply prefers its new approach as a matter of policy, such a position would be indefensible in light of the harm EPA acknowledges the proposed rule would cause to human health. In either case, EPA should withdraw this harmful proposed rule and implement the Clean Power Plan, or a strengthened version of that Plan.

Section I of these comments contains a discussion of recent scientific reports on climate change harms, a summary of threats the States and Cities are facing from climate change and the corresponding need for EPA to perform its duty under the Clean Air Act to set nationwide limits on power plant carbon pollution, and a description of efforts our States and Cities have undertaken to compel reductions of carbon dioxide emissions from the electricity generating sector.

In Section II, we express our concerns regarding the lack of public participation in the rulemaking process. EPA's failure to schedule sufficient public hearings or provide for an adequate period for public comment deprives our residents of a meaningful voice on these critical issues.

In Section III, we address how EPA's revised determination of the "best system of emission reduction" is inconsistent with the Clean Air Act and fundamental principles of administrative law. The agency's revised determination is inherently flawed because it ignores the way power plants generate electricity (and emissions) on the interconnected grid and treats each plant as an isolated island. In an about face from its careful consideration in the Clean Power Plan of successful state programs that have reduced power-sector carbon pollution, EPA's new approach simply ignores those programs. EPA cannot lawfully do so under the Clean Air Act.

Section IV sets forth our comments on EPA's proposed changes to its section 111(d) implementing regulations. In a nutshell, we oppose the changes that would have EPA abdicate its role to set a minimum level of emission reduction and give states wide discretion regarding whether to require sources to reduce their pollution. These changes, which would apply to future rules well beyond carbon dioxide regulation of power plants, would effectively rewrite the Clean Air Act, undermining Congressional intent that the agency ensure a baseline of protection from pollution to avoid a harmful "race to the bottom" competition among the states for industry.

Section V describes how, under EPA's own analysis, the proposed rule would increase air pollution compared to the Clean Power Plan, causing harm to public health and the environment, including a disproportionate impact on environmental justice communities. EPA's attempt to argue that the proposed rule will deliver commensurate carbon pollution reductions is based on a flawed analysis and on the mistaken premise that it can reopen the Clean Power Plan rulemaking to relax the required emission reductions without consideration of changed circumstances since the Plan was promulgated. Those changed circumstances require that for EPA to fulfill its statutory duty, the Clean Power Plan must be strengthened, not weakened. This section of the comments also discusses independent analyses showing that in several states, the proposed replacement could result in greater pollution than no replacement rule at all.

Section VI discusses EPA's proposed changes to the New Source Review (NSR) program. The agency's proposed addition of a maximum hourly emissions test as a prerequisite to triggering NSR is inconsistent with the language and purpose of the statute, and would result in increased air pollution. Indeed, in seeking to eviscerate the pollution reduction requirements of NSR here, EPA's proposal is a misuse of a section 111(d) rulemaking, the statutory purpose of which is secure *reductions* in dangerous pollution. In addition, even if EPA's contention that the heat-rate improvement "candidate technologies" will lead to lower power plant emissions had merit, the agency has proposed that the new test would apply to *all* power plant modifications, regardless of their impact on power plant efficiency.

Section VII addresses EPA's flawed economic analysis of the proposal. As with its economic analysis of its proposed repeal of the Clean Power Plan, the agency's analysis of the replacement rule is flawed in multiple respects: it underestimates the foregone benefits of the more protective Clean Power Plan by, among other things, using an inappropriately high discount rate and a constrained view of the social cost of carbon and co-benefits from reducing other pollutants.

As noted in the Conclusion to these comments, the proposed rule, if finalized, would be unlawful. EPA should abandon it and instead focus on implementing and strengthening the Clean Power Plan.

I. INTRODUCTION

A. Recent Evidence of Climate Change

In our comments on EPA's proposed repeal of the Clean Power Plan, dated April 26, 2018 ("Repeal Comments"), EPA-HQ-OAR-2017-0355-20778, we noted several recent reports since publication of the Clean Power Plan in October 2015 confirming the already well-accepted scientific consensus that the Earth's climate system is changing rapidly primarily due to human activities, especially from emissions of greenhouse gases. *See* Repeal Comments at 2-6. There have been several notable findings since we submitted our Repeal Comments:

- According to the October 2018 report by the Intergovernmental Panel on Climate Change (IPCC), global warming is likely to reach 1.5°C between 2030 and 2052 if emissions continue to increase at the current rate.[1]

- We are already seeing the consequences of the 1°C of warming to date as demonstrated by more extreme weather, rising sea levels, and diminishing Arctic sea ice. The IPCC projects major damage to marine ecosystems such as coral reefs, which are projected to decline an additional 70–90 percent at 1.5°C of warming, while essentially being eliminated worldwide at warming of 2°C. IPCC 2018 Summary at SPM-10.

- Limiting global warming to 1.5°C, the IPCC affirmed, would require rapid and far-reaching economy-wide transitions, including massive electrification of the economy with carbon-free fuels. IPCC 2018 Summary at SPM-15-16.

- In 2018, atmospheric carbon dioxide (CO_2) levels measured at the National Oceanic and Atmospheric Administration's Mauna Loa Observatory exceeded the 410 parts per million (ppm) threshold for the first time, reaching 411 ppm in May 2018. The growth rate of the global CO_2 level is accelerating, averaging about 1.6 ppm per year in the 1980s and 1.5 ppm per year in the 1990s, but increasing to 2.2 ppm per year during the last decade. Historically

[1] IPCC. 2018. Global Warming of 1.5 °C - Summary for Policymakers (approved by IPCC October 6, 2018) ("IPCC 2018 Summary"), at SPM-4, *available at*: http://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf.

high levels of coal, oil, and natural gas consumption are fueling these escalating CO_2 growth rates.[2]

- Global temperatures during the first half of 2018 were the hottest on record during a La Niña year.[3]

- Researchers report that 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.[4]

- Scientists have concluded that self-reinforcing climate system feedbacks, such as the die-off of boreal forests, Arctic sea ice loss, and the release of methane from permafrost, could create 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.[5]

- A study of agricultural crop response to climate change indicates that insect pests will consume important U.S. grain crops—wheat, rice and corn—at an alarmingly increasing rate. While insects already consume 5 to 20 percent of major grain crops, models show yield lost to insects will increase by 10 to 25 percent per degree Celsius of warming.[6]

- Future hurricanes will have stronger maximum winds, move more slowly, and drop more precipitation according to a modeling analysis by U.S. government scientists of 22 recent hurricanes.[7] The unprecedented rainfall totals associated with the stall of Hurricane Harvey over Texas in 2017 provide a notable example of the relationship between regional rainfall

---

[2] https://research.noaa.gov/article/ArtMID/587/ArticleID/2362/Another-climate-milestone-falls-at-NOAA%E2%80%99s-Mauna-Loa-observatory

[3] https://public.wmo.int/en/media/news/july-sees-extreme-weather-high-impacts

[4] S. M. Sosdian, R. Greenop, M. P. Hain, G. L. Foster, P.N. Pearson, C.H. Lear. 2018. Earth and Planetary Science Letters. Volume 498, Pages 362-376. https://doi.org/10.1016/j.epsl.2018.06.017

[5] Steffen et al. 2018. Proceedings of the National Academy of Sciences. 115 (33) 8252-8259; DOI: 10.1073, *available at*: http://www.pnas.org/content/115/33/8252.

[6] Deutsch et al. 2018. Science. 31 August 2018: 916-919 (attached hereto as ***Exhibit A***).

[7] Gutmann et al. 2018. J. Climate, 31, 3643–3657, https://doi.org/10.1175/JCLI-D-17-0391.1

amounts and tropical-cyclone translation speed.[8] Similarly, before Hurricane Florence came ashore over the Carolinas this summer, U.S. government and academic scientists forecasted rainfall amounts would be increased by over 50 percent due to warmer sea surface temperatures and available atmospheric moisture attributable to climate change.[9]

- 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 U.S., abnormally warm waters in the Gulf of Mexico fueled its rapid intensification.[10] As with Hurricane Sandy and other recent storms, this intensification is being driven by increasingly warm ocean water temperatures, consistent with scientists' prediction for increasing hurricane intensity in a warming world.[11]

B. Climate Change-Related Harms Impacting States and Cities

We previously described in detail the climate change-related harms the States and Cities are experiencing or face in the near future. *See* Repeal Comments at 6-9, and *id.*, Appendix A. An updated version of Appendix A is being filed with these comments. This section highlights several of these recent harms:

- On May 27, 2018, Maryland experienced catastrophic amounts of rainfall and flooding. Portions of the state received nearly ten inches of rain in just two hours. Flash floods turned Old Ellicott City's Main Street into a river more than ten-feet deep. The Patapsco River rose nearly eighteen feet in less than two hours. More generally, torrential rains drenched Maryland for much of the summer. This was Maryland's wettest summer since 1955, with year-to-date rainfall totals through September setting a record for the state.

---

[8] Kossin, J. 2018. Nature. 558, 104-107 (attached hereto as ***Exhibit B***).

[9] Reed et al. 2018. The Human Influence on Hurricane Florence, *available at*: https://crd.lbl.gov/assets/Uploads/Wehner/climate-change-Florence-0911201800Z-final.pdf

[10] https://www.nhc.noaa.gov/archive/2018/al14/al142018.discus.010.shtml.

[11] USGCRP, 2017: Climate Science Special Report: Fourth National Climate Assessment, Volume I [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, doi: 10.7930/J0J964J6. Page 416, *available at*: https://science2017.globalchange.gov/.

- In August 2018, California published "***California's Fourth Climate Assessment***," which includes thirty-three papers from State-funded researchers, and eleven papers from externally-funded researchers, as well as regional summaries and a statewide summary of climate vulnerabilities, and a key findings paper.[12] Regarding wildfires, one Fourth Assessment model suggests large wildfires (greater than 25,000 acres) could become 50 percent more frequent by the end of century if emissions are not reduced. The model produces more years with extremely high areas burned, even compared to the historically destructive wildfires of 2017 and 2018.[13] By the end of the century, California could experience wildfires that burn up to a maximum of 178 percent more acres per year than current averages.[14] Increased wildfire smoke will also lead to more respiratory illness.[15]

- In August 2018, Hurricane Florence claimed the lives of 39 people in North Carolina[16] and caused an estimated $13 billion in damage.[17] A meteorologist at North Carolina State calculated that Hurricane Florence, compared to all storms in the U.S. over the last 70 years, produced the second highest amount of rain in a concentrated (14,000 square mile) land area.[18] On the meteorologist's list, four of the top seven storms occurred in the last three years.[19] In 2016, Hurricane Matthew had devastating impacts on many of the

---

[12] *See* Thorne, James H., Joseph Wraithwall, Guido Franco. 2018. California's Fourth Climate Change Assessment, California Natural Resources Agency, *available at*: www.ClimateAssessment.ca.gov.

[13] California 4th Climate Assessment, Key Findings at 6.

[14] *Id.*

[15] *Id.* at 8.

[16] North Carolina Governor's Office, As Recovery Moves Ahead, North Carolina Mourns Lives Lost, Works to Connect Storm Survivors with Housing (Oct. 2, 2018), *available at*: https://governor.nc.gov/news/recovery-moves-ahead-north-carolina-mourns-lives-lost-works-connect-storm-survivors-housing.

[17] North Carolina Governor's Office, Governor Cooper Recommends Robust State Funding Package for Hurricane Florence Recovery and Resiliency (Oct. 10, 2018), *available at*: https://governor.nc.gov/news/governor-cooper-recommends-robust-state-funding-package-hurricane-florence-recovery-and.

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

[19] *Id.*

same areas of eastern North Carolina, killing at least 27 people and causing some $1.5 billion in damage, from which the state is still recovering.[20] The amount of rainfall and flooding these hurricanes have brought used to be extremely rare in North Carolina, but it is not rare anymore. Based on pre-climate change weather patterns, Hurricane Florence's rainfall was described as an event that eastern North Carolina could expect to occur only once every 1000 years.[21] Hurricane Matthew, a 500-year flood event,[22] hit eastern North Carolina just two years before Florence.

In addition, nationally, 2017 was the most expensive year on record for climate response costs, $306 billion, as calculated by the National Oceanic and Atmospheric Administration.[23]

C. States' and Cities' Response to the Urgent Need to Reduce Carbon Dioxide Emissions from the Electric Generating Sector

Although EPA has previously acknowledged the need for urgent reductions in greenhouse gas emissions, EPA's proposed rule does not, nor does it explain the rationale for its apparent reversal. States and Cities, by contrast, are acting to address the threat posed by climate change. For more than fifteen years, the States and Cities have sought to limit carbon pollution from fossil-fueled power plants. We have used two primary strategies to further that goal: (1) pursuing litigation to compel emission limits on carbon dioxide emitted by power plants, and (2) enacting state and local programs requiring power plants located in our States to reduce their carbon pollution and incentivizing cleaner electricity generation.

---

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

[21] Risk Management Solutions, Hurricane Florence: Rainfall up to a 1,000-Year Return Period (Sep. 14, 2018), *available at*: https://www.rms.com/blog/2018/09/14/hurricane-florence-rainfall-up-to-a-1000-year-return-period/.

[22] Office of Water Prediction, National Weather Service, Hurricane Matthew, 6-10 October 2016 Annual Exceedance Probabilities (AEPs) for the Worst Case 24-Hour Rainfall (prepared Oct. 18, 2016), *available at*: http://www.nws.noaa.gov/ohd/hdsc/aep_storm_analysis/AEP_HurricaneMatthew_October2016.pdf.

[23] https://www.ncei.noaa.gov/news/national-climate-201712.

1. Litigation against EPA and power companies to compel emission reductions

As set forth in our Repeal Comments, many of the States and Cities have fought in the courts for more than a decade for enforceable limits on greenhouse gas emissions from power plants. Much of that litigation has sought to compel and then to defend EPA's promulgation of regulations under section 111 requiring new and existing power plants to cut carbon pollution. *See* Repeal Comments at 10-12. In addition, several of the States and Cities brought a common law public nuisance case seeking to require that the five largest power plant companies in the nation cut their carbon pollution, *Connecticut v. Am. Elec. Power*, No. 04-CIV-5669 (S.D.N.Y.). *See id.* at 9. There, the Supreme Court held that section 111 of the Clean Air Act and EPA regulatory authority to implement that section by limiting power plant pollution displaced the States' and Cities' federal common law nuisance remedy against the power plants. *AEP v. Connecticut*, 564 U.S. 410. The rules EPA issued in 2015 to limit carbon 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. 80 Fed. Reg. at 64,527, 64,759; *see AEP v. Connecticut,* 564 U.S. at 424.

2. Implementing programs to reduce CO_2 emissions from the power sector

Our Repeal Comments discussed in detail the different types of programs the States and Cities have undertaken to cut carbon pollution from existing fossil-fueled power plants in the absence of federal leadership. These programs, including statewide cap-and-trade, regional cap-and-trade, and renewable portfolio standards (RPS), have resulted in substantial CO_2 emission reductions, without increasing consumer electricity prices or undermining the reliability of the grid. *See* Repeal Comments at 25-27 and Appendix B (an updated version of Appendix B is being filed with these comments); *see also* Comments of New York, et al. on EPA's Advance Notice of Proposed Rulemaking (Feb. 26, 2018) at 8-9.[24] Since we submitted our Repeal Comments, there have been the following developments of note:

[24] A copy of the rulemaking comments on the Advance Notice, previously submitted to EPA in that rulemaking docket, has been re-filed in this rulemaking docket.

- On September 4, 2018, Massachusetts's highest court upheld state regulations that require power plants in the state to meet a statewide annually declining cap on their greenhouse gas emissions under Massachusetts' Global Warming Solutions Act, MASS. GEN. LAWS ch. 21N, §§ 3, 4, which mandates the state to reduce greenhouse gas emissions by 80 percent below 1990 levels by 2050. *New England Power Generators Ass'n, Inc. v. Dep't of Envtl. Prot.*, 480 Mass. 398 (2018). These requirements are supplemental to those imposed under the Regional Greenhouse Gas Initiative (RGGI) cap-and-trade program, which also applies to Massachusetts power plants.

- The 2018 Virginia Energy Plan recognizes the clean energy transformation already occurring in Virginia and contains a suite of recommendations to further that growth.[25] For instance, the energy plan recommends that each investor-owned utility issue an annual Request for Proposals (RFP) for the development of at least 500 megawatts of solar and wind generation each year in the Commonwealth.[26] Dominion Energy has already announced one such RFP.[27]

II. EPA'S FAILURE TO ADEQUATELY PROVIDE FOR PUBLIC INPUT IN THE RULEMAKING PROCESS

EPA has failed to provide a sufficient opportunity for public participation in the rulemaking process for the proposed rule. EPA has held only *one* public hearing. As explained in our letter dated September 11, 2018 (attached hereto as ***Exhibit C***), providing only one opportunity for our residents to be heard in person—in light of the numerous impacts our States and Cities are facing from climate change—is not sufficient. Despite our request that EPA hold additional hearings in other major geographic areas of the country, the agency refused. That failure is particularly unfair to communities located nearby and downwind of power plants and that are at the greatest risk of climate change impacts.[28] Furthermore, EPA found in the Clean

---

[25] 2018 Virginia Energy Plan, *available at*: https://www.governor.virginia.gov/media/governorvirginiagov/secretary-of-commerce-and-trade/2018-Virginia-Energy-Plan.pdf

[26] *Id*. at 12.

[27] "Solar and Onshore Wind Generation Proposals," Dominion Energy website, *available at*: https://www.dominionenergy.com/2018solarwindrfp.

[28] *See e.g.,* Stefani L. Penn, et al., *Estimating State-Specific Contributions to $PM_{2.5}$- and O_3-Related Health Burden from Residential Combustion and Electricity Generating*

Power Plan rulemaking that communities in closest proximity to power plants include a higher percentage of communities of color and low-income communities than national averages. 80 Fed. Reg. at 64,670.

In addition to insufficient opportunities for people to personally convey their input to the agency, the length of the public comment period was also inadequate. As explained in our September 11 letter, a public comment period of 61 days is unreasonable given that the proposed rule is effectively three rules in one. *See* Exhibit C at 1. Moreover, as explained in Sections III-VII below, EPA has deprived the public of a meaningful comment period by failing to adequately explain its legal rationale for the proposed rule or to analyze its impacts on public health and welfare. Under the Clean Air Act, EPA is required to provide with a proposed rule, *inter alia*, "(A) the factual data on which the proposed rule is based; (B) the methodology used in obtaining the data and in analyzing the data; and (C) the major legal interpretations and policy considerations underlying the proposed rule." 42 U.S.C. § 7607(d)(3). Its failure to correct these deficiencies and allow comment on any proffered data, methodologies, or legal interpretations before finalizing the proposed rule would violate those obligations under the statute.

EPA's paltry efforts here to seek public input can be contrasted to the agency's efforts in the Clean Power Plan, which was "the result of unprecedented outreach and engagement with states, tribes, utilities, and other stakeholders." 80 Fed. Reg. at 64,663. As noted in our September 11 letter, EPA provided a 167-day public comment period on its proposed rulemaking and held four hearings in regions across the country. And given that, as explained below, the proposed rule is likely to do more harm than good for public health, there is no justification whatsoever for EPA to rush to complete this flawed rule.

Unit Emissions in the United States, Environ Health Perspect. 2017 Mar; 125(3): 324–332, *available at*: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5332198/ (isolating contribution of PM2.5 and ozone emissions from electric generating units (EGUs) by state of origin, estimating 21,000 premature mortalities each year from EGU emissions of PM2.5, and finding that half of EGU health impacts are attributable to emissions from eight states with significant coal combustion and large downwind populations).

III. EPA'S REVISED DETERMINATIONS OF THE BEST SYSTEM OF EMISSION REDUCTION FOR EXISTING FOSSIL-FUELED POWER PLANTS

A. Overview Comparison of EPA's Determination of the Best System of Emission Reduction in the Clean Power Plan and the Proposed Rule

In the Clean Power Plan, EPA established section 111(d) emission guidelines for states to follow in developing state plans to limit CO_2 emissions from existing fossil fuel-fired electric generating units (EGUs). The Clean Power Plan applies to existing coal-fired power plants—which includes steam generating units as well as integrated gasification combined cycle (IGCC) units—and also to gas-fired power plants (referred to as stationary combustion turbines). 40 C.F.R. § 60.5845. At the same time it issued the Clean Power Plan, EPA issued a final rule under section 111(b) controlling emissions from new, modified, and reconstructed power plants. 80 Fed. Reg. at 64,510. The types of units covered by the 111(b) rule and the Clean Power Plan existing source rule are the same. 40 C.F.R. § 60.5509. Indeed, the Clean Air Act requires this alignment between new and existing sources subject to emission controls: when EPA establishes performance standards for a pollutant emitted by new sources within a source category, section 111(d)(1) requires EPA to issue emission guidelines regulating that same pollutant from existing sources in that same source category. 42 U.S.C. § 7411(d)(1).

After a detailed analysis of what power plants actually do to cost-effectively reduce emissions, EPA determined under section 111 that the best system of emission reduction (BSER) adequately demonstrated for existing power plants is a combination of three types of pollution control measures, which the Clean Power Plan referred to as building blocks one, two, and three: (1) making heat rate efficiency improvements at coal-fired steam generating units; (2) substituting electricity generation from gas plants for generation from coal plants; and (3) substituting electricity generation from zero-emitting renewable energy sources for generation from coal and gas plants. 80 Fed. Reg. at 64,666-67. EPA determined that these measures constitute the "best" system of emission reduction, applying the statutory considerations of degree of reductions achieved, costs, energy requirements, and non-air quality health and environmental impacts. *Id.* at 64,744-51. EPA determined that these measures were not only adequately demonstrated

but the most cost-effective system available for sources to meaningfully limit their CO_2 emissions. *Id.*[29]

Based on this system of emission reduction, EPA quantified ultimate emission performance rates for existing coal plants (both steam generating and IGCC) of 1,305 pounds of CO_2 per net megawatt-hour (lb CO_2/MWh) and for gas plants of 771 lb CO_2/MWh. For each state, EPA also promulgated rate-based CO_2 emission goals for 2030 using those performance rates (which are the weighted aggregate of the emission performance rates for the state's coal- and gas-fired power plants), as well as mass-based goals for each state, intended to facilitate trading. *Id.* at 64,667. Thus, the Clean Power Plan included gas-fired power plants under the same regulatory system as coal-fired plants, and set state-specific emission goals that applied to both types of sources using building blocks one, two, and three.

In evaluating the BSER for the Clean Power Plan, EPA also considered other methods for reducing emissions from affected sources, such as heat rate improvements (HRI) alone (that is, making efficiency improvements not in combination with building blocks two and three), co-firing coal plants with gas, capturing CO_2 and storing it securely underground (known as carbon capture and storage, or CCS), and converting coal plants to gas. However, EPA determined that such methods for reducing CO_2 emissions from power plants are either more expensive than generation shifting (in the case of gas co-firing and carbon capture and storage), or are capable of achieving only a fraction of the reduction in CO_2 emissions (in the case of heat rate improvement measures alone). 80 Fed. Reg. at 64,727-28, 64,769.

Through its proposed rule, EPA seeks to reverse its existing BSER determination in two fundamental ways: first, EPA proposes to exempt all existing gas plants and IGCC coal plants from CO_2 emission controls; and second, for steam

---

[29] In developing the Clean Power Plan, EPA also found that such measures were consistent with global nature of CO_2 pollution and how power grids operate as integrated machines. *Id.* at 64,726 ("In this rule, when evaluating the types and amounts of measures that the source category can take to reduce CO_2 emissions, we have appropriately taken into account the global nature of the pollutant and the high degree to which each individual affected EGU is integrated into a 'complex machine' that makes it possible for generation from one generating unit to be replaced with generation from another generating unit for the purpose of reducing generation from CO_2-emitting generating units."); *see also id.* at 64,734 ("[T]he utility power sector—and the affected EGUs and other generation assets that it encompasses—has a long history of working on a coordinated basis to meet operating and environmental objectives, necessitated and facilitated by the unique interconnectedness and interdependence of the sector.").

generating coal units—the only power plants that would remain subject to controls—EPA proposes to eliminate building blocks two and three from its determination of BSER. In doing so, EPA improperly reverses its interpretation of what kinds of emission-reduction systems may be considered in a BSER determination, mischaracterizes and/or ignores evidence in its possession regarding alternative emission-control measures that should be considered in that determination, and fails to regulate sources in the category that are subject to control under section 111(b).

B. EPA Misinterprets Section 111 of the Clean Air Act to Unlawfully Support Its Revised Determination of BSER for Coal-fired Plants, as It Did in the Repeal Proposal

In revising its determination of BSER, EPA expressly relies on the legal analysis it provided in its proposed repeal of the Clean Power Plan. 83 Fed. Reg. at 44,748. The States and Cities provided extensive input in their Repeal Comments and incorporate those comments herein by reference.[30]

In the proposed rule, EPA mischaracterizes the BSER identified in the Clean Power Plan and then relies on that mischaracterization to reject those emission reduction measures. Mischaracterizations of prior rules, however, cannot support the repeal and wholesale replacement of those rules. *See Motor Vehicle Mfrs. Ass'n of U.S., Inc. v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 42-43 (1983) (hereinafter "*State Farm*").

1. EPA has no basis for changing position and determining that generation shifting cannot be considered a system of emission reduction (C-2)

EPA did not provide a reasoned explanation for rejecting its analysis in the Clean Power Plan and accompanying Legal Memorandum. In the Clean Power Plan, EPA specifically rejected the constrained interpretation it now proposes to adopt as inconsistent with both the deliberately broad plain meaning of "system of emission reduction" and the context in which that phrase appears. *See*, *e.g.*, 80 Fed. Reg. at 64,766-77 ("We see nothing in CAA section 111(d)(1) or (a)(1) which by its terms

[30] We will not repeat certain issues in this comment letter in reliance on EPA's representation in the proposed replacement rule that "[c]omments submitted on the proposed repeal will be considered in the promulgation of this rulemaking so there is no need to resubmit comments that have already been timely submitted." 83 Fed. Reg. at 44,748 n.1.

limits CAA section 111 to measures that must be integrated into the sources' own design or operations.").

EPA's restrictive interpretation of section 111 as prohibiting consideration of generation shifting measures is inconsistent with Congress's specific instruction to EPA in section 111 to choose the "best" system of emission reduction that has been "adequately demonstrated." EPA's interpretation also unreasonably forecloses EPA from considering the very measures that are most effective at reducing emissions, that are already widely used, and that power plants themselves often choose to reduce emissions. As such, EPA's newly adopted restrictive interpretation is an impermissible construction of section 111(a)(1). *See Chevron, U.S.A. Inc. v. Natural Resources Defense Council, Inc.*, 467 U.S. 837, 842-43 (1984).

EPA's cursory explanation in the proposed rule for its complete reversal of position also fails to satisfy the more detailed justification standard required by the Supreme Court in *FCC v. Fox Television, Inc.* (hereinafter "*Fox Television*"), where the Court stated, "it is not that further justification is demanded by the mere fact of policy change; but that a reasoned explanation is needed for disregarding facts and circumstances that underlay or were engendered by the prior policy." 556 U.S. 502, 515-16 (2009).

a. EPA has not shown that its legal interpretation of BSER in the proposed rule actually precludes consideration of Clean Power Plan-like measures

EPA's purported reason for rejecting the Clean Power Plan—namely, that it has revised its interpretation of BSER—is not supported by the legal rationale EPA describes in the proposed rule. As a result, EPA fails to provide a reasoned basis for rejecting the emission reduction measures utilized by the Clean Power Plan. *See, e.g.*, *United Food & Commercial Workers Intern. Union, AFL- CIO, Local 150-A v. NLRB*, 880 F.2d 1422, 1436 (D.C. Cir. 1989) ("*United Food*") (agencies "must accept responsibility for clarifying and identifying the standards that are guiding its decisions").

In the proposed rule, EPA purports to have revised its interpretation of BSER and claims that the Clean Power Plan is incompatible with its revised interpretation. Specifically, EPA states that BSER "is to be determined by evaluating technologies or systems of emission reduction that are *applicable to, at, and on* the premises of the facility for an affected source." 83 Fed. Reg. at 44,748 (emphasis added). "That is, such measures must be based on a physical or operational change to a building, structure, facility or installation at that source

rather than measures the source's owner or operator can implement at another location." *Id.* at 44,752. However, this is *consistent* with EPA's prior interpretation of BSER—at a minimum, EPA has failed to adequately identify and explain the differences between the interpretation underlying the Clean Power Plan and the proposed rule.

Describing the purportedly "changed" interpretation as "source-oriented" does not fulfill EPA's duty to "clarify[] and identify[] the standards that are guiding its decisions," *United Food*, 880 F.2d at 1436, given that EPA's interpretation in the Clean Power Plan was likewise source-oriented, expressly focusing on measures that would reduce emissions at and from the affected source. *See* 80 Fed. Reg. at 64,672 (describing the Clean Power Plan as "establish[ing] source-level emission performance rates"); *see also id.* at 64,674-75. Because of the unique interconnected nature of the nation's electricity system, generation shifting does in fact incorporate changes to an individual plant's physical operations. As EPA previously explained in rejecting arguments that largely mirror its interpretation in the proposed rule: "a particular plant may change its production process to increase or reduce its level of generation, and that action—in and of itself—accomplishes generation-shifting, because other sources must decrease or increase commensurately their operations to balance supply and demand." EPA Br. at 45-46.[31] The "best system" EPA described in the Clean Power Plan fits well within that frame.

EPA's failure to explain how its purportedly new interpretation precludes the BSER selected in the Clean Power Plan makes complete comments on that new interpretation difficult, if not impossible. Nonetheless, there are obvious flaws in the purportedly new interpretation, particularly if one accepts, at face value, the (unexplained) conclusions EPA draws from the purportedly new interpretation. The remainder of these BSER-related comments discuss these flaws, accepting EPA's statements about the consequences of its purportedly new interpretation, even though the interpretation itself and the necessity of those consequences remain unclear.

b. In determining the BSER, EPA must look at what states and plants are actually doing

EPA has not explained its decision to now disregard the fact that the sources at issue here deploy generation shifting as a way to reduce emissions. As EPA

[31] *See also generally* Brief of Amici Curiae Grid Experts, *West Virginia v. EPA*, 15-1363, ECF 1606654 (D.C. Cir. Apr. 1, 2016) (Repeal Comments JA, Att. A3).

determined in the Clean Power Plan, the phrase "system of emission reduction" cannot rationally be read to preclude generation shifting; it is a deliberately broad term that must necessarily encompass actions that may occur off-site but that result in emission reductions from the covered sources. *See, e.g.*, 80 Fed. Reg. at 64,761-62; *see also* EPA Br. at 27. Because the statute requires the "system of emission reduction" EPA selects to be "adequately demonstrated" and the "best" available system, the statutory language clearly requires EPA to look at methods that sources themselves use to reduce emissions and to select the best such method or methods. Generation shifting must be a "system of emission reduction" within the plain meaning and context of the statutory text because it is a method that power plants themselves have chosen to reduce their own emissions. *See* 80 Fed. Reg. at 64,725, 64,769-72. To conclude otherwise, as EPA proposes to do here, is to conclude that Congress intended EPA to ignore reality—to ignore how the very sources EPA intends to regulate are reducing the very pollution EPA intends to control. Interpreting the Act in this way—to preclude consideration of demonstrated and effective means of pollution control, currently being deployed by the sources at issue, when determining the "best system of emission reduction"—is unlawful, particularly in light of the plain meaning and context of the statutory language in section 111.

Similarly, EPA's revised interpretation is arbitrary and capricious because, by ignoring evidence of how power plants have successfully reduced carbon pollution, the agency has "entirely failed to consider an important aspect of the problem[.]" *State Farm*, 463 U.S. at 43. EPA noted in the Clean Power Plan that power plants "have long implemented, and are continuing to implement, the measures in building blocks two and three for various purposes, including for the purpose of reducing CO_2 emissions." 80 Fed. 64,769 & n.520 (citing various "climate mitigation plans" implemented by utilities). The Clean Power Plan record is replete with information supporting the viability of generation shifting "at" and "by" sources to reduce emissions at those sources, which EPA makes no attempt to rebut in its proposed rule.[32] By contrast, the proposed rule does not identify a single

[32] *See*, *e.g.*, EPA's Responses to Public Comments on the EPA's Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units (EPA-HQ-OAR-2013-0602-37106) § 3.2, at 4-5 (Repeal Comments JA, Att. F26) (hereinafter "Response to Comments on the CPP"). Indeed, the States submitted comments demonstrating the effectiveness of shifting generation from coal- and oil-fired power plants to cleaner renewable or natural gas-fired power plants. Joint State Comments (EPA-HQ-OAR-2013-0602-23597) at 15-19, 22-24 (Repeal Comments JA, Att. D3); RGGI States' Comments (EPA-HQ-OAR-2013-0602-22395) at 3 (Repeal Comments JA, Att. D4)

instance of sources using or even considering heat-rate improvements alone for the purpose of reducing CO_2 emissions.

EPA previously concluded that even if it selected other emission control measures such as co-firing or carbon capture and storage as BSER, power plants would use generation shifting—due to its cost-effectiveness—to reduce emissions. 80 Fed. Reg. at 64,728. In addition, as set forth in detail in Appendix B, the States and Cities have enacted programs that have resulted in shifts to cleaner forms of electricity generation and energy efficiency, successfully cutting carbon pollution from existing power plants without harming grid reliability or impeding economic growth. EPA's proposed rule ignores these well-demonstrated systems of emission reduction, and does not address EPA's prior conclusions or otherwise distinguish the existing record.

EPA also ignores the integrated nature of the power grid, which by design causes generation to be distributed and shifted among sources, and which allows shifts in generation in order to reduce greenhouse gas emissions and other air pollutants. Much of EPA's reasoning for adopting the Clean Power Plan's building blocks was based on the integrated nature of the power grid. 80 Fed. Reg. at 64,728. EPA described at length the unique nature of the power industry, which allows for changes as to which generators are operating and for how long as a simple means to reduce power sector pollution. *Id.* at 64,769–72. These shifts already occur in response to policy measures, economic forces, and other factors. 80 Fed. Reg. at 64,677, 64,795. EPA properly rejected arguments that it should ignore the integrated nature of the electricity generating industry, characterizing such an approach as treating each power plant as if it were "hermetically sealed off from the rest of the world." EPA Br. at 61. In the Clean Power Plan, EPA correctly recognized the way electricity—and emissions—are generated in the power sector, whereas EPA now, in the proposed rule, simply ignores it. Compounding this error, EPA—by disregarding the integrated nature of the power grid—fails to consider that the proposed rule may actually result in *greater* emissions than would occur without any regulation at all, as discussed in Section V.C, *infra*.

California Air Resources Board's Comments (EPA-HQ-OAR-2013-0602-23433), Attachment, at 43 (Repeal Comments JA, Att. D1).

2. The legislative history of section 111 does not support EPA's revised determination (C-2)

There is nothing in the legislative history of the Clean Air Act suggesting that Congress intended to limit the measures that EPA could consider in its BSER analysis so as to exclude or disqualify generation shifting. When EPA adopted the Clean Power Plan, it comprehensively assessed this history in the context of the larger protective purposes of the Clean Air Act. *See* 80 Fed. Reg. at 64,763-66. EPA explained that "[t]his history strongly suggests that Congress intended to authorize the EPA to consider a wide range of measures in calculating a standard of performance for stationary sources. At a minimum, there is no indication that Congress intended to preclude measures or actions such as the ones in building blocks 2 and 3 from the EPA's assessment of the BSER." 80 Fed. Reg. at 64,764. In its proposed rule, EPA ignores this legislative history and fails to explain, one, how its new proposal is compatible with that history, and two, on what grounds it has changed its understanding of Congress's intent in creating section 111.

In the Clean Power Plan, EPA expressly rejected the theory that it now embraces in the proposed rule that the legislative history of section 111 confirms that Congress intended BSER to be limited to "a physical or operational change to a building, structure, facility or installation at" each source. 83 Fed. Reg. at 44,752. As EPA recognized in the Clean Power Plan, the Congress that enacted section 111 in 1970 did not limit the term "standards of performance" to add-on "control technology," but also contemplated "processes, operating methods, *or other alternatives*." 80 Fed. Reg. at 64,764 (citing "Summary of the Provisions of Conference Agreement on the Clean Air Act Amendments of 1970," Sen. Muskie, S. Consideration of H.R. Conf. Rep. No. 91-1763 (Dec. 17, 1970), 1970 CAA Legis. Hist. at 130) (emphasis original)); *see also id*. ("The Senate Committee Report explains that 'performance standards should be met through application of the latest available emission control technology *or through other means of preventing or controlling air pollution*.'" (citing S. Rep. No. 91-1196, at 15-16 (Sept. 17, 1970), 1970 CAA Legis. Hist. at 415-16 (emphasis added by EPA))). In 1977, Congress emphasized that "best systems" for existing sources under section 111(d) would "not necessarily [be] technological." 80 Fed. Reg. at 64,765 (citing H.R. Rep. No. 95-294 (May 12, 1977), 1977 CAA Legis. Hist. at 2662). In its proposed rule, EPA does not and cannot provide a reasonable explanation of how its new interpretation is compatible with this history.

Further, EPA fails to provide any evidence that its new understanding of the legislative history is more credible than its previous one. During development of

the Clean Power Plan, commenters suggested that EPA interpret the legislative history the way EPA is proposing to do now, arguing that "Congress intended that CAA section 111(d)(1) and (a)(1) be limited to measures that are integrated into the source's design or operations." 80 Fed. Reg. at 64,767. EPA then rejected this interpretation outright, explaining that "it would be unreasonable to presume that Congress intended to limit the BSER, indirectly through these other provisions [in section 111], to measures that are integrated into the affected source's design or operations, when Congress could have done so expressly . . . ." *Id*. EPA has not provided a reasoned explanation for its reversal of position as to Congress's intent in enacting section 111.

There is simply nothing in the legislative history to suggest that Congress intended to prohibit EPA from considering methods, such as generation shifting, that are already in use at affected sources, and EPA has failed to explain how the proposed rule can be reconciled with its previous understanding of that history.

3. EPA's new "additional legal rationales" do not provide a reasonable basis for it to change its interpretation of section 111

a. EPA's assertion that its "historical understanding" of section 111 mandates that BSER be limited to physical controls on each source is incorrect

EPA argues that its changed interpretation of BSER is actually just a return to its "historical understanding" of the function of section 111. 83 Fed. Reg. at 44,572. EPA fails to point to any evidence that the interpretation it proposes for its proposed rule is more consistent with its historical interpretation of BSER than the interpretation it relied on for the Clean Power Plan. As EPA itself explained in the preamble to the Plan, EPA has a history of basing BSER on control measures other than the "physical or operational change to a building, structure, facility or installation at that source" that EPA now suggests is a restriction on BSER measures. During the administration of George W. Bush, EPA established a cap-and-trade system for control of mercury emissions under Section 111(d) (the Clean Air Mercury Rule) that did not require "physical or operational change to a building, structure, facility or installation at" each regulated source, but instead established statewide emissions budgets for mercury. EPA determined that BSER included a cap-and-trade mechanism, dispatch changes, and coal switching. 80 Fed. Reg. at 64,697. EPA previously explained its approach in the Clean Air Mercury Rule as follows:

> On March 15, 2005, the EPA issued a rule to control mercury (Hg) emissions from new and existing fossil fuel-fired power plants under CAA section 111(b) and (d). The rule, known as the Clean Air Mercury Rule (CAMR), established, in relevant part, a nationwide cap-and-trade program under CAA section 111(d), which was designed to complement the cap-and-trade program for SO_2 and NO_X emissions under the Clean Air Interstate Rule (CAIR) . . . Though CAMR was later vacated by the D.C. Circuit on account of the EPA's flawed CAA section 112 delisting rule, the court declined to reach the merits of the EPA's interpretation of CAA section 111(d). Accordingly, CAMR continues to be an informative model for a cap-and-trade program under CAA section 111(d).[33]

Contrary to EPA's argument, EPA has historically interpreted section 111 to include emission reduction systems beyond the facility fenceline in recognition of the operating variables and practices within the industry. EPA fails to acknowledge that it is rejecting its own historical interpretation of BSER prior to the Clean Power Plan, much less explain such a reversal.

b. EPA's alleged traditional interpretation of the Best Available Control Technology as "source-specific" is not in conflict with EPA's interpretation in the Clean Power Plan that BSER need not be limited to physical controls on each source

EPA incorrectly argues that its new constrained interpretation of section 111 is necessary to harmonize BSER with the "best available control technology" (BACT) provision in the Prevention of Significant Deterioration (PSD) program, which involves the case-by-case review of the construction or modification of an individual stationary source. 82 Fed. Reg. at 48,041-42; 83 Fed. Reg. at 44,752. This is incorrect for two reasons: first, the BACT framework does not constrain or otherwise bear on the analysis of BSER under section 111, and, second, even if it did, the BSER that EPA set forth in the Clean Power Plan is not in conflict with it.

EPA ignores fundamental differences between the structure and purpose of the PSD program and section 111(d) requirements. EPA cites the "floor" language in

---

[33] 80 Fed. Reg. at 64,697 (footnotes omitted); *see New Jersey v. EPA*, 517 F.3d 574, 583-84 (D.C. Cir. 2008) (holding that EPA lacked authority to remove coal- and oil-fired power plants from the list of sources regulated under section 112 without following the Clean Air Act's delisting provisions).

the BACT definition in section 169(3), which states that the application of BACT shall not "result in the emissions of any pollutants which will exceed the emissions allowed by any applicable standard established pursuant to section 7411 or 7412 of this title." 42 U.S.C. § 7479(3). But the "applicable standards" for facilities that trigger PSD permitting as newly-constructed or modified would be those established by EPA under section 111(b) for new and modified facilities, respectively. Any standards established by states for *existing* facilities pursuant to the section 111(d) guidelines would not be "applicable" to *new* or modified facilities. This is by congressional design. Congress expressly distinguished between new and existing sources, in section 111, and made a similar distinction under the PSD provisions, in which BACT plainly applies to newly-constructed sources. Thus, while section 169(3) does reference standards established in section 111 for new sources, there is nothing in either section that supports EPA's conclusion that standards for existing sources under 111(d) are somehow constrained by the requirements of section 169(3) for new sources.

In fact, EPA previously determined that the emission reduction measures comprising building blocks two and three were not in tension with EPA's interpretation of PSD requirements or other parts of the statute. EPA explained:

> In contrast [to BACT], section 111(d) expressly applies to "existing sources." Developing an emission guideline generally applicable to existing sources within an entire category under CAA section 111(d) differs from the five-step case-specific analysis under CAA section 165 for assessing whether the best available pollution controls can be incorporated into a particular facility at the time it is newly constructed or undergoes a major modification.
>
> * * *
>
> [T]he requirements of section 111 and the PSD program are linked together in various ways. . . . The linkage reflects Congressional intent for these program[s] to complement each other, not for EPA to implement them in exactly the same way. The latter would be redundant, and frustrate the distinct purpose for which each program was created. . . . [T]he PSD provisions and section 111 are phrased fundamentally differently. BACT is prescriptive and BSER is open-ended. For that reason alone, there is no basis to claim that they must be

> interpreted in the same way to limit controls to measures that can be implemented into the design or operations of the source. In addition, while standards promulgated under section 111 serve as the floor for BACT limits established under section 169(3), nothing in the Act requires that BACT limitations serve as the floor for emission guidelines under section 111.[34]

Attempting to distance itself from its previous legal position, EPA asserts in the proposed rule that it is the source-specific nature of the *states'* role in regulating sources under 111(d) that makes the PSD program applicable to the BSER analysis, and as a result, building blocks two and three cannot be part of BSER. But the question here is *EPA*'s role, and, as EPA noted in the Clean Power Plan rulemaking, section 111 directs EPA to select BSER and issue emission guidelines *for the source category* based on that best system. Under section 111(d), EPA has no express role regarding individual sources, regardless of how EPA interprets the states' role. EPA does not address this in the proposed rule, nor explain why focusing on the states' role is appropriate for interpreting BSER. There is no conflict between states applying BACT to individual sources on a case-by-case basis under the PSD program and EPA issuing emission guidelines under section 111(d) for a source category based on its determination of BSER. EPA has provided no justification for reversing its interpretation that section 169(3) does not bear on the analysis of BSER under section 111 other than that EPA needs to invent a constraint on its discretion under section 111 to justify its new, narrower understanding of BSER.

EPA employs circular logic as justification for its change of position on how to interpret 111, arguing that its previous understanding of the PSD program and other statutory requirements was wrong because that previous understanding is in conflict with its new understanding that only certain emission controls imposed at the source location can be considered in its BSER analysis. 83 Fed. Reg. at 44,752. But EPA fails to provide any convincing rationale supporting its change, other than that it needs to revise its legal position to reach EPA's apparently preordained conclusion that building blocks two and three cannot be part of the BSER. This is the essence of arbitrary and capricious decision making and underscores the impermissibility of EPA's interpretation.

---

[34] Response to Comments on the CPP, Ch. 1A, 171-72 (Repeal Comments JA, Att-F26).

c. EPA's policy of not mandating "redefining the source" in BACT analyses is not a valid justification for EPA to change its interpretation of measures that should be considered in BSER analyses

The agency further contends that its new reading of its BACT guidance supports its changed understanding of how to determine BSER. 83 Fed. Reg. at 44,752. That is, EPA is now proposing to change the way it interprets what Congress commanded in section 111—not because of a conflict between EPA's legal position in the Clean Power Plan and other statutory language or between the Clean Power Plan and a duly promulgated regulation, but because of EPA's new interpretations of its own BACT interpretive guidance documents. Regardless, EPA's BACT guidance documents provide no justification for EPA's change of position on how to determine BSER.

Specifically, EPA cites to its 2011 PSD and Title V Permitting Guidance for Greenhouse Gases for the proposition that a BACT analysis "need not necessarily include" processes that would fundamentally "redefine" the nature of the source. It also quotes (out of context) from its 1990 draft New Source Review Workshop Manual for the proposition that a proponent of a coal-fired plant need not consider building a gas-fired plant. 83 Fed. Reg. at 44,752. EPA's own guidance explains, however, why this is irrelevant to EPA's selection of BSER under section 111(d): because BACT applies at the preconstruction (or pre-modification) stage—on a case-by-case basis—and generally requires the installation of control technology, a permitting authority may choose to define BACT in light of the proposed purpose and design of a project.[35]

Contrary to its suggestion in the proposed rule, EPA has not taken the position that permitting agencies are categorically forbidden from analyzing or imposing BACT requirements that would "redefine" the source, such as by requiring a different fuel mixture. In its draft 1990 guidance, EPA explained the concept of "redefining the source" as follows, which provides the context for the language quoted by EPA in the proposed rule:

> Historically, EPA has not considered the BACT requirement as a means to redefine the design of the source when considering

[35] Office of Air and Radiation, EPA, PSD and Title V Permitting Guidance for Greenhouse Gases, (Mar. 2011) (Repeal Comments JA, Att. F34) (hereinafter "PSD and Title V Permitting Guidance for GHGs").

> available control alternatives. For example, applicants proposing to construct a coal-fired electric generator, have not been required by EPA as part of a BACT analysis to consider building a natural gas-fired electric turbine although the turbine may be inherently less polluting per unit product (in this case electricity). *However, this is an aspect of the PSD permitting process in which states have the discretion to engage in a broader analysis if they so desire*. Thus, a gas turbine normally would not be included in the list of control alternatives for a coal-fired boiler. *However, there may be instances where, in the permit authority's judgment, the consideration of alternative production processes is warranted and appropriate for consideration in the BACT analysis*. A production process is defined in terms of its physical and chemical unit operations used to produce the desired product from a specified set of raw materials. In such cases, the permit agency may require the applicant to include the inherently lower-polluting process in the list of BACT candidates.[36]

Consistent with this language, in promulgating the Clean Power Plan, EPA determined that its "redefining the source" policy was not an impediment because (1) BACT is not applicable to existing sources, and section 111(d) is; (2) the policy is not absolute, as permitting authorities retain discretion to conduct a broader analysis;[37] and (3) generation shifting as in building blocks two and three is not redefining the source because generation shifting is what these sources have historically done to keep the lights on, as well as for environmental compliance and business purposes. In its Response to Comments on the Clean Power Plan, EPA explained:

> EPA does not agree that its approach to the "redefining the source" question in the context of PSD permitting makes it impermissible or unreasonable for EPA to determine that

---

[36] New Source Review Workshop Manual (Draft) (October 1990), at B.13-B.14, *available at*: https://www.epa.gov/sites/production/files/2015-07/documents/1990wman.pdf (emphases added).

[37] EPA's CPP Legal Memorandum provides examples of PSD permits that involve limits based on reduced utilization of the source. EPA, Legal Memorandum Accompanying Clean Power Plan for Certain Issues, (Aug. 2015) (Repeal Comments JA, Att. F18) 72-82 (hereinafter "Legal Mem.").

> building blocks 1, 2, and 3 constitute the BSER for existing sources covered by this rule.
>
> * * *
>
> As we discuss at length in the preamble, owners/operators of existing steam EGUs have for many years employed generation shifts that are similar to building block 2, and, in fact, have in recent years shifted generation to [natural gas combined cycle] units as a means of reducing emissions of air pollutants, including CO_2. As we also discuss at length in the preamble, owners/operators of existing steam EGUs and NGCC units have also for many years invested in renewable energy and, in recent years, have done so for the purpose of reducing air pollutants, including CO_2. . . . In light of this history and current practice of EGUs implementing the same measures that are in building blocks 2 and 3, it is apparent that those measures are part of the business purposes and objectives within the power sector. Accordingly, the BSER, which incorporates building blocks 2 and 3, cannot be said to force a fundamental redefinition of the business of generating electric-power. Likewise, it cannot be said that this rule forces a fundamental redefinition of the design of any particular source.[38]

In the proposed rule, EPA now rejects the position it took in the Clean Power Plan rulemaking, but EPA has provided no reasoned basis for its change in position. *See Fox Television*, 556 U.S. at 515-16. EPA's previous position was correct, as underscored by the fact generation shifting does not require the kinds of changes that EPA and the regulated community consider "redefinitions"—e.g., conversion of an EGU to run on a different type of fuel.

EPA also appears to ignore its own guidance on implementing the PSD program with respect to greenhouse gases, under which a source may reduce its operations as a way to obviate the need for greater emission controls. In that guidance, EPA explains that a source may limit its potential to emit (PTE) to avoid application of PSD permitting requirements by obtaining a permit that contains a production or operational limitation in addition to a unit-specific emissions limitation: "Restrictions on production or operation that limit a source's PTE

[38] Response to Comments on the CPP, Ch. 1A, 170-72.

include limitations on quantities of raw materials consumed, fuel combusted, hours of operation."[39] In the proposed rule, however, EPA changes course without justification, and now states that its own guidance documents prohibit affecting the intended operation of a source; in fact, the guidance documents do no such thing.

For coal-fired power plants, EPA's guidance states that fundamental changes in the design of the plant should be evaluated to determine whether they are BACT, instead of being categorically excluded as "redefining the source." For example, EPA states that BACT analysis for a proposed coal plant should include evaluating whether the plant should be completely redesigned as an IGCC facility.[40] Whether such a redesign would improperly redefine the source is to be evaluated "on a case-by-case basis if it can be shown that application of such a control strategy would disrupt the applicants' basic or fundamental business purpose for the proposed facility." Such a redesign is not, however, categorically excluded from BACT analysis, as EPA suggests in its proposed rule. PSD and Title V Permitting Guidance for GHGs, 30 n.83 ("IGCC should not be categorically excluded from a BACT analysis for a coal fired electric generating unit, and this technology should not be excluded on redefining the source grounds at Step 1 of a BACT analysis in any particular case unless the record clearly demonstrates why the permit applicant's basic or fundamental business purpose would be frustrated by application of this process."). "The 'redefining the source' issue is ultimately a question of degree that is within the discretion of the permitting authority."[41]

EPA now says that even if it is not prohibited from considering systems of emission reduction that affect the fuel intended to be used by the source, EPA should not consider such systems anyway because it would be "sensible" to not base BSER on measures that could result in a source making significant modifications. 83 Fed. Reg. at 44,753. This position is contrary to congressional intent, however, because Congress intended the Clean Air Act, including section 111(d), to result in meaningful emissions reductions, some of which might require significant modifications. EPA also fails to provide any support for the proposition that its interpretation in the proposed rule is more "sensible" than its Clean Power Plan interpretation. In fact, the opposite is true, as the proposed rule fails to consider how both power plants and electric grids operate in practice.

---

[39] PSD and Title V Permitting Guidance for GHGs at 8 (citing EPA's Guidance on Limiting Potential to Emit in New Source Permitting (June 13, 1989)).

[40] *Id.* at 30.

[41] *Id.* at 27.

More importantly, EPA fails to establish that Congress gave EPA the discretion to categorically exclude from its best system analysis any emission reduction measures that would lead to some sources producing electricity from different fuels or combustion processes than they had originally intended. Indeed, the text of section 169(3) suggests that Congress did not think it "sensible" to categorically exclude substituting one fuel for another in a power plant, because Congress expressly included "clean fuels" and "innovative fuel combustion techniques" as measures that may be considered in BACT analysis. 42 U.S.C. § 7479(3). Indeed, Congress recognized that these might be sensible pollution-reduction measures. Congress was aware that substituting one fuel for another was possible, and, thus, would have known to expressly prohibit EPA from considering that as a system of emission reduction if it so intended. The absence of any such limitation—and the presence of the word "best"—suggests quite the opposite: that Congress wanted EPA to consider a broad array of emissions-reducing measures and to choose those that maximized reductions or were otherwise "best" among the possible options.

EPA's BACT guidance does not categorically exclude reduced utilization, IGCC, or fuel switching from BACT analysis and recommends evaluating the appropriateness of such technologies to a source on a case-by-case basis. Therefore, even if EPA's BACT guidance were relevant to the determination of the BSER, EPA cannot rely on its BACT guidance to categorically exclude these source-specific control strategies from the source-specific approach EPA proposes in the proposed rule for determining BSER under section 111. EPA's attempt to justify the constraints it now places on its BSER analysis on the basis of its own less-restrictive BACT guidance lacks any support in the statute, congressional intent, EPA's prior interpretations, or the guidance on which EPA purports to rely. EPA's new constraints on what may constitute BSER are therefore unlawful.

4. EPA's legal analysis of BSER is arbitrary, unreasonable, and contrary to Congressional intent because it makes an illogical distinction between off-site coal cleaning (i.e., not "at the source") measures EPA previously considered to be part of a "system of emission reduction"

Congress recognized that emission reduction measures under section 111 could include measures taken off-site at facilities owned and operated by third parties if those actions allow the affected source to meet its emission limitation. For instance, Congress specifically contemplated that "standards of performance for electric power plants could be based on measures implemented by other entities, for

example, entities that 'wash,' or desulfurize, coal (or, for oil-fired EGUs, that desulfurize oil)." 80 Fed. Reg. at 64,765; *see also* Legal Mem. at 85-88 (detailing the history of EPA's and Congress's reliance on coal-cleaning, which has been used in establishing emission limits under section 111). EPA acknowledged in its Clean Power Plan repeal proposal that Congress expressly indicated that "pre-combustion cleaning or treatment of fuels" is a "system of emission reduction" (a technological one). 82 Fed. Reg. at 48,040 n.13. EPA also acknowledged that such cleaning can occur off-site from the regulated source. *Id.* Thus, under this view, a recognized "system of emission reduction" can include measures that are not taken at the site of the source itself. Moreover, the fact that Congress expressly treated such cleaning as a system of emission reduction confirms that BSER cannot be interpreted to *exclude* measures taken off-site.

EPA's new interpretation of section 111—that the only emission reduction techniques that can be considered in a BSER analysis are those "based on a physical or operational change to a building, structure, facility or installation at that source"—is logically inconsistent with off-site fuel cleaning serving as a system of emission reduction under section 111 and is contrary to congressional intent. In a strained attempt to distinguish this system from others, EPA now argues that off-site fuel cleaning is still a "source-oriented" measure, and therefore a legitimate "system," because the fuel is ultimately used in the source. 82 Fed. Reg. at 48,040 n.13. But this attempted explanation does not distinguish pre-combustion cleaning or treatment of fuels from generation shifting measures, because both are "source-oriented." It is the off-site, third-party coal cleaning that enables reductions in the amount of pollutants in the fuel and allows the coal to be combusted on-site with fewer emissions. Similarly, when off-site clean energy generation increases, on-site emission reductions from the regulated source may occur. EPA cannot logically treat the former mechanism as applying "at" the source but not the latter. EPA has failed to account for its inconsistent treatment of coal- cleaning as a beyond-the-unit measure previously utilized by EPA and endorsed by Congress. *See Fox Television*, 556 U.S. at 515-16. EPA has also failed to reconcile, and cannot reconcile, its new position with the intent of Congress or the language of the statute. *Chevron*, 467 U.S. at 842-43.

C. EPA's Revised Determination of the Best System of Emission Reduction for Coal Plants is Arbitrary and Capricious because EPA Failed to Consider Relevant Evidence

In the proposed rule, EPA arbitrarily and capriciously ignores and/or mischaracterizes the record, such that EPA cannot articulate a rational connection

between the facts it has found and the conclusions it draws. *See State Farm*, 463 U.S. at 43. Accordingly, in addition to being grounded in an unlawful interpretation of the statute, EPA's failure to consider emission reduction measures other than heat rate improvements to be part of BSER is arbitrary and capricious.

1. EPA has ignored relevant evidence in the record regarding additional proven systems of emission reduction

a. EPA grounded its analysis of potential best systems on assertions about the nation's electrical grid that are not supported by evidence

To support its determination that heat rate improvements are the only measures that qualify as BSER, EPA asserts, without any evidence, that heat rate improvements are the only form of emission reduction that the power sector can implement without disastrous consequences for electricity reliability. EPA supports its conclusion only with vague statements unsupported by the record. For example, EPA asserts that a shift from coal-fired generation to renewables "is creating a tremendous strain on the power infrastructure" and that EPA cannot "further challenge" the electricity system. 83 Fed. Reg. at 44,754. EPA does not attempt to support these allegations with facts.

The only source EPA cites for these statements—a Department of Energy report[42] —does not support EPA's position. Given the full depth of the information in that nearly 200-page report, the summary statement cited by EPA does not represent either the technical conclusions or the policy recommendations in the report itself. By contrast with the tone of the cited statement, the body of the report explains the myriad ways in which electric system planners and operators are doing a good job of managing a reliable transition in the nation's generation mix. For example, consider the following statements in the report itself: "The U.S. generation mix has continually evolved as changes in technology, economics, government policy, and geopolitical forces affected the relative availability, economics, and feasibility of competing energy sources." DOE Report at 89. Pointing to a "diversity index" that represents the changing diversity of the nation's electricity generation mix over the 1949-2016 period, the DOE Report shows that there has been an increase in diversity levels in the last decade as more power comes from gas and

[42] U.S. DOE, Staff Report to the Secretary on Electricity Markets and Reliability (Aug. 2017) (hereinafter "DOE Report"), *available at*: https://www.energy.gov/sites/prod/files/2017/08/f36/Staff%20Report%20on%20Electricity%20Markets%20and%20Reliability_0.pdf.

renewables than in the past (when coal produced approximately half of the nation's power). *Id.* On the value of diversity to system reliability, the DOE Report states that: "Given the many problems that can affect different generation and fuel types, system-wide reliability and resilience can be supported by a diverse portfolio of generation resources that limit over-dependence on any single fuel or technology type, plus demand-side resources that reduce overall demand and better protect customers in the event of a widespread extreme event." *Id.* at 100.

EPA also fails to consider subsequent action by the Federal Energy Regulatory Commission (FERC) rejecting the idea that the grid is under "tremendous strain" requiring action to prop up coal-fired generation. Shortly after the publication of that DOE Report, the Secretary of Energy submitted a formal request to FERC seeking action to provide support for certain financially distressed "baseload" coal and nuclear plants, on the grounds that those plants were needed for reliability of the electric system. Several months later, FERC rejected the Secretary's proposal, in a written order that cited the DOE report:

> [DOE's] own staff Grid Study concluded that changes in the generation mix, including the retirement of coal and nuclear generators, have not diminished the grid's reliability or otherwise posed a significant and immediate threat to the resilience of the electric grid. To the contrary, the addition of a diverse array of generation resources, including natural gas, solar, wind, and geothermal, as well as maturing technologies, such as energy storage, distributed generation, and demand response, have in many respects contributed to the resilience of the bulk power system. The record in this proceeding does not demonstrate any need for the Commission to interfere with the continued evolution of the bulk power system.[43]

In addition, EPA appears to not have considered the fact that claims made by the Secretary of Energy that retirements of baseload coal and nuclear plants are threatening electric system reliability have been widely criticized and are unsupported by scores of other studies undertaken by grid operators, the North

[43] FERC Order Terminating Rulemaking Proceeding, Initiating New Proceeding, and Establishing Additional Procedures," Docket Nos. RM18-1-000 and AD18-7-000, 162 FERC ¶ 61,012 (Jan. 8, 2018) (FERC Order), *available at*: https://elibrary.ferc.gov/idmws/file_list.asp?document_id=14633130.

American Electric Reliability Corporation, think tanks, academics, and others.[44] Moreover, with respect to the implications of the Secretary's proposed electricity-rule change for greenhouse gas emissions, a research paper by Resources for the Future estimates that adopting the Secretary's proposed action would result in an additional 53 million tons of CO_2 emissions and cause 27,000 premature deaths by 2045 by increasing the emissions of other air pollutants (NO_x and SO_2).[45]

Another example of EPA basing its decisions on arbitrary reasoning is seen in its concerns about the "already significant changes taking place within the power sector that are resulting in shifts away from coal-fired generation," because EPA appears to have ignored effects on nuclear generating units, which have much higher capacity factors and produce electricity without CO_2 emissions (and were the subject of the DOE Report, along with coal-fired power plants). EPA's analysis of illustrative scenarios in the Regulatory Impact Analysis (RIA) of the proposed rule indicates that replacing the Clean Power Plan with the proposed rule would lead to an increase in coal-fired generation and decrease in generation from carbon-free nuclear plants. *See* RIA at 3-23, tbl. 3-17 (excerpted below).

---

[44] *See*, *e.g.*, Bradley, "Former FERC Chairmen, Commissioners Add Their Voices To Anti-DOE NOPR Chorus," Natural Gas Intelligence, October 20, 2017, *available at*: https://www.naturalgasintel.com/articles/print/112160-former-ferc-chairmen-commissioners-add-their-voices-to-anti-doe-nopr-chorus; Hibbard, Tierney, and Franklin, "Electricity Markets, Reliability and the Evolving U.S. Power System," June 2017, *available at*: http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/ag_markets_reliability_final_june_2017.pdf; Larsen, "Electric System Reliability: No clear link to coal and nuclear," Rhodium Group, October 23, 2018, *available at*: https://rhg.com/research/electric-system-reliability-no-clear-link-to-coal-and-nuclear/; Pfeifenberger, Chang, and Aydin, "Advancing Past 'Baseload' to a Flexible Grid: How Grid Planners and Power Markets Are Better Defining System Needs to Achieve a Cost-Effective and Reliable Supply Mix," Brattle Group, June 26, 2017, *available at*: http://files.brattle.com/files/5641_advancing_past_baseload_to_a_flexible_grid.pdf; Tierney and Palmer, "Grid Resilience, Generation Portfolios, and National Security, Resources for the Future, May 8, 2018, *available at*: http://www.rff.org/blog/2018/grid-resilience-generation-portfolios-and-national-security; Tierney and Palmer, "Federal Interventions in Wholesale Power Markets: Examining the Implication for Market Performance and National Security," May 9, 2018, Resources for the Future, *available at*: http://www.rff.org/blog/2018/federal-interventions-wholesale-power-markets-examining-implications-market-performance.

[45] Shawhan and Picciano, Resources for the Future, Costs and Benefits of Saving Unprofitable Generators: A Simulation Case Study for US Coal and Nuclear Power Plants (Nov. 2017) at 11, *available at*: http://www.rff.org/research/publications/costs-and-benefits-saving-unprofitable-generators-simulation-case-study-us.

EPA's Projected Generation Mix (From Table 3-17 of EPA's RIA (2018))				
		GWh (1000s)		
Generating Technology	Scenario	2025	2030	2035
Coal-Fired Units	CPP case (Base Case)	908	861	774
	4.5% HRI at $50/kW	1004	974	878
	Difference	+96	+113	+104
Nuclear Units	CPP case (Base Case)	704	683	674
	4.5% HRI at $50/kW	670	646	646
	Difference	-34	-37	-28
All: Total Generation	CPP case (Base Case)	4245	4372	4509
	4.5% HRI at $50/kW	4248	4375	4514
	Difference	+3	+3	+5

Not only is this an outcome that undermines EPA's purported concern about the reliability risk of losing generation from power plants that have historically operated in "baseload" mode (because nuclear output is backed out as part of the effect of increased output at coal-fired plants), but it also produces a perverse result from the point of view of carbon-free electricity supply that will lead to more, rather than less, generation at the most carbon-intensive generating assets. In simplest terms, replacing carbon-free generation at nuclear plants with electricity from the most carbon-intensive generating technology (i.e., coal-fired power plants) is exactly the opposite outcome of what one would expect from an EPA regulation allegedly designed to reduce greenhouse gas emissions.

In contrast to baseless and simplistic concerns about grid reliability EPA now makes in the proposed rule, when EPA issued the Clean Power Plan three years ago, it performed extensive analysis to ensure that grid reliability would not be negatively impacted by the rule. *See* 80 Fed. Reg. at 64,874-81. In its 2015 Technical Support Document: Resource Adequacy and Reliability Analysis, for example, EPA detailed its analysis of the impacts of generation shifting on the power system's resource adequacy (the provision of adequate generating resources to meet projected load and generating reserve requirements) and reliability (the ability to deliver the resources to the loads, such that the overall power grid remains stable). EPA used the Integrated Planning Model—"a multi-regional, dynamic, deterministic linear programming model of the U.S. electric power sector"—to project likely future electricity market conditions with and without the generation shifting envisioned by

the Clean Power Plan. EPA's modeling demonstrated that the generation shifting of the Plan "can be achieved without undermining resource adequacy or reliability" and that the "power system impacts of the final rule on system operations, under conditions preserving resource adequacy, are modest and manageable."[46]

In the proposed rule, however, EPA provides no evidence to counter its own earlier determination that generation shifting can be achieved without detrimental effects on the reliability of the electrical system. EPA's reliance on unsupported, generalized concerns regarding grid reliability to reverse its previous analysis-based position is another example of arbitrary and capricious rulemaking.

b. EPA's claimed inability to take into account the interconnected way in which power plants operate and emit shows that the agency failed to consider the evidence before it

In numerous previous rulemakings EPA demonstrated that it had sufficient information to analyze impacts to grid operations from generation shifting expected to result from those rules. In the proposed rule, however, EPA ignored the information in its possession and now claims to be unable to understand how the grid works in order to justify rejecting generation shifting as a component of BSER. *See*, *e.g.*, 83 Fed. Reg. at 44,764 ("Because of . . . significant uncertainties that can have large impacts on electric reliability and the cost of electricity to consumers, EPA believes this further supports the unreasonableness of basing the BSER on generation-shifting measures.").

EPA has experience devising and implementing rules designed to allow for generation shifting in the power grid. For example, EPA's 2011 Cross-State Air Pollution Rule (CSAPR) set statewide emissions budgets for power plant nitrogen oxides and sulfur dioxide emissions, and based those budgets in part on the ability of plants to cost-efficiently shift generation to lower-emitting plants. *See* 80 Fed. Reg. at 64,772 (citing 76 Fed. Reg. 48,452). Generation shifting was also an important component of the two transport rules that preceded CSAPR: the NO_x SIP Call and the Clean Air Interstate Rule. *See* 80 Fed. Reg. at 64,772 n.545. EPA also implements the acid rain cap-and-trade program in Title IV, in which Congress recognized power plants' ability to use generation shifting as one available pollution control strategy for sulfur dioxide emissions. *See* 80 Fed. Reg. at 64,770-71. EPA's claim in the proposed rule that it is unable to consider generation shifting as a

[46] Technical Support Document: Resource Adequacy and Reliability Analysis 2, EPA-HQ-OAR-2013-0602-36847 (Repeal Comments JA, Att. F32) at 1, 2.

component of BSER shows that EPA is willfully ignoring evidence and expertise it possesses about operation of the power grid and how power plants respond to air pollution regulation.

Furthermore, EPA's claimed inability to understand the effects on the power grid of generation shifting as an intentional system of emission reduction is arbitrary and capricious given that EPA shows no such uncertainty as to the effects on grid operations due to generation shifting that could result from implementing heat rate improvements alone, as it proposes. While claiming inability to assess how generation shifting as part of BSER might affect the power grid, EPA simultaneously claims to be able to reliably predict that (1) "there will be no cumulative increases in system-wide emissions" under a BSER based on heat rate improvements,[47] and (2) power plants will change operations in various ways in response to its proposed New Source Review changes[48] (discussed in Section VI, *infra*). EPA cannot use predictions of how the power grid may respond to heat rate improvements as justification for the proposed rule while simultaneously denying its ability to make similar predictions for generation shifting.

c. EPA fails to meaningfully consider other emission control options that meet its own definition of acceptable systems of emission reduction

Even accepting EPA's premise that only changes "to a building, structure, facility or installation at that source"[49] can be considered as part of BSER, and

---

[47] 83 Fed. Reg. at 44,761 n.17 ("EPA modeled a range of potential HRIs for ACE and the Agency's analysis indicates that system-wide emission decreases from heat rate improvements will likely outweigh any potential system-wide emission increases. Accordingly, EPA proposes to conclude that the 'rebound effect' does not preclude a determination that HRIs constitute the BSER."); *Id.* at 44,775 ("Along with this increase in energy efficiency, the EGU which undergoes the HRI project will typically experience greater unit availability and reliability, all of which contribute to lower operating costs. EGUs that operate at lower costs are generally preferred in the dispatch order by the system operator over units that have higher operational costs, and EPA's regulatory impact analysis (RIA) for this action . . . shows that improving an EGU's heat rate will lead to increased generation due to its improved efficiency and relative economics.")

[48] *Id.* at 44,783 ("This scenario [4.5 Percent HRI at $50/kW] is informative in that it represents the ability of all coal-fired EGUs to obtain greater improvements in heat rate because of NSR reform at the $50/kW cost identified earlier. EPA believes this higher heat rate improvement potential is possible because without NSR a greater number of units may have the opportunity to make cost effective heat rate improvements such as steam turbine upgrades that have the potential to offer greater heat rate improvement opportunities.")

[49] 83 Fed. Reg. at 44,752.

generation shifting is not such a change, EPA's proposed rule is arbitrary and capricious because it does not consider options meeting EPA's own constrained interpretation, both at coal-fired and gas-fired power plants. *See* 83 Fed. Reg. at 44,762. EPA found in the Clean Power Plan that coal-fired power plants could reduce CO_2 emissions by "co-firing" with gas or by implementing carbon capture and storage. *See* 80 Fed. Reg. at 64,727. Carbon capture and storage, co-firing, and fuel-switching clearly fall within EPA's purportedly new criteria for physical or operational changes at the source. EPA has previously acknowledged that carbon capture and storage can reduce emissions by up to 90 percent; that fuel-switching can reduce emissions by 40 percent; and that both are viable and cost-effective measures. But EPA now arbitrarily dismisses both options.

EPA's rejection of carbon capture and storage is arbitrary and capricious (C-12)

EPA's proposed rule summarily dismisses the idea that carbon capture and storage should be part of BSER:

> EPA has previously determined that CCS (or partial CCS) should not be a part of the BSER for existing fossil fuel fired EGUs because it was significantly more expensive than alternative options for reducing emissions and may not be a viable option for many individual facilities. *See* 80 Fed. Reg. 64,756. . . . EPA continues to believe that neither CCS nor partial CCS are technologies that can be considered the BSER for existing fossil fuel-fired EGUs.[50]

EPA ignores the fact that its previous determination that carbon capture and storage should not be part of BSER was based on comparing CCS to options that EPA adopted in the Clean Power Plan, and that EPA now declines to consider: specifically, the generation shifting measures represented by building blocks two and three. *See* 80 Fed. Reg. at 64,667, 64,727. In 2015, EPA did not conclude that carbon capture and storage was inherently "too expensive;" indeed, it found that it was cost-effective, but *more* expensive than generation shifting measures. If EPA intends to exclude generation shifting as part of best system, EPA is obliged to reconsider the merits of carbon capture and storage relative to other potential systems of emission reduction EPA is now considering. In failing to do so, EPA is, in

[50] 83 Fed. Reg. at 44,761-62.

effect, ignoring all evidence it has already obtained about carbon capture and storage.

EPA bases its rejection of carbon capture and storage in part on its assertion that CCS is not feasible at every site. But there is no legal basis for the proposition that to be a component of BSER, a technology must be feasible at every site. Any such interpretation would be impermissible and unreasonable. And in making this argument, EPA arbitrarily applies different criteria to carbon capture and storage than to its own favored heat rate improvement technologies; it requires those technologies to be evaluated on a site-by-site basis, even though it admits that not all of them will be viable at every power plant.

EPA's decision not to include carbon capture and storage as part of BSER in the Clean Power Plan was based on a comparison with the system-wide best system EPA chose, not a blanket conclusion that carbon capture and storage is not a viable, cost-effective option at individual plants. To the contrary, EPA stated that it "believe[d]that CCS is a very promising technology for many existing fossil fuel-fired EGUs."[51] It noted that "CCS offers the technical potential for CO_2 emission reductions of over 90 percent, or smaller percentages in partial applications."[52] And EPA rejected the idea that carbon capture and storage is an unproven technology: "The components of CCS – capture, compression, transportation, and storage have been used for decades in a variety of industries – including the power sector."[53]

EPA explained its decision not to include carbon capture and storage as part of BSER as follows:

> [S]ome of these co-firing and CCS measures are technically feasible and within price ranges that the EPA has found to be cost effective in the context of other GHG rules, that a segment of the source category may implement these measures, and that the resulting emission reductions could be potentially significant.
>
> However, these co-firing and CCS measures are more expensive than other available measures for existing sources. This is

[51] Response to Comments on the CPP at 220.

[52] 79 Fed. Reg. at 34,856.

[53] Response to Comments on the CPP at 190.

> because the integrated nature of the electricity system affords significantly lower cost options, ones that fossil fuel-fired power plants throughout the U.S. and in foreign nations are already using to reduce their CO_2 emissions.
>
> . . . .
>
> As a result, as a practical matter, were the EPA to include co-firing and CCS in the BSER and promulgate performance standards accordingly, few EGUs would likely comply with their emission standards through co-firing and CCS; rather, the EGUs would rely on the lower cost options of substituting lower- or zero-emitting generation or, as a related matter, reducing generation.

80 Fed. Reg. at 64,727-28; *see also id.* at 64,756 ("[W]e are determining that use of full or partial CCS technology should not be part of the BSER for existing EGUs because it would be more expensive than the measures determined to be part of the BSER, particularly if applied broadly to the overall source category."). EPA rejected carbon capture and storage as a part of BSER not because EPA did not think it was a viable option, but because it considered generation shifting a *better* option. EPA repeatedly noted that power plants *themselves* might conclude that CCS is an attractive compliance option: "[S]ome existing EGUs with available space and accommodating layouts may find CCS—or maybe partial CCS—to be an appealing compliance option. This may be especially the case for sources that can take advantage of EOR opportunities—much like the Petra Nova project."[54]

Therefore, EPA's determination that carbon capture and storage was not BSER was based on comparative, rather than absolute, cost-effectiveness. Now that EPA has rejected the building block framework of the Clean Power Plan, EPA cannot rely on its prior comparison of the cost of CCS with the cost of those building blocks as a basis for rejecting it as an element of best system. It must reevaluate carbon capture and storage in a context where the Clean Power Plan framework has been rejected by the agency.[55]

---

[54] Response to Comments on the CPP at 201.

[55] Similarly, EPA previously explained in its PSD and Title V Permitting Guidance for Greenhouse Gases (2011) that carbon capture and storage should be identified as an available control measure in the first step of BACT analysis for power plants. "For purposes of a BACT analysis for GHGs, EPA classifies CCS as an add-on pollution control technology that is 'available' for facilities emitting CO_2 in large amounts, including fossil fuel-fired

Relatedly, in categorically rejecting carbon capture and storage on the grounds that it may not be feasible at every plant, EPA has arbitrarily applied different criteria to CCS than to EPA's favored heat rate improvement technologies. In addition to cost, the reason EPA now cites for rejecting carbon capture and storage as an element of BSER is that "EPA has previously determined that CCS or partial CCS . . . may not be a viable option for many individual facilities." 83 Fed. Reg. at 44,761. EPA is arbitrarily applying different criteria to CCS than it does to its candidate list of heat rate improvement technologies.

In 2015, EPA adopted a BSER for the Clean Power Plan that assumed that a major factor in reducing emissions from coal plants would be generation shifting from coal plants and increased reliance on gas and renewables. EPA's approach in the Clean Power Plan acknowledged the reality that the energy system works as a system, rather than as independent, isolated facilities. EPA did not argue that, as a general matter, the only technologies that can ever be components of BSER are technologies that can be adopted at every site (nor does EPA now take such a position).

In the Clean Power Plan EPA stated that "as a practical matter, were the EPA to include co-firing and CCS in the BSER and promulgate performance standards accordingly, few EGUs would likely comply with their emission standards through co-firing and CCS; rather, the EGUs would rely on the lower cost options of substituting lower- or zero-emitting generation or, as a related matter, reducing generation." 80 Fed. Reg. at 64,728.

In its replacement proposal, by contrast, EPA eschews generation shifting and instead requires a site-specific evaluation of what measures should be taken at each source. EPA arbitrarily limits the evaluation to heat rate improvement measures, but does not mandate that all power plants adopt any particular heat rate improvement technology. Instead, it instructs the states to conduct unit-specific evaluations of the appropriateness of 'candidate technologies':

> The states will use the information provided by EPA as guidance, but will be expected to conduct unit-specific evaluations of HRI *potential, technical feasibility, and applicability* for each of the BSER candidate technologies.

---

power plants . . . . For these types of facilities, CCS should be listed in Step 1 of a top-down BACT analysis for GHGs." PSD and Title V Permitting Guidance for GHGs at 32.

83 Fed. Reg. at 44,763 (emphasis added). There is no legal basis for EPA's assertion that CCS should not be a component of BSER because it may not be appropriate at some "individual facilities." And this assertion is flagrantly arbitrary in the context of EPA's proposal that the determination of which emission reduction measures will be applied to a source will now be a site-specific exercise. EPA does not assert that any of its *own* heat rate improvement "candidate technologies" are viable options at *all* facilities; instead, in the proposed rule it requires states to make a facility-by-facility evaluation.[56]

EPA has also ignored important recent developments and information regarding carbon capture and storage, including information that EPA itself described in its 2017 denial of petitions to reconsider the Clean Power Plan.[57] *See* 2017 Clean Power Plan Reconsideration Denial at 3-4 (describing three recent examples of projects at power plants in the U.S. and Canada and stating, "Carbon Capture and Storage (CCS) is a technology that has been successfully implemented at multiple projects around the world during the past decades."). EPA further stated last year that "Retrofit CCS is Broadly Available Across the U.S.," and that "[o]ne study concluded that up to 60 GWs of coal-fired generation might be amenable to CCS. (Approximately 20% of the coal-fired fleet)." *Id.* at 5 (citing Zhai et al., *Opportunities for Decarbonizing Existing U.S. Coal-Fired Power Plants via CO2 Capture, Utilization and Storage* (May 2015)). EPA further observed that "opportunities to store captured CO_2 are widely available across the country." *Id.* at 6. EPA received additional new information supporting the viability of carbon capture and storage in comments to the Advance Notice of Proposed Rulemaking that preceded this proposal.[58] For example, Congress passed the Bipartisan Budget Act of 2018, which increased the '45Q' tax credit for sequestering carbon dioxide

---

[56] EPA says that "nearly all sources can or have implemented *some form* of heat rate improvement measures." 83 Fed. Reg. at 44,762 (emphasis added). But the specific type of HRI measures must be determined by a site-specific analysis. EPA offers no legal rationale for the idea that a type of technology can be a component of BSER if "some form" of it can be used at "nearly all" sites, but another type of technology cannot be a component of BSER even though it "is a very promising technology for many existing … EGUs.," Response to Comments on the CPP at 220 (addressing CCS).

[57] EPA, Basis for Denial of Petitions to Reconsider and Petitions to Stay the Clean Power Plan Reconsideration Denial: Appendix 3 — Non-BSER CPP Flexibilities (Jan. 2017) (Repeal Comments JA, Att. F6) (hereinafter "CPP Reconsideration Denial").

[58] *See* Clean Air Task Force, Comments on Advance Notice of Proposed Rulemaking, "State Guidelines for Greenhouse Gas Emissions for Existing Utility Generating Units," at pp. 30-33 (Feb. 26, 2018), Docket No. EPA-HQ-OAR-2017-0545-0391.

from $10 per ton to $35. In the proposed rule, EPA fails to acknowledge any of these post-2015 developments, which, in and of themselves, would be significant enough to warrant a reevaluation of carbon capture and storage.

EPA's dismissal of carbon capture and storage is thus arbitrary and capricious and otherwise unlawful. In *State Farm*, the Court made it clear that failing to consider a potential solution to a problem is an example of failing "to consider an important aspect" of the problem. 463 U.S. at 43. Similarly, as noted above, the Supreme Court found in *Fox Television* than an agency must offer "a reasoned explanation . . . for disregarding facts and circumstances that underlay or were engendered by the prior policy." 566 U.S. at 516. "An agency cannot simply disregard contrary or inconvenient factual determinations that it made in the past." *Id.* at 537 (Kennedy, J., concurring). Here, as explained above, EPA has, for all practical purposes, entirely failed to consider carbon capture and storage as a system of emission reduction within EPA's new site-specific interpretation of BSER.

EPA's rejection of co-firing with gas is arbitrary and capricious

EPA's rejection of co-firing a coal-fired plant with gas or biomass, like its rejection of carbon capture and storage, relies on EPA's now irrelevant comparison of the cost of co-firing with the cost of the generation shifting, and on the unlawful interpretation that co-firing must be feasible at every site in order to be considered as a component of BSER of emission reduction.

In the proposed rule, referring to the Clean Power Plan, EPA states that "EPA has previously determined that co-firing of alternative fuels (biomass or natural gas) in coal-fired utility boilers is not part of BSER for existing fossil fuel-fired sources due to cost and feasibility considerations." 83 Fed. Reg. at 44762. Again, as with carbon capture and storage, EPA's reliance on its previous determination is taken out of context. As quoted above in the CCS discussion, EPA determined that co-firing did not constitute a component of BSER only as compared to generation shifting measures.

And as with carbon capture and storage, in the proposed rule, EPA erroneously cites to two alleged barriers to considering co-firing as part of BSER: cost and feasibility. As with CCS, EPA made no generic statement that co-firing is inherently "too costly." EPA cannot now reject co-firing on the basis of cost without undertaking a new analysis, in a context in which generation shifting is off the

table. And any new analysis must address the fact that EPA has already acknowledged that co-firing can be conducted "within price ranges that the EPA has found to be cost effective." 80 Fed. Reg. at 64,727.

As to "feasibility," as noted above, EPA has previously acknowledged that "some of these co-firing . . . measures are technically feasible." 80 Fed. Reg. at 64,727. In the current proposal, EPA relies on the argument that co-firing is not feasible at *every* site:

> Although some fuel co-firing methods are technically feasible for some affected sources, there are factors and considerations that prevent its inclusion as BSER. In general, fuel use opportunities are dependent upon many regional considerations and characteristics (*e.g.*, access to biomass, or natural gas pipeline infrastructure limitations), that prevent its adoption as BSER on a national level …
>
> Moreover, unlike coal, natural gas cannot be stored in quantities sufficient for sustained utilization on site. Accordingly, delivery of natural gas via pipeline is essential for using natural gas at coal-fired EGUs. Many existing coal-fired plants, however, do not have access to natural gas transportation infrastructure and gaining access would be either infeasible (due to technical or timing considerations) or unreasonably costly.

83 Fed. Reg. at 44,762.

Again, as noted above in the carbon capture and storage discussion, EPA does not offer any legal justification for the position that the only technologies that can ever be components of BSER are technologies that can be adopted at every site. There is none. And, as with CCS, EPA is applying a different standard with co-firing than with heat rate improvement technologies. EPA's assertion that co-firing should not be a component of BSER because its feasibility may vary depending on "regional characteristics" is arbitrary in the context of its decision that the determination of BSER will now be a site-specific exercise.[59] In the context of its decision to require site-specific evaluations of which emission reduction measures

[59] *See* text accompanying note 56 *supra*.

should be applied, in order to exclude co-firing as a component of BSER, EPA would need to explain why co-firing would *never* be the best option at any specific site. EPA does not even try to make such a case.

In any event, EPA's concern that "[m]any existing coal-fired plants . . . do not have access to natural gas transportation infrastructure and gaining access would be either infeasible (due to technical or timing considerations) or unreasonably costly" is exaggerated, and ignores information that EPA itself recited as recently as 2017. In the CPP Reconsideration Denial, EPA stated:

> Natural gas co-firing or complete fuel switching at coal-fired steam EGUs is becoming a more common way to reduce CO_2 emissions from these types of sources. The EPA has discussed this extensively in the final Carbon Pollution Standards with respect to new, modified or reconstructed EGUs. Many existing coal-fired EGUs already have the capability to utilize natural gas co-firing as most use it to initiate start-up or heat-up of the boiler. This means that there is an existing opportunity for EGUs to utilize more natural gas and is a step that, for most, *can be relatively easily taken.*[60]

EPA also provided examples of and evidence of the feasibility of co-firing and fuel switching, concluding that "[t]hese examples of coal-to-natural gas conversions and development of improved natural gas delivery infrastructure show that increased natural gas utilization can extend the operating life of some coal-fired units and allow facility owners and operators to take advantage of the historic low cost of natural gas. This in turn allows for a decrease in CO_2 emissions."[61]

Thus, EPA recognized in 2017 that *most* power plants could already utilize more gas, and could do so *relatively easily*. This points to the conclusion that if co-firing was included in site-by-site evaluations of BSER, it could, at least in some cases, prove to be the best option for cost-effectively and substantially reducing emissions (or a component thereof). But EPA unlawfully refuses to include co-firing in these site-specific evaluations. EPA's rejection of the evidence before it that co-

[60] CPP Reconsideration Denial at 2-3 (emphasis added).

[61] CPP Reconsideration Denial at 2-3.

firing could be a component of BSER is arbitrary and capricious. *See State Farm*, 463 U.S. at 43.

EPA's categorical rejection of fuel switching as a component of BSER is arbitrary and capricious

In its proposed rule, EPA categorically refuses to evaluate fuel switching as a component of BSER. 83 Fed. Reg. at 44,753 ("For purposes of ACE, therefore, we did not consider natural gas repowering (i.e., converting from a coal-fired boiler to a gas-fired turbine) or refueling (i.e., converting from a coal-fired boiler to a natural gas-fired boiler) as a system of emission reduction for coal-fired steam generating units."). In doing so, EPA again employs an unlawful interpretation of the statute. EPA also ignores the evidence that fuel switching can be a viable emission control strategy for some sources. EPA wrote in 2015:

> In the proposal we discussed the opportunity to reduce CO_2 emissions at an individual affected EGU by switching fuels at the EGU, particularly by switching from coal to natural gas. Most coal-fired EGUs could be modified to burn natural gas instead, and the potential CO_2 emission reductions from this measure are large—approximately 40 percent in the case of conversion from 100 percent coal to 100 percent natural gas, and proportionately smaller for partial co-firing of coal with natural gas. The primary reason for not considering this measure part of the BSER, both at proposal and in this final rule, is that it is more expensive than the BSER measures.

80 Fed. Reg. at 64,756. And in response to comments, EPA wrote that it "agrees that coal-to-gas fuel switching is an important CO_2 reduction option."[62]

[62] Response to Comments on the CPP at 158. As with CCS, EPA, in 2015, had ample evidence in the record of the viability of co-firing. For example, Clean Air Task Force submitted comments pointing out that "the electric power industry is undertaking gas co-firing and full coal-to-gas conversions at a wide variety of units," and that the cost of conversion is reasonable, especially in light of the "benefits associated with criteria pollutant reductions from conversion." Comments of the Clean Air Task Force on the Clean Power Plan (EPA-HQ-OAR-2013-0602-22612), 27-28, 29 (Dec. 1, 2014).

As with carbon capture and storage and co-firing, EPA's failure to adequately consider—in the context of a rule that requires site-specific evaluation of control measures—an emission control measure on which it already possesses evidence of feasibility and effectiveness is arbitrary and capricious.

d. EPA has ignored systems of emissions reduction successfully used by states and power companies to substantially and cost effectively reduce CO_2 emissions, such as cap-and-trade programs, renewable portfolio standards, energy efficiency, and demand response programs

As a result of its improperly constrained view of what emission reduction measures can be considered to be the BSER, EPA fails to consider evidence in the record of what power plants and states are already doing to reduce greenhouse gas emissions. As EPA is well aware, Congress, EPA, and states have long selected market-based compliance approaches to address regional and global pollution from power plants. In adopting these programs, Congress, EPA, and states recognized that trading and averaging approaches are cost-effective, facilitate compliance flexibility, and integrate efficiently into the machine-like operations of the power sector. *See* 80 Fed. Reg. at 64,675, 64,735. EPA's rejection of evidence of these "demonstrated" systems of emissions reduction in developing the proposed rule is arbitrary and capricious.

As EPA stated in the Clean Power Plan, "[t]rading programs have been commonplace under the CAA, particularly for EGUs, for decades." *Id.* at 64,773. Examples include the acid rain trading program under Clean Air Act Title IV, the transport rules promulgated under the "good neighbor provision" of Clean Air Act section 110(a)(2)(D)(i)(I), the regional haze trading programs, the NOx Budget Trading Program, and the Clean Air Mercury Rule. And in at least two prior emission guidelines, the Clean Air Mercury Rule and the 1995 Municipal Solid Waste Combustor rule, EPA explicitly authorized emissions trading. *See id.* at 64,841.

The record supporting the Clean Power Plan is also replete with information regarding successful, market-based state programs that have resulted in substantial reductions in power-sector emissions, including carbon emissions.[63] For

[63] *See*, *e.g.*, Joint State Comments, note 32 *supra*, at 15-19; RGGI States' Comments, note 32 *supra*, at 3; Response to Comments on the CPP, ch. 3.2; 80 Fed. Reg. at 64,726, 64,735, 64,773, 64,783, 64,796, 64,803. *See also* Appendix B. EPA also has in its possession

example, through RGGI, ten Northeast and mid-Atlantic States agreed to limits for greenhouse gas emissions from the electricity generating sector and created a market where power plants can buy and sell allowances to meet agreed-upon limits.[64] By encouraging shifts from power plants that generate more greenhouse gas emissions, such as oil and coal plants, to sources that generate fewer, such as gas plants and renewable resources, RGGI states succeeded in reducing carbon pollution from fossil-fuel fired power plants by over forty percent between 2005 and 2012.[65] Additional programs in Minnesota, California, and other states—including California's Global Warming Solutions Act program, the South Coast Air Quality Management District's RECLAIM program, and RPS programs—have also led power plants to make meaningful reductions in greenhouse gas emissions through some of the same measures EPA appropriately considered as part of the BSER in the Clean Power Plan.[66] Moreover, these greenhouse gas emissions reductions were achieved while delivering significant economic benefits and without threatening grid reliability.[67]

The proposed rule unlawfully fails to justify EPA's departure from its prior findings or to support its unprecedented interpretation that rejects market-based compliance approaches. In promulgating the Clean Power Plan, EPA explicitly relied on successful state programs that incorporated averaging and trading approaches. *See* 80 Fed. Reg. at 64,726, 64,735; EPA Br. at 25-26 ("The [Clean

---

evidence that mass-based compliance options were an appropriate alternative to rate-based standards, and in fact, had a track record of success in reducing the very emissions at issue here. *See* 80 Fed. Reg. at 64,820-21; *see also, e.g.*, State Plan Considerations, TSD, Docket No. EPA-HQ-OAR-2013-0602-36853, at 97-135, June 2014). EPA specifically solicited information on translating rate-based goals to mass-based goals, and published a supplemental notice of additional information on that topic, as well as a Technical Support Document. *See* 79 Fed. Reg. 67,406 (Nov. 13, 2014).

[64] *See* RGGI States' Comments, note 32 *supra*. RGGI member states include: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. New Jersey was a member of RGGI during the first three-month compliance period (2009-11), before withdrawing in 2012. New Jersey Governor Phil Murphy has announced that the state will be rejoining RGGI.

[65] Joint State Comments, note 32 *supra* at 18.

[66] *Id.* at 23-24.

[67] *See* RGGI States' Comments, note 32 *supra* at 23, 27-28; Joint State Comments, note 32 *supra* at 12, 15, 19-24.

Power Plan]'s emission requirements are based on methods of cleaner electricity generation that are *already* prevalent in the industry and included within existing state programs."). EPA found previously that "[t]rading is a regulatory mechanism that works well for this industry." 80 Fed. Reg. at 64,735. Indeed, "industry has readily adapted to [trading], taking advantage of the flexibility and incorporating those programs into the planning and operation of the 'machine.'" *Id.* at 64,726. Thus, "it is reasonable for the EPA to determine that states can establish standards of performance that incorporate trading." *Id.* at 64,735; *see also id.* at 64,733 (finding that states could, and likely will, incorporate emissions trading into state plans). EPA's protestations now that it lacks information about the feasibility or mechanics of such approaches are plainly arbitrary and capricious.

e. EPA's proposed restriction on averaging and trading conflicts with the Clean Air Act and decades of agency and industry practice, and is further evidence of EPA's flawed interpretation of section 111 (C-28, C-29, C-30, C-40, C-41)

In a stark reversal of past agency practice and findings, the proposed rule would prohibit state plans from including any averaging or trading except for averaging among fossil-fueled units at a single facility. 83 Fed. Reg. at 44,767. The proposed rule raises several novel "legal and practical concerns" in attempting to justify this new restriction. 83 Fed. Reg. at 44,767. As described below, none of the concerns raised by EPA has merit, and EPA's interpretation is unlawful. The proposed restriction on averaging and trading is driven by EPA's perceived need not to undermine its BSER determination, and is further evidence that the agency's revised BSER determination is critically flawed. The solution is not just to allow trading and emissions averaging to comply with EPA's weak rule, but to revise the BSER determination in the proposed rule to reflect the systems of emission reduction that have in reality successfully reduced carbon pollution from power plants.

EPA's purported concerns about trading or averaging programs undermining its BSER determination are further evidence that EPA's interpretation of section 111 is flawed in the first instance (C-40)

EPA states that broader averaging or trading would shift generation to lower-emitting sources, and could allow for "the shutdown or reduced operation of one or a small handful of sources" to achieve a category-wide cap on emissions. *Id.* at 44,767–68. Under EPA's circular logic, such outcomes would undermine EPA's

interpretation of section 111, and therefore must be prohibited. *Id.* That EPA anticipates one power plant could achieve sufficient emissions reductions to satisfy the entire sector's compliance obligation further suggests that EPA has failed its mandatory duty to identify the "best" system to meaningfully reduce dangerous carbon pollution from existing plants. EPA's analysis is backwards: just as EPA's BSER determination is legally and factually unsupported, so, too, is EPA's conclusion that broader averaging or trading is impermissible in state plans. Emissions trading programs and other programs that promote shifts to lower-emitting generation sources are among the most successful and cost-effective systems for reducing power-sector carbon emissions. As EPA found in adopting the Clean Power Plan, "[t]he experience of multiple trading programs over many years has shown that . . . a system that allows for those lower-cost reductions to be maximized is more cost-effective overall to the industry and to society." 80 Fed. Reg. at 64,733. Trading programs are particularly well suited to pollutants such as carbon dioxide that have global effects. *Id.* at 64,734. It would be arbitrary and capricious for EPA now to disregard such programs both in its BSER determination and as potential state compliance mechanisms.[68]

EPA also proposes that facility-wide-only averaging is consistent with its interpretation of section 111 because state plans with broader averaging or trading mechanisms could generate "more stringent" emission reductions than would otherwise be achieved through application of the BSER as contemplated in the proposal. 83 Fed. Reg. at 44,767. But this is an unlawful basis for limiting the content of state plans. Section 116 of the Clean Air Act preserves the authority of states to adopt and enforce more stringent air pollution control requirements. 42 U.S.C. § 7416. Read together with section 111(d), section 116 reinforces the states' primary authority to determine how to implement and enforce emissions standards under section 111(d), and preserves the authority of states to provide for more stringent emissions limitations in state plans than EPA's emission guidelines. Prohibiting states from incorporating successful trading and averaging programs

[68] To the extent EPA proposes a broader finding that state plans cannot permit affected units to rely on actions by other entities to facilitate compliance with a standard of performance (*e.g.*, by purchasing emission allowances or credits under a trading program), EPA has failed to justify this novel restriction. *See* Section III.B, *supra*. There is no legal basis for such a restriction, and it is unworkable in practice, as "virtually all pollution control requirements require the affected sources to depend in one way or another on other entities." 80 Fed. Reg. at 64,772–73.

into their state plans would violate the cooperative federalism structure and intent of the Clean Air Act.

EPA's purported concern about potential "non-additionality" is speculative and contradicted by the demonstrated success of emissions trading programs

EPA questions whether averaging among affected and non-affected units "might not result in real reductions" in emissions because non-affected units "would have been operating anyway." 83 Fed. Reg. at 44,767. The States and Cities' experiences implementing power-sector emissions trading programs show that well-designed programs can, and do, in fact generate additional reductions in carbon pollution. For instance, RGGI requires certain fossil-fuel-fired power plants in participating states to hold tradable allowances equal to their carbon emissions. A regional cap on allowances reflects a budget for the sector's emissions, averaged across facilities. Under this sector-wide approach, power plants subject to RGGI have cut carbon pollution by more than 40 percent since 2008, the year before the program began.[69] Given the demonstrated success of trading programs such as RGGI, and states' and EPA's expertise in designing and implementing successful trading programs, it would be arbitrary for EPA to conclude that the hypothetical potential for non-additionality renders any averaging or trading across facilities unsuitable as a compliance mechanism in any state plan. Such a conclusion would also contradict EPA's prior finding that emissions trading programs "incentivize[] over-compliance" by creating a saleable commodity. 80 Fed. Reg. at 64,734.

Moreover, EPA's purported concern is purely speculative. As contemplated by the statute, EPA should properly consider the adequacy of proposed implementation mechanisms in the context of the state plan review process. Section 111(d)(1)(B) provides that states, in the first instance, have the primary responsibility to propose plans for implementation and enforcement of emissions standards; EPA then has an opportunity to review each submitted state plan and evaluate whether specific proposed averaging and trading approaches are "satisfactory." 42 U.S.C. § 7411(d)(1)–(2); *see also* 80 Fed. Reg. at 64,775.

---

[69] Acadia Center, *Outpacing the Nation: RGGI's Environmental and Economic Success* 4 (2017), *available at*: https://acadiacenter.org/wp-content/uploads/2017/09/Acadia-Center_RGGI-Report_Outpacing-the-Nation.pdf.

EPA's purported concern regarding the theoretical "burden" and "complexity" of trading programs is contradicted by states' actual experiences implementing such programs, as well as EPA's own findings

EPA suggests that states will have "difficulty" implementing state plans that incorporate broader averaging or trading due to the "relative complexity" and administrative "burden" of such plans. 83 Fed. Reg. at 44,768. EPA's purported concerns about the theoretical burden of state trading programs completely ignore the fact that states across the country have designed and are implementing numerous successful trading programs designed to reduce power-sector carbon emissions, including RGGI, California's greenhouse gas trading program, and trading programs for renewable energy credits (RECs) under dozens of state RPS programs.

The notion that averaging and trading approaches would be somehow alien or particularly onerous to states is absurd. States have harnessed averaging and trading approaches to pioneer some of the world's most effective regulatory regimes to reduce power-sector carbon emissions. In adopting these programs, states recognized that averaging and trading approaches are cost-effective, efficient, and easily administered methods of reducing emissions of a globalized pollutant in this uniquely integrated and machine-like sector. Indeed, as described further below, the unit-by-unit command-and-control approach contemplated in the proposed rule has the potential to be far more administratively burdensome for states and regulated entities than a flexible, market-based program.

The proposed rule's reliance on the potential burden of trading programs is also contradicted by EPA's prior findings and the extensive record supporting the Clean Power Plan. EPA noted that it "received significant comment to the effect that mass-based allowance trading was . . . highly familiar to states and EGUs." 80 Fed. Reg. at 64,664. *See, e.g.*, Joint State Comments, note 32 *supra* at 31 ("Tradable allowance systems incorporating covered EGUs are likely among the most efficient ways of ensuring enforceability, and are a favored state design option . . . ."). EPA further found that "it is entirely feasible for states to establish standards of performance that incorporate emissions trading, and it is reasonable to expect that states will do so. These approaches lower overall costs, add flexibility, and make it easier for individual sources to address pollution control objectives." 80 Fed. Reg. at 64,726; *see also id.* at 64,733–34. Furthermore, EPA found that trading and averaging approaches are well-suited to the uniquely integrated and transactional power sector, which "has a long history of working on a coordinated basis to meet

operating and environmental objectives." *Id.* at 64,734; *see also id.* at 64,726. The States and Cities reconfirm EPA's prior findings and reiterate that EPA should consider averaging and trading approaches that reflect programs that have successfully reduced carbon emissions in the States and Cities in its determination of the BSER and its guidance and evaluation of state plans.

The States and Cities refer EPA to the substantial information in the rulemaking record supporting the Clean Power Plan regarding successful averaging and trading approaches. For instance, multiple states submitted comments to EPA describing successful state programs that incorporate averaging and trading approaches to limit carbon pollution from power plants, including RGGI and California's cap-and-trade program, and offering feedback on the effective design of an emission guideline incorporating averaging and trading approaches. *See, e.g.*, Joint State Comments, note 32 *supra* at 15-24, 26. Additionally, a group of environmental and energy agency leaders and public utility commissioners from fifteen states submitted extensive comments detailing how EPA should develop an emission guideline based on successful state approaches and specifically including compliance options that incorporate averaging and trading approaches.[70] And earlier this year, the States and Cities again submitted to EPA a summary compilation of States' and Cities' efforts to address power-plant carbon pollution, together with their comments on EPA's proposed repeal of the Clean Power Plan, 82 Fed. Reg. 48,035 (Oct. 16, 2017). These comments described, *inter alia*, the structure and success of RGGI as well as numerous state RPS programs.[71] Thus, EPA has ample relevant information describing the design, success, and workability of averaging and trading compliance approaches that reflect successful state programs. And EPA has numerous prior comments indicating that such approaches are among those favored by the States and Cities.

---

[70] *See* California Air Resources Board's Comments, EPA-HQ-OAR-2013-0602-23433, (Nov. 24, 2014) (Repeal Comments JA, Att. D1) (attaching States' §111(d) Implementation Group Input to EPA on Carbon Pollution Standards for Existing Power Plants, Docket No. EPA-HQ-OAR-2013-0602-0198 (Dec. 16, 2013).

[71] *See* Appendix B, attached hereto (updated version of same document).

2. EPA erred in its analysis of what heat rate improvements are feasible and cost effective

a. EPA's rejection of the Clean Power Plan building block 1 approach of examining heat rate improvements available at the interconnect level, which reflects the way the grid actually works, is arbitrary and capricious

In its proposed rule, EPA determined that BSER for coal-fired power plants is one or more "candidate technology" heat rate improvements that can be applied at the plant based on a case-by-case evaluation by the state. 83 Fed. Reg. at 44,756. In the Clean Power Plan, in contrast, EPA evaluated the average heat rate improvements that would be available for sources within each of the three regional interconnects. As explained in the proposed rule, in the Clean Power Plan, EPA "concluded that EGUs can achieve on average a 4.3 percent improvement in the Eastern Interconnection, a 2.1 percent improvement in the Western Interconnection and a 2.3 percent improvement in the Texas Interconnection." 83 Fed. Reg. at 44,756 (citing 80 Fed. Reg. at 64,789). Unlike the Clean Power Plan, EPA's evaluation of potential efficiency improvements in the proposed rule fails to account for how the power grid actually works and responds to efficiency improvements, and is therefore unsupportable. Each of the three regional grids operates as an integrated machine, continuously dispatching power through orchestrated moment-to-moment shifts among generators in order to balance power demand with supply in real time. This shifting of generation, as well as application of reliability standards, occurs at the level of these three regional interconnections, not at the level of each power plant.[72]

In the proposed rule, EPA requires consideration of heat rate improvements only at the level of each power plant, even though applying heat rate improvements to some coal-fired units can result in greater CO_2 emissions because, if the unit's marginal cost of generation has fallen, the integrated grid operator would typically dispatch more power from that source. In this way, EPA's focus on evaluating heat rate improvements only at the unit level ignores how the regional interconnects actually work in practice in a manner that may result in CO_2 increases. EPA's rejection of the Clean Power Plan's more realistic framework of considering heat rate improvements at the interconnect level is therefore arbitrary and capricious.

---

[72] *See* Brief of Amici Curiae Grid Experts, 31-34, *West Virginia v. EPA*, 15-1363, ECF 1606654 (D.C. Cir. Apr. 1, 2016) (Repeal Comments JA, Att. A3).

b. EPA lacks information even to know whether site-specific heat rate improvement is BSER because EPA failed to adequately analyze that system's emission impacts

EPA failed to sufficiently evaluate whether heat rate improvement projects endorsed by the proposed rule would result in higher overall emissions from coal-fired plants. EPA has not adequately explained its conclusion that "there will be no cumulative increases in system-wide emissions" under a BSER based on heat rate improvements (C-9). EPA previously expressed concern that heat rate measures alone, which is what it has now proposed, would lead to increased CO_2 emissions. EPA has not provided a reasonable explanation as to why it no longer has this concern.

In the Clean Power Plan, EPA summarized its concern about the rebound effect that could result from applying only heat rate improvements, as EPA now proposes to do:

> EPA is concerned about the potential "rebound effect" associated with building block 1 if applied in isolation. More specifically, we noted that in the context of the integrated electricity system, absent other incentives to reduce generation and CO_2 emissions from coal-fired EGUs, heat rate improvements and consequent variable cost reductions at those EGUs would cause them to become more competitive compared to other EGUs and increase their generation, leading to smaller overall reductions in CO_2 emissions (depending on the CO_2 emission rates of the displaced generating capacity). Unless mitigated, the occurrence of a rebound effect would reduce the emission reductions achieved by building block 1, exacerbating the inadequacy of emission reductions that is the basis for our conclusion that building block 1 alone would not represent the BSER for this industry. However, we believe that our concern about the potential rebound effect can be readily addressed by ensuring that the BSER also reflects other CO_2 reduction strategies that encourage increases in generation from lower- or zero-carbon EGUs, thereby allowing building block 1 to be considered an appropriate part of the BSER for CO_2 emissions at affected EGUs as long as the building block is applied in combination with other building blocks.

80 Fed. Reg. at 64,745.

But in the proposed rule, EPA now disclaims confidence in its ability to project what sources will do in the future in response to fuel price changes and market trends. EPA points out that the downward trend in CO_2 emissions compared to what was anticipated when it promulgated the Clean Power Plan means that determining BSER based on these trends "may or may not result in emission reductions from ACE if the actual trends once again prove to be stronger than projected." 83 Fed. Reg. at 44,754. EPA's statement is an example of the agency's new position that it is incapable of making reasonable projections of CO_2 emissions from the power sector. EPA goes on to explain that "the uncertainties that have resulted in faster than projected emission reductions are also uncertain in the opposite direction," explaining that gas prices went up unexpectedly before, and the cost of renewables could stop its downward trend. *Id.* "Because of these significant uncertainties that can have large impacts on electric reliability[73] and the cost of electricity to consumers, EPA believes this further supports the unreasonableness of basing the BSER on generation-shifting measures." *Id.* Because EPA now finds too much uncertainty to be able to make a reasonable estimate of which plants might burn what amount of fuel under reasonably anticipated market conditions, it cannot simultaneously have sufficient information to confidently conclude that the increased coal plant efficiency it expects will result from the proposed rule will not lead to an increase in emissions due to the rebound effect. BSER must be a system that, at a minimum, EPA is able to confidently and rationally predict will result in overall reduced emissions.

c. EPA overestimates the sustainability of emission reductions from heat rate improvements

Another reason that EPA's analysis of heat rate improvements as BSER is arbitrary and capricious is that the agency overestimates the sustainability of heat rate improvement projects. An analysis by Ranajit Sahu, Ph.D., an expert in power plant design, operation and emission generation, discusses this error. *See* Ranajit Sahu, *Heat Rate Improvements Are Not Sustained Over Time*, attached as ***Exhibit D*** ("Sahu Heat Rate Report"). As noted in the rulemaking comments of the Electric Power Research Institute (EPRI), efficiency gains from heat rate improvement projects may not persist for long after initial implementation. *See*

[73] EPA makes no attempt to connect the examples it gives to the concept of reliability of the electric system, and it appears that this reference to reliability is completely unfounded.

Electric Power Research Institute, Comments (Oct. 15, 2018) at 6, EPA-HQ-OAR-2017-0355-22738. That fact is further confirmed by Dr. Sahu's analysis of the results of various heat rate improvement projects. Dr. Sahu found that such improvements degrade over time—over periods as short as 6 years or less—and initial heat rate improvements are then no longer observed. Sahu Heat Rate Report at 4-10. EPA's analysis assumes, however, that heat rate improvements will result in emission reductions well into the future. *See,, e.g.*, RIA at ES-2 through ES-3, 1-7 through 1-8, 1-16 (Table 1-3), 1-17 & 3-7 through 3-8; *but see id.* at 5-10 (acknowledging cost of maintaining heat rate improvements). Because EPA failed to consider this critical problem, its analysis produces significant overestimates of available heat rate improvements and emissions reductions under the proposed rule. This is another reason the proposed rule is unlawful. *See State Farm*, 463 U.S. at 43.

D. EPA's Proposal to Stop Regulating Gas Plants and IGCC units as "Affected Units" Is Contrary to Section 111 and Is Arbitrary and Capricious and Contrary to Law

1. EPA fails to comply with its obligations under section 111(d) to issue emissions guidelines for sources that have been regulated under 111(b) for three years

Under Clean Air Act section 111, EPA "shall" establish standards of performance for new and existing stationary sources that emit air pollutants. 42 U.S.C. § 7411(a)(3), (b)(1), (d). The language and structure of section 111 contemplate that a rule for existing sources be promulgated at the same time, or shortly after, a rule for new sources. *See*, *e.g.*, *id.* § 7410(b)(1)(B) (requiring EPA to promulgate standards for new sources within one year of listing a stationary source category); *id.* § 7411(d) (requiring EPA to establish procedures for submission of state plans for existing sources similar to section 110, 42 U.S.C. § 7410); 40 C.F.R. § 60.22(a) (draft guidelines to be published "concurrently or after" proposal of section 111(b) standards). As the States and Cities have long argued, and the Supreme Court has held, EPA is statutorily obligated to regulate CO_2 from power plants. *AEP v. Connecticut*, 564 U.S. at 426-27.

EPA defines "affected units" to only include coal-fired power plants, removing gas-fired plants and IGCC coal plants from the definition, and declines to include heat rate improvement opportunities for gas-fired power plants and IGCC units in the BSER. *See* 83 Fed. Reg. at 44,754-55, 44,761. EPA therefore fails to comply with the clear requirements of the Clean Air Act. The Act requires that "[t]he Administrator shall prescribe regulations . . . for any existing source for any air

pollutant . . . (ii) to which a standard of performance under this section would apply if such existing source were a new source. . ." 42 U.S.C. § 7411(d); *see also AEP v. Connecticut*, 564 U.S. at 411-412; *New York v. Reilly*, 969 F.2d 1147, 1149 (D.C. Cir. 1992). Because new gas-fired power plants and IGCC units are regulated under § 111(b), and have been for three years, *see* 80 Fed. Reg. at 64,510, 40 C.F.R. pt. 60 subpt. TTTT, EPA is required to promulgate an emission guideline for existing gas-fired power plants and IGCC units. By repealing emission guidelines for these sources that are already regulated under section 111(b), EPA is in direct contravention of the Act's statutory mandate.

Additionally, it is essential to include heat rate improvements at gas-fired plants to meet the Clean Air Act statutory requirement of developing the "best system of emission reduction" from fossil fuel-fired power plants, insofar as a system that does not include *any* requirements for gas-fired power plants cannot even arguably be a best system. While the proportion of power-sector CO_2 emissions coming from gas-fired plants is not as high that of coal-fired plants, it is still substantial on an absolute basis.[74] Moreover, as EPA recognizes, "[some] power plant generators have announced that they expect to continue to change their generation mix away from coal-fired generation toward natural-gas fired generation," increasing the generation at gas-fired plants. *See* 83 Fed. Reg. at 44,751. EPA has long understood that sources on the power grid will shift generation to lower cost sources.[75] By entirely repealing the existing emission guidelines for gas plants and IGCC units and not even proposing a replacement rule that applies to those units, EPA is failing to consider the interconnected nature of the power grid and how these units may shift generation (and resulting CO_2 emissions) amongst themselves. To meet the statutory mandate of the Act to regulate all sources subject to section 111(b) standards of performance and to avoid

---

[74] U.S. Energy Information Agency, *How much of U.S. carbon dioxide emissions are associated with electricity generation?* (June 8, 2018) (reporting that 69 percent of U.S. power sector CO_2 emissions were from coal-fired plants, and 29 percent were from gas-fired plants), *available at*: https://www.eia.gov/tools/faqs/faq.php?id=77&t=3; M.J. Bradley & Associates, LLC, *Coal-Fired Electricity Generation in the United States and Future Outlook* (Aug. 28, 2017) ("[S]ince [2005], coal's share of generation has declined at a steady clip [citation]. In 2016, U.S. coal plants accounted for just 30 percent of total generation output . . . . For the first time, in 2016, natural gas was the leading source of electricity generation (34 percent of total generation), reflecting an on-going trend that is reshaping the nation's generation mix."), *available at*: https://www.mjbradley.com/sites/default/files/MJBAcoalretirementissuebrief.pdf.

[75] *See* sections III.C.1.a & b, *supra*.

an arbitrary and capricious decision to only regulate a portion of the electrical grid, EPA must issue emission guidelines for gas-fired power plants and IGCC units.

2. EPA's conclusion that it lacks sufficient information to determine BSER for gas plants is contradicted by the record in the Clean Power Plan rulemaking (C-3, C-5)

EPA states that because the agency "does not currently have sufficient information on adequately demonstrated systems of emission reduction—including HRI opportunities—for existing natural gas-fired stationary combustion turbines," it "is currently unable to determine the BSER for such units." *See* 83 Fed. Reg. at 44,755.[76] To the contrary, there is significant information before EPA regarding heat rate improvement opportunities at gas-fired power plants.[77]

EPA concedes that "[i]n the development of the CAA section 111(b) standards of performance for new, modified, and reconstructed EGUs, several commenters provided information on options that may be available to improve the efficiency of existing natural gas-fired stationary combustion turbines." *See id.* (citing 80 Fed. Reg. at 64,620[78]). Yet EPA fails to rationally explain why this information was insufficient for EPA to include heat rate improvements technologies at gas-fired plants in the BSER. EPA's failure to consider with specificity prior comments demonstrating heat rate improvements at gas-fired plants is arbitrary.

In its denial of petitions to reconsider the Clean Power Plan, EPA estimated that the heat rate at existing natural gas combined cycle plants could be improved

---

[76] While EPA "solicits information on adequately demonstrated systems of GHG emission reduction for [natural gas-fired stationary combustion turbines]—especially on the efficiency, applicability, and cost of such systems," it does not discuss whether, or on what timeframe, it expects to propose a rule to require heat rate improvements at natural gas-fired plants. *See* 83 Fed. Reg. at 44,755.

[77] To the extent that EPA finds it lacks information on heat rate improvement opportunities at gas-fired power plants, that is due to EPA's own failure to solicit comments on this subject in earlier rulemakings and collect this information prior to its current action.

[78] *Referring to "Exergetic and Economic Evaluation of the Effects of HRSG Configurations on the Performance of Combined Cycle Power Plants."* M. Mansouri, et al. Energy Conversion and Management 58:47-58, 2012; *"Combined Cycle Power Plant Performance Analyses Based on Single-Pressure and Multipressure Heat Recovery Steam Generator."* M. Rahim, Journal of Energy Engineering, 138:136-145, 2012; *"Thermodynamic Evaluation of Combined Cycle Plants."* N. Woudstras et al. Energy Conversion and Management 51:1099-1110, 2010.

by 4 percent and would also allow for load shifting from power plants with higher CO_2 emissions.[79] Yet in the proposed rule, EPA did not explain why it abandoned this analysis and the findings reached in a prior rulemaking. In fact, consistent with this finding, in the proposal EPA claims that it assessed "11 years of historical gross heat rate data from 2007 to 2017 for existing [gas-fired] EGUs," finding "average HRI potential of 3.4 percent." 83 Fed. Reg. at 44,761. However, EPA failed to make this analysis available for review, and does not explain why the assessed heat rate improvements are insufficient to warrant inclusion of the evaluated technologies in the BSER. EPA's failure to include heat rate improvements for gas-fired power plants despite its own findings that emissions reductions are available is irrational and capricious.

Indeed, there have been other submissions to EPA relating to heat rate improvements at gas-fired power plants. For instance, the Environmental Defense Fund submitted with its comments on EPA's advance notice of proposed rulemaking relating to the replacement of the Clean Power Plan a report authored by Andover Technology Partners that discussed several technologies that can achieve heat rate improvements at gas-fired plants.[80] Specifically, the Andover Report found that significant heat rate improvements had been successfully achieved at existing gas-fired power plants via turbine inlet cooling technologies and upgrading gas and steam turbine components. Additionally, General Electric submitted comments on the proposed Clean Power Plan that "opportunities for equipment upgrades and improved efficiency [at natural gas fired EGUs] may be on par, and may even exceed the opportunities available with coal-fired EGUs."[81]

---

[79] *See* CPP Reconsideration Denial at 10.

[80] *See* Andover Technology Partners, Improving Heat Rate on Combined Cycle Power Plants: Working Draft (Dec. 31, 2016) ("Andover Report"), submitted as Attachment A to Environmental Defense Fund Comments on EPA's Advance Notice of Proposed Rulemaking on State Guidelines for Greenhouse Gas Emissions from Existing Sources, 82 Fed. Reg. 61,507 (Dec. 28, 2017), dated Feb. 26, 2018, *available at*: https://www.regulations.gov/document?D=EPA-HQ-OAR-2017-0545-0297.

[81] The General Electric Company, Comments on Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units (EPA-HQ-OAR-2013-0602-22971), dated Dec. 1, 2014 at 13-14, *available at* https://www.regulations.gov/document?D=EPA-HQ-OAR-2013-0602-22971. *See also* Power Engineering, *Major Upgrade of Oregon Power Plant Completed* (July 22, 2016) (discussing GHG reductions resulting from upgrades at the Coyote Springs combined cycle power plant in Boardman, Oregon), *available at*: http://www.power-eng.com/articles/2016/07/major-upgrade-of-oregon-power-plant-completed.html?cmpid=enl-poe-weekly-july-26-2016&cmpid=enl_PE_Weekly_2016-07-26&eid=294698054&bid=1478248.

EPA has failed to either assess these submissions and its own prior findings to determine whether heat rate improvements for gas-fired power plants are available to include within BSER, or adequately explain with specificity why they are insufficient to provide EPA the information it needs to promulgate a BSER that regulates gas-fired power plants.

3. EPA's decision to ignore heat rate improvements at gas-fired power plants is contrary to law and arbitrary and capricious (C-5)

EPA justifies declining to include heat rate improvements at gas-fired power plants by stating that it "previously determined that the available emission reductions would likely be expensive or would likely provide only small overall reductions relative to those that were predicted through application of other systems of emission reduction identified in the CPP building blocks." 83 Fed. Reg. at 44,761. This assertion is directly contradicted by the record and unsupported by the statute, and EPA's failure to include heat rate improvements at gas-fired power plants is arbitrary and capricious and contrary to the law.

First, although EPA did not define heat rate improvements in the Clean Power Plan at gas-fired power plants as components of BSER, EPA explicitly stated that "those controls remain measures that some affected EGUs may be expected to implement and that as a result, will provide reductions that those affected EGUs may rely on to achieve their emission limits or may sell, through emissions trading, to other affected EGUs to achieve emission limits (to the extent permitted under the relevant section 111(d) plans)." *See* 80 Fed. Reg. at 64,728. Therefore, heat rate improvements at gas-fired power plants were explicitly considered and endorsed by EPA for implementation where appropriate, rendering EPA's election here not to include them in BSER unsupported by any rational justification. EPA failed to sufficiently explain why it is reversing its position that heat rate improvements at gas-fired power plants are a viable emission reduction measure. *Fox Television*, 556 U.S. at 515-16.

Second, EPA fails to explain why heat rate improvements at gas-fired power plants are, in the context of the proposed BSER, excessively expensive or ineffective. EPA concedes in this rulemaking that it had earlier declined to incorporate heat rate improvement technologies at gas-fired power plants because it "determined that the available emission reductions would likely be expensive or would likely provide only small overall reductions *relative to those that were predicted through application of other systems of emission reduction identified in the CPP building blocks*," *see* 83 Fed. Reg. at 44,761 (emphasis added), but fails to explain why such a

determination is warranted here, where heat rate improvement technologies at gas-fired power plants must be compared to different emission reduction measures in order to determine that they are excessively expensive or result in too few emissions reduction gains.

Third, EPA fails to rationally explain why the information before it regarding heat rate improvements at gas-fired power plants was insufficient for EPA to include heat rate improvement technologies at gas-fired plants as part of BSER. To the contrary, EPA dismissed such comments, stating that "while numerous comments suggested that there are available HRI opportunities at existing NGCC EGUs, no commenters provided specific information on the availability, applicability, or cost of HRI opportunities for NGCC units—nor did any commenters provide any information on the magnitude of expected heat rate reductions." *See id.* However, EPA required no such showing for heat rate improvements at coal-fired plants—instead, EPA relies on states to determine heat rate improvements at coal-fired plants within their borders. EPA's failure to consider with specificity prior comments demonstrating heat rate improvement opportunities at gas-fired plants, and EPA's separate standard for those heat rate improvement opportunities demonstrated, is arbitrary.

* * *

In summary, EPA's revised determination of the BSER is inconsistent with the Clean Air Act and fundamental principles of administrative law. The agency's revised determination, which ignores the way power plants generate electricity (and emissions) on the interconnected grid and how states and power plants have successfully reduced CO_2 emissions, is not compelled by the Clean Air Act and is contrary to the record and common sense.

IV. EPA'S PROPOSED CHANGES TO THE SECTION 111(D) IMPLEMENTING REGULATIONS

A. The Proposed Rule

The proposed rule envisions significant revisions to the current implementing regulations for section 111(d) of the Clean Air Act at 40 CFR Part 60, Subpart B. As EPA notes, the existing regulations have proven durable and successful, with few significant revisions necessary since their original promulgation in 1975. 83 Fed. Reg. at 44,769. Although EPA proposes to carry over certain requirements from the existing implementing regulations, it proposes significant revisions to many of the

most important and operative provisions. If implemented as proposed, these changes would fundamentally alter the operation of the section 111(d) implementing regulations, not only for the regulation of greenhouse gas emissions, but for all other pollutants regulated under section 111(d). The proposed rule includes the following revisions to the section 111(d) implementing regulations and their application to greenhouse gas emissions from power plants:

- ***Removal of information on endangerment caused by the pollutant.*** EPA proposes to delete the provision of its current regulations that requires it to provide "[i]nformation concerning known or suspected endangerment of public health or welfare caused, or contributed to, by the designated pollutant." *See* 83 Fed. Reg. at 44,804 (proposed 40 C.F.R. § 60.22a(b) (omitting current 40 C.F.R. § 60.22(b)(1))).
- ***Allow a specific emission guideline to supersede the requirements of the new implementing regulations.*** 83 Fed. Reg. at 44,770. Although the effects of this change are not described or discussed in any detail, the proposed rule suggests use of this provision in various ways, including to supersede compliance deadlines as discussed below. Accordingly, this change to the implementing regulations is likely to result in numerous source-specific standards of performance and compliance deadlines established by each state, as opposed to overall numerical emission guidelines and compliance deadlines established by EPA for particular categories of sources.
- ***Alter various timing requirements for submissions and actions on state plans.*** 83 Fed. Reg. at 44,770-71. These changes include: (1) greatly lengthening the deadline for state submissions from the present nine months from promulgation of a final emission guideline to three years after such promulgation; (2) giving EPA 12 months for action on a state plan submission (after a determination of completeness), as opposed to the present four months after the submittal deadline; and (3) lengthening the time for EPA to promulgate a federal plan from the current six months after the submittal deadline to a proposed two years after a finding of failure to submit a complete plan or EPA's disapproval of a state plan submission. 83 Fed. Reg. at 44,770. The proposed rule also removes the requirement that states submit to EPA a plan revision that delays compliance or relaxes emission standards within 60 days of adoption, and instead requires plan revisions to only be submitted within 12 months. *Compare* 40 C.F.R. § 60.28(a) *with* 83 Fed. Reg. at 44,807 (proposed 40 C.F.R. § 60.28a(a)-(b)). EPA concurrently proposes to raise the

threshold for when increments of progress are required in a state plan. 83 Fed. Reg. at 44,772. The proposed rule doubles the current threshold, proposing to only require increments of progress when a compliance schedule is longer than 24 months after the plan is due. For the emission guideline established in the proposed rule for CO_2 emissions from power plans, EPA proposes to abolish uniform compliance schedules and instead provides for "tailored compliance deadlines for [a state's] sources based on the standard ultimately determined *for each source*." *Id.* at 44,763 (emphasis added).

- ***Substantially revise key definitions.*** The proposed rule would significantly alter the definitions section of the regulations. First, EPA would change the definition of "emission guideline." The implementing regulations currently define the term as a "guideline set forth in subpart C of this part, or in a final guideline document . . . which reflects the degree of emission reduction achievable through the application of the best system of emission reduction (taking into account the cost of such reduction) the Administrator has determined has been adequately demonstrated for designated facilities." 40 C.F.R. § 60.21(e). EPA would change this definition to one that merely "includes *information on* the degree of emission reduction achievable through the application of the best system of emission reduction . . . ." 83 Fed. Reg. at 44,771 (emphasis added). This definitional change would enable EPA to forego issuing a presumptive emission standard. *Id.* EPA also proposes changing the definition of "standard of performance" by removing "allowance system" and permitting the standard to set forth either an "allowable rate or limit of emissions" or prescribe "a design, equipment, work practice, or operational standard, or combination thereof," without specifying that such design, equipment, work practice or operational standard must meet an allowable rate or limit of emissions. *Id.* at 44,772-73. EPA also proposes that state plans—at least for greenhouse gas emissions from power plants—include only one form of standard of performance: an allowable emission rate. *Id.* at 44,764.

- ***Eliminate the distinction between public health-based and welfare-based pollutants in an emission guideline.*** 83 Fed. Reg. at 44,772-73. This change would alter the operation of the variance provision. Currently, section 60.24(c) requires that emission standards for pollutants that endanger public health must be no less stringent than the emissions guideline set by the EPA, subject only to the presently narrow

variance provision in section 60.24(f). In addition, the Administrator currently may balance the emission guidelines, compliance times and other information in the applicable guideline documents against other factors of public concern in establishing emission standards, compliance schedules and variances only when the designated pollutant endangers public welfare, but not public health. *See* 40 C.F.R. § 60.24(d). The proposed rule would remove this distinction.

- ***Expand the variance provision.*** EPA proposes a new variance provision (new 40 C.F.R. § 60.24a) to permit states to more broadly take into account the remaining useful life of a source and other factors when setting standards of performance for that source. 83 Fed. Reg. at 44,773. This new provision would retain the factors in the current regulations that states may consider when granting variances, which include unreasonable cost of control resulting from plant age, location, or basic process design; physical impossibility of installing necessary control equipment; and other facilities-specific factors. *Id*. at 44,766. However, where the current regulations provide for only "the application of less stringent emissions standards or longer compliance schedules" in specific cases, the proposed new variance provision appears to grant broader latitude to states, allowing them to "take into consideration" these factors in "applying a standard of performance to a particular source," without limits on how a state may take such consideration or what aspects of a standard of performance may be altered. EPA also proposes to alter its application of the "remaining useful life" factor to allow a state to reduce the performance standard for a particular source without requiring the overall category of sources to meet a specified numerical emission limit. *Id*. at 44,766. Combined with the end of EPA's role in setting a presumptive emissions standard, these changes to the variance provisions will likely expand the use of variances under section 111(d).

- ***Use of non-BSER measures to meet compliance obligations.*** The proposed rule would allow affected sources to use both BSER and non-BSER measures to achieve compliance with their state plan obligations, but EPA does not specify if this applies only to the CO_2 emission guideline for power plants or is intended to apply more broadly to other section 111(d) emission guidelines. EPA also proposes that measures taken to meet compliance obligations must meet two criteria: (1) they are implemented at the source itself, and (2) measures at the source of

> emissions using data, emissions monitoring equipment or other methods to demonstrate compliance, such that they can be easily monitored, reported and verified at a unit. 83 Fed. Reg. at 44,765. Again, it is unclear if EPA intends this restriction to apply only to greenhouse gas emissions from power plants, or more broadly. In any event, at least with respect to the sources covered by this proposed rule, EPA also proposes to prohibit state plans from including any averaging or trading except for averaging among fossil-fueled units at a single facility. *Id*. at 44,767.

In sum, the proposed revisions to the section 111(d) regulations would transform EPA's approach to regulation of pollutants and sectors for which it has established or will establish an emission guideline, not only for CO_2 emissions from power plants but also for any other pollutants and sectors regulated under this section.

B. States' and Cities' Comments

The proposed rule upends the stability of the existing scheme that has supported a robust role for EPA and instead proposes to abdicate EPA's responsibility to require and ensure actual emissions reductions of pollutants that endanger the public health and welfare. Although the context of the proposed rule is the regulation of power plant CO_2 emissions, the proposed revisions to the implementing regulations would apply to all subsequently promulgated section 111(d) regulations and therefore would have much broader effects, which EPA fails to acknowledge or explain.

Section 111(d) applies to "*any* existing source for *any air pollutant*" for which a section 111 standard of performance must be established. 42 U.S.C. § 7411(d)(1) (emphasis added). Although the proposed rule would alter section 111(d)'s implementation for regulation of CO_2 emissions, it would also apply to other air pollutants and sectors regulated under this provision. EPA has consistently and reasonably employed its section 111(d) authority to set substantive emission guidelines for various pollutants, which establish minimum levels of reductions for regulated sources, while allowing states to establish performance standards for sources located within their borders. *See, e.g.,* 40 C.F.R. § 60.24(c), (f); 40 Fed. Reg. 53,340, 53,342 (Nov. 17, 1975). EPA has exercised this authority at least 14 times to set emission guidelines for pollutants, including to regulate CO_2 under the Clean

Power Plan, but also for phosphates and sulfuric acid, and emissions from various forms of municipal, medical and industrial wastes.[82]

By altering the underlying section 111(d) implementing regulations in ways plainly tailored to avoid meaningful regulation of CO_2 emissions from existing power plants, EPA is at the same time weakening the entire framework of regulatory protections for a host of dangerous pollutants. Furthermore, although not clearly reflected in the proposed textual revisions to section 111(d) regulations, the proposed rule appears to make other substantive changes to EPA's application of the section 111(d) implementing regulations, such as limiting the form of a standard of performance and constraining compliance to only "inside the fence" measures. Although applied in the context of this particular rulemaking, these revisions may have much broader application, and the States object to their application both as to regulating CO_2 from power plants and to future section 111(d) rulemakings. EPA's failure to acknowledge the much broader implications of this fundamental change in the protective scheme for a wide range of pollutants, much less analyze these effects beyond the greenhouse gas emissions context, is arbitrary

---

[82] *See* Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64,662 (Oct. 23, 2015) (Clean Power Plan); *see* Robert Nordhaus and Ilan Gutherz, *Regulation of CO_2 Emissions from Existing Power Plants under § 111(d) of the Clean Air Act: Program Design and Statutory Authority*, 44 Env. Law Reporter 10366, 10372 at n.57, *available at*: http://www.vnf.com/files/9035_44%2010366.pdf. (listing past rulemakings under section 111(d): Phosphate Fertilizer Plants; Final Guideline Document Availability, 42 Fed. Reg. 12,022 (Mar. 1, 1977); Standards of Performance for New Stationary Sources; Emission Guideline for Sulfuric Acid Mist, 42 Fed. Reg. 55,796 (Oct. 18, 1977); Kraft Pulp Mills, Notice of Availability of Final Guideline Document, 44 Fed. Reg. 29828 (May 22, 1979); Primary Aluminum Plants, Notice of Availability of Final Guideline Document, 45 Fed. Reg. 26,294 (Apr. 17, 1980); Emission Guidelines; Municipal Waste Combustors, Final Emission Guidelines, 56 Fed. Reg. 5,514 (Feb. 11, 1991), withdrawn & superseded by 60 Fed. Reg. 65,387 (Dec. 19, 1995) (same source category); Standards of Performance for New Stationary Sources and Guidelines for Control of Existing Sources: Municipal Solid Waste Landfills, Final Rule, 61 Fed. Reg. 9,905 (Mar. 12, 1996); Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources: Hospital/Medical/Infectious Waste Incinerators, Final Rule, 62 Fed. Reg. 48,348 (Sept. 15, 1997); Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources: Commercial and Industrial Solid Waste Incineration Units, Final Standards and Guidelines, 65 Fed. Reg. 75,338 (Dec. 1, 2000); Emission Guidelines for Existing Small Municipal Waste Combustion Units, Final Rule, 65 Fed. Reg. 76,350 (Dec. 6, 2000); CAMR, 70 Fed. Reg. 28,606; Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources: Other Solid Waste Incineration Units, Final Rule, 70 Fed. Reg. 74,870 (Dec. 16, 2005); Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources: Sewage Sludge Incineration Units, Final Rule, 76 Fed. Reg. 15,372 (Mar. 21, 2011)).

and capricious. *See State Farm*, 463 U.S. at 43. Furthermore, EPA's failure to address these broader potential effects violates the Clean Air Act's notice-and-comment rulemaking requirement. *See* 42 U.S.C. § 7607(d)(3).

1. The proposed rule would improperly remove the requirement that emission guidelines provide information to states on the endangerment caused by the pollutant

The proposed rule would remove the requirement that emission guidelines include information concerning known or suspected endangerment of public health or welfare by the designated pollutant. *See* Proposed 40 C.F.R. § 60.22a(b); 83 Fed. Reg. at 44,804. EPA offers no rationale for the deletion of "[i]nformation concerning known or suspected endangerment of public health or welfare cause, or contributed to, by the designated pollutant" from the information the agency must provide in an emission guideline, a violation of the notice-and-comment requirements of the Clean Air Act. *See* 42 U.S.C. § 7607(d)(3). EPA ignores the fact that such information is crucial to development of state plans for pollutants whose regulation is justified in the first instance by such endangerment. The nature of a pollutant, its localized effects (if any) and information regarding its effective control must be provided to states so they can effectively develop their standards of performance. The proposed rule would undermine any efforts to actually address the harm from pollutants regulated under section 111(d). EPA's unexplained reversal in longstanding policy would be arbitrary and capricious. *Fox Television*, 556 U.S. at 515.

2. The proposed revisions to the regulations would effectively turn section 111(d) into a toothless program that requires few, if any, emissions reductions, would result in significant inequities between states, and would undermine the integrity of the process of determining whether state plans are "satisfactory," as required by the Act

a. EPA's proposed elimination of a presumptive emission standard by changing the definition of "emission guideline" would abdicate EPA's critical role under the Act to set a minimum level of emission reduction to address endangerment from existing source pollution

In addition to compelling EPA to establish standards of performance for new sources of pollutants such as CO_2, the Act requires EPA to exercise a supervisory role to ensure state plans contain "standards of performance" that are "satisfactory." 42 U.S.C. § 7411(d)(1), (2)(A). EPA has the authority and the

responsibility to set criteria for evaluating the standards of performance proposed in state plans. Section 111(d)(1) makes clear that states are required to "establish standards of performance" for existing sources applying the best system of emission reduction that *EPA determines* is adequately demonstrated. 42 U.S.C. § 7411(a)(1). Similarly, EPA must have some objective criteria to determine whether state plans are "satisfactory." 42 U.S.C. § 7411(d)(2). Thus, the statute provides a central role for EPA's determination of the best system, *see* Section III, *supra*, and also the sufficiency of the state standards and plans.

As noted above, EPA has used its section 111(d) authority to set substantive emission guidelines, setting minimum required levels of emission reductions for regulated sources, while allowing individual states to establish performance standards for sources located within their borders. *See* 40 CFR § 60.24(c), (f); 40 Fed. Reg. at 53,342. Under the cooperative federalism approach of the Clean Air Act, states have the power and responsibility to implement section 111(d), but can only do so pursuant to a standard of performance commensurate to that established under section 111(b) by EPA and with EPA oversight of state plans. Moreover, EPA also has the authority and responsibility to regulate these sources if a state fails to do so. 42 U.S.C. § 7411(d)(2); *see North Dakota v. Swanson*, No. CIV. 11-3232 SRN/SER, 2012 WL 4479246, at *13 (D. Minn. Sept. 30, 2012) ("States may implement § 7411(d) standards, but the EPA retains approval power and the ability to regulate if a state fails to do so."). This settled scheme of complementary duties under the Act rests on decades of experience implementing section 111(d) and properly balances the roles of EPA and states under the statute.

In contrast to this settled historic practice and the requirements of section 111(d), EPA now proposes to turn its supervisory role into a purely advisory one—providing only *information* as opposed to setting an overall emission limit that reflects application of the BSER and requires actual reductions. (C-14). EPA's proposed rule ignores EPA's clear duty to address endangerment from existing source pollution. This statutory scheme provides that EPA—not each state—selects the BSER, and thus EPA determines the emissions reductions achievable. In setting the BSER, EPA already accounts for costs, energy requirements, and other factors. The standard of performance set by a state only "*reflects*" the quantity of emissions reductions available pursuant to the BSER already determined by EPA. 42 U.S.C. § 7411(a)(1). By essentially delegating the task of setting an emissions limitation to the state, the proposed implementing regulations would reverse the roles envisioned by the statutory scheme and interfere with EPA's authority and

duty to select the BSER and set an emissions limitation that reflects the application of the BSER to control pollution from the sources.

Section 111(d)'s cross-reference to section 110, requiring EPA to establish a "similar" state plan framework, confirms the approach that the current implementing regulations take, requiring EPA to first set a numerical emission limitation. Under section 110, EPA sets national ambient air quality standards (NAAQS) for criteria pollutants, and then states submit plans developed to reduce the emissions of sources within their borders to achieve necessary reductions. Although section 110 sets standards based on the level necessary to protect public health, while section 111 requires emission limitations set by reference to BSER, both statutory provisions require EPA as an initial matter to determine a numerical emission limitation identifying and quantifying the amount of pollution that Congress determined to allow.[83]

The current regulations provide that the emission standards in a state plan "shall be no less stringent that the corresponding emission guideline" set by EPA. 40 C.F.R. § 60.24(c). This regulatory language flows directly from the statute, which envisions not only EPA supervision of state plans through a submissions and approval process, 42 U.S.C. § 7411(d)(1), but also a backstop role for EPA should a state fail to submit a satisfactory plan or fail to enforce the provisions of the state plan. 42 U.S.C. §§ 7411(d)(2)(A) & (B). EPA considered whether a substantive emissions limitation was necessary in its original adoption of the implementing regulations, finding that "it seems clear that some substantive criterion was intended to govern not only the Administrator's promulgation of standards but also [EPA's] review of state plans." 40 Fed. Reg. at 53,342. Under the proposed rule, however, EPA rejects this long-settled position, effectively abandoning regulation of pollutant emissions from existing sources under section 111(d), even if these same sources would be subject to an EPA-determined standard of performance under section 111(b) if they were new or modified.[84] This proposal ignores the statutory

---

[83] Other statutory context also confirms this reading. Section 129, which EPA uses along with section 111 to set solid waste incinerator unit performance standards, expressly requires EPA's emissions guidelines to set an emission limitation for existing sources. 42 U.S.C. § 7429.

[84] EPA's proposal to permit "any emission guideline to supersede the applicability of the implementing regulations as appropriate," 83 Fed. Reg. at 44,770, has the potential to inject further uncertainty and variation into the operation of section 111(d) and further reduce EPA's substantive oversight of existing stationary sources of pollutants even beyond the minimal role it would establish for itself in the proposed replacement rule. As EPA notes, there is no explicit authority for this provision, 83 Fed. Reg. at 44,770 (Table 4), and

structure and EPA's duty to address pollutants that endanger public health and welfare. Indeed, EPA makes no attempt to analyze how the proposal may harm the public health and welfare from delayed or diminished reductions of harmful pollutants. *See American Lung Ass'n v. EPA*, 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).

EPA's proposed new framework also ignores the relative expertise and experience needed to set an emissions limitation and places a tremendous new burden on the states. In setting the BSER, EPA has already calculated emissions reductions available from a source category and has gained experience from analysis of various systems required to regulate new sources in that category (for which it must also establish new source performance standards). Therefore, as a matter of statutory interpretation and sound public policy, it is plain that the agency that has performed the analysis and quantification of available emissions reductions must set the numerical emissions limitation for that category of sources. A state would lack this information and analysis and instead be forced to develop an emissions limitation on its own. States will be faced with significant new demands on their resources, a burden which EPA glosses over in its proposed rule.

The lack of a federal emissions limitation would also create uncertainty for states in developing their own emissions limitations, leading also to uncertainty for their regulated sources. EPA takes no account of the effect of this uncertainty on states and sources. The lack of a federal numerical emissions limitation will also leave state plans vulnerable to challenge on the basis that they do not establish a performance standard reflective of the emissions limitation achievable from application of the BSER EPA has chosen, and will greatly complicate judicial review of individual plans. *See* 42 U.S.C. § 7607(b)(1).

By proposing to allow states to set individualized standards of performance under section 111(d) without EPA establishing any overall statewide numerical emissions limits, the agency would also undermine national uniformity and create incentives for a "race to the bottom," encouraging states to outcompete each other for new industry. Congress sought to avoid this very situation in the Clean Air Act Amendments of 1970, where it expressed concerns with "efforts on the part of States to compete with each other in trying to attract new plants and facilities without

---

therefore to the extent EPA intends to use this provision in a manner contrary to the statute to justify even weaker protections from pollutants or sources, the States and Cities object to this provision (C-51).

assuring adequate control of extra-hazardous or large-scale emissions therefrom." H. Rep. No. 91-1146, Reporting on H.R. 17255, p. 893 (Jun. 3, 1970), *reprinted in* 1970 U.S.C.C.A.N 5356, 5358. The proposed rule ignores this critical concern. *See State Farm*, 463 U.S. at 43.

Finally, EPA's proposal to no longer require emissions guidelines to include a numerical emissions limitation is not only unlawful, it is also an arbitrary and capricious, unexplained reversal of policy. As EPA effectively concedes and the existing implementing regulations make clear, EPA has required a numerical emission limitation in its emission guidelines since 1975, both in regulation and in practice. To reverse this long-standing policy, EPA is required to address the numerous reasons it adopted this requirement in 1975 and explain why the facts and circumstances no longer justify this approach. Instead, EPA offers only a short and deeply flawed legal analysis of why it now believes that a presumptive emission standard is no longer required. See 83 Fed. Reg. at 44,771. Where an agency changes a decades-old regulation on which states and regulated entities have come to rely, it must provide a "more detailed justification than what would suffice for a new policy created on a blank slate." *Fox Television*, 556 U.S. at 515. EPA has not met that significant burden here.

b. EPA's proposal to allow states to develop their own compliance deadlines for affected facilities is another example of its abdication of its statutory duty to ensure that states have "satisfactory" plans to ensure that existing sources control pollution endangering public health and welfare (C-13)

Under the current implementing regulations, compliance with emissions standards in the state plan "shall be required as expeditiously as practicable, but no later than the compliance times" in the emission guideline established by EPA. 40 C.F.R. § 60.24(c). This regulation ensures not only that state plans contain emissions standards, but also that the state plan "provides for implementation and enforcement" of such standards. 42 U.S.C. § 7411(d)(1) (the section 111[d] implementing regulations must require state plans to both [A] establish standards for performance and [B] provide for implementation and enforcement). However, the proposed rule dramatically lengthens the default times for state submissions and compliance and EPA's action under section 111(d). Currently the implementing regulations require 21 months from EPA's publication of a final emission guideline to state implementation of state-established performance standards. Under the proposed rule, this time would at least double and possibly nearly triple, to up to 60 months between EPA's issuance of a final emission guideline and the time

sources must comply with state-issued performance standards—allowing more than an additional three years of pollution not subject to these standards.

With respect to CO_2 emissions from power plants, the proposed rule would further allow states to "establish tailored compliance deadlines for its sources based on the standard ultimately determined for each source." 83 Fed. Reg. at 44,763. These "custom compliance schedules" are proposed to rest on unspecified "unit specific factors." *Id*. at 44,763. This approach would turn the existing regulatory scheme on its head, and transfer all authority to states to determine the compliance deadlines applicable to their sources. Such a fragmented scheme would require EPA to examine the individual compliance schedules set for each and every source in a state plan and attempt to assess multiple compliance deadlines. Under such a scheme, there is virtually no objective measure for EPA to use to determine whether such compliance deadlines are part of a "satisfactory" plan.

EPA has not justified extending its own time for review to 18 months. It has not shown that the current period for review is inadequate, nor estimated the actual workload that its proposed revised regulations would require. Furthermore, the proposed rule would also double the threshold time for requiring legally enforceable increments of progress in compliance schedules—only requiring such schedules for sources whose compliance schedules extend more than 24 months from the submittal of a state plan, twice the current 12-month threshold. 83 Fed. Reg. at 44,770.

Extending EPA's own time for review to up to 18 months and providing sources another six months beyond that for compliance, combined with the source-specific approach EPA proposes, will greatly delay interim compliance deadlines to ensure progress. EPA's only justification for this change is that it will align with its proposed extension of time for agency review of state plans—now proposed to be 12 months from a determination that a submission is complete (a determination that EPA proposes to give itself six months to make). 83 Fed. Reg. at 44,770. EPA suggests that regulated sources would otherwise face uncertainty during the period that EPA is reviewing a state plan, and that extending the time would ease this concern. *Id*. at 44,772. However, EPA has not examined the effect of additional pollution during this extended period, nor, as discussed above, supported extending its own time for review to 18 months, which is the sole basis for the 24-month threshold.

The proposed rule's source-specific, ad hoc approach contrasts sharply with EPA's approach under the Clean Power Plan, where it set a uniform compliance

deadline of 2030, 80 Fed. Reg. at 64,663-64, ensuring that EPA could both assess whether state plans were "satisfactory" and ensure sector-wide legally enforceable increments of progress towards addressing climate change-related harms, *id.* at 64,682-64,683, and meeting various policy goals and agreements. *Id.* at 64,682, 64,698-64,700 (discussing growing congressional awareness of climate change and international agreements and actions). Indeed, in the Clean Power Plan, EPA acknowledged that setting actual emissions standards and a uniform compliance deadline "demonstrates to other countries that the U.S. is taking action to limit GHG emissions from its largest emission sources, in line with our international commitments. The impact of GHGs is global, and U.S. action to reduce GHG emissions complements and encourages ongoing programs and efforts in other countries." *Id.* at 64,700. EPA's proposed rule turns its back on this well-reasoned approach.

c. EPA's proposed elimination of the requirement for state plans to meet a minimum emissions reduction requirement for pollutants that endanger public health is contrary to the statute

EPA incorrectly interprets section 111(a)(1)'s definition of "standard of performance" as providing the states, not EPA, with the responsibility of determining the overall degree of emission limitation achievable through application of the BSER. EPA concludes that this definition points to a requirement that states make this determination source by source, with no substantive oversight by EPA.[85] However, EPA's interpretation conflicts with the plain language of section 111(a)(1), which requires the Administrator to determine that the best system of emission reduction has been "adequately demonstrated" in establishing a standard for emission limitation—a conclusion that must rest on application of the BSER to a category of sources. Furthermore, section 111(d) plainly contemplates that "standards of performance" apply beyond a single source, by permitting a state or EPA to "take into consideration" various factors such as "the remaining useful lives of the sources" in applying a standard of performance to a particular source. 42 U.S.C. § 7411(d)(1)&(2). This language requires that a standard of performance be established for a category of similar sources, with the "application" of such standard

[85] Indeed, combined with proposed 40 C.F.R. § 60.5740a(a)(1), *see* 83 Fed. Reg. at 44,809, which requires only that states "evaluat[e]" the applicability of heat rate improvements to each affected power plant—not necessarily apply those improvements—EPA increases the likelihood that states will simply determine the heat rate improvements are not achievable at their power plant sources.

that can vary in the appropriate case. If a state were to set completely ad hoc, individualized source-specific emissions limitations as opposed to a standard for a category or subcategory of sources (the level at which BSER is established), it would ignore the plain meaning of "standard" and would effectively create no standard from which variance would be required. Thus, the variance provision is further indication that the statute requires EPA to set a numerical emission limit when establishing an emission guideline upon which states can base their standards of performance.

EPA's proposed rule is also contrary to the statutory requirement that the implementing regulations must require state plans to establish a meaningful standard of performance and require EPA to oversee state enforcement of that standard, or undertake federal enforcement if the state fails to submit a satisfactory plan or enforce such plan. 42 U.S.C. § 7411(d)(2). EPA has previously rejected comments that it should limit its plan approval authority under section 111(d) to only procedural criteria. 40 Fed. Reg. at 53,343. As EPA reasoned, "[u]nder that interpretation, States could set extremely lenient standards—even standards permitting greatly increased emissions . . . it is difficult to believe that Congress meant to leave such as gaping loophole in a statutory scheme otherwise designed to force meaningful action." *Id.* Similarly here, EPA cannot reasonably delegate all substantive authority to each state to determine a standard of performance that EPA is then charged with ensuring is satisfactory. Moreover, EPA's proposed rule provides no guidance as to when variances from standards would be appropriate. The proposal leaves states essentially without guidance or requirements and EPA with no grounds to disapprove a state plan, in violation of section 111(d)(2).

3. Other proposed changes to the implementing regulations are not legally or factually supported

a. EPA's proposed deletion of the term "allowance system" from 40 C.F.R. § 60.21(f) is based on EPA's flawed reading of its authority under the statute (C-56)

EPA proposes to delete the term "allowance system" from 40 C.F.R. § 60.21(f).[86] Although EPA correctly notes the "allowance system" language was added to the regulations as part of the now-vacated Clean Air Mercury Rule (CAMR), 83 Fed. Reg. at 44,773, that is not a valid basis for removing this

[86] As noted, besides changing the definition of "emission standard," the proposed replacement rule would replace the term with "standard of performance." *See* EPA-HQ-OAR-2017-0355-21155, at 2.

provision, given its broader applicability to pollutants such as CO_2. First, EPA ignores the holding of the CAMR litigation. The D.C. Circuit did not reach the legality of the cap-and-trade system under section 111(d). *New Jersey v. EPA*, 517 F.3d at 583-84. Second, the "allowance system" language in the implementing regulations is not limited to mercury emissions, but facilitates the use of regional emissions trading systems to qualify as a system of emission reduction to address other pollutants. For example, the rules for large municipal waste combustors allow state plans to authorize facilities to comply by trading NOx emission credits and also by averaging the emission rates of several facilities within a state. *See* 40 C.F.R. § 60.33b(d)(1)-(2). EPA should not, by deleting this provision, use its regulations to reduce state flexibility and undermine existing, successful systems of emissions reduction.

b. EPA's proposed across-the-board lengthening of the timeframes for state plan submission and EPA review (and implementation of a federal plan, if necessary) is not justified (C-52 – C-55)

As described in Sections IV.A and IV.B.3.b, above, EPA proposes to significantly lengthen the default timeframes for section 111(d) regulations, including: (1) extending the deadline for state submissions from the present 9 months from promulgation of a final emission guideline to three years after such promulgation; (2) granting EPA 12 months for action on a state plan submissions (after a determination of completeness), as opposed to the present four months after the submittal deadline; (3) lengthening the time for EPA to promulgate a federal plan from the current six months after the submittal deadline to a proposed two years after a finding of failure to submit a complete plan or EPA's disapproval of a state plan submission. 83 Fed. Reg. at 44,770. The proposed rule also removes, without justification, the requirement that states submit to EPA a plan revision that delays compliance or relaxes emission standards within 60 days of adoption. *Compare* 40 C.F.R. § 60.28(a) *with* 83 Fed. Reg. at 44,807 (proposed 40 C.F.R. § 60.28a(a)). There is no demonstration in the proposed rule that lengthening the timeframe for state plan submissions by more than two years, or adding more than two years to the time for EPA's own action on plans, is justified as a new default rule. EPA attempts no analysis of the air pollution effects of delaying the time for implementation of emission guidelines. Nor does EPA examine workload or the time required for state preparation and EPA review of plans. EPA also ignores the significant period of uncertainty that these longer submission and review periods will cause for states and regulates sources. Instead of the proposed extension of

these various deadlines, to the extent that a particular section 111(d) rule requires additional time than the norm for states and/or EPA, the regulations could be revised to allow for additional time based on a showing of need. Such an approach would strike a balance between implementing emission standards expeditiously to address endangerment and not creating undue burdens on the states and EPA.

EPA cannot persuasively rely on similarity with section 110 to justify the longer proposed deadlines. *See* 83 Fed. Reg. at 44,771. Similarity does not require that sections 110 and 111 have identical timelines. Furthermore, as EPA observed in its 1975 adoption of the current implementing regulations—a conclusion it has not refuted in the proposed rule—section 111(d) state plans are "much less complex" than the state implementation plans (SIPs) required by section 110. *See* 40 Fed. Reg. at 53,345. Section 111(d) plans apply to a single category of sources, as opposed to numerous different types of sources for SIPs. And EPA has already selected the BSER for section 111(d) plans, unlike SIPs, which require more detailed analysis across a broader emissions inventory. Moreover, although EPA had established the current timeframe for submissions and its own action in the 1975 implementing regulations, Congress took no action to amend or alter section 111 in the 1990 Clean Air Act amendments, even as it significantly changed the timing provisions in section 110. In light of these amendments, Congressional inaction on the timing of section 111(d)'s requirements is certainly "persuasive evidence that the interpretation [of section 111(d)] is the one intended by Congress." *See Commodity Futures Trading Comm'n v. Schor*, 478 U.S. 833, 846 (1986).

With respect to lengthening the timeframe for EPA to act on a state plan submission in particular (C-53), the proposed rule includes some unjustified changes to the current approach. For example, EPA has changed the starting of the clock from the date a state plan's submittal is *due* to the date EPA determines such submission is *complete*. EPA's history of determinations of completeness (or findings of failure to submit) under section 110 is particularly instructive here. For example, under the 2008 ozone NAAQS, EPA delayed action on making even completeness findings (or findings of failure to submit) for SIPs, acting only under court order and causing long delays to an already lengthy process, *see, e.g.,* Order Granting in Part Motions and Cross-Motions for Summary Judgment, *Sierra Club v. McCarthy*, Case No. 4:14-cv-05091-YGR, 2015 WL 3666419, at *3-4 (N.D. Cal. May 7, 2015). Not starting the clock on a state section 111(d) plan's due date also could allow states to delay plan submissions, even past their due dates.

EPA also proposes to quadruple from six months to two years the time for promulgating a federal plan if a state fails to submit an approvable plan. (C-54 & C-

55). EPA's only explanation is that this accords with the statutory framework in section 110 for federal implementation plans under the NAAQS for criteria pollutants. 83 Fed. Reg. at 44,771. However, EPA provides no justification for why the section 111(d) process, which is considerably more limited than the section 110 process, requires such a lengthy time following EPA's issuance of an appropriate emission guideline. And EPA already proposes a three-year time period during which states will purportedly develop state plans in consultation with EPA. EPA should have ample notice of a state's progress–or lack thereof—during that time, and should be able to plan accordingly. Moreover, the experience of EPA's implementation of its obligations under section 110 with respect to the good neighbor provision for the ozone NAAQS strongly suggests that a two-year deadline for federal implementation plans simply extends the period of EPA's inaction, often requiring deadline litigation to force promulgation of such plans. *See, e.g., New York v. Pruitt*, No. 18-cv-406 (JGK), 2018 WL 2976018 (S.D.N.Y. Jun. 12, 2018). Accordingly, the States and Cities oppose EPA's proposal to extend its time by an additional 18 months to issue a federal plan under section 111(d)(2)(A).

c. The States and Cities object to EPA's proposed limitation that compliance measures adopted in state plans must be "implemented at the source itself" in light of EPA's constrained interpretation of that phrase (C-17)

EPA justifies its proposed condition that a compliance measure be "implementable at the source itself" as a purported "return" to a "historical" approach to interpreting BSER. EPA has not clearly proposed a revision of the section 111(d) implementing regulations to address this critical issue, nor clearly stated whether this restriction applies only to the emission guideline in the proposed rule, or will be applied to other section 111(d) standards of performance. However, whether intended to apply more broadly, or only with respect to greenhouse gas emissions from power plants, as above with respect to the proposed rule's reinterpretation of the BSER, EPA too narrowly construes its historic approach and is acting unlawfully and arbitrarily and capriciously in proposing this restriction on compliance measures as well. *See* Section III.B, *supra.*

d. The proposed last sentence of 40 C.F.R. § 60.20a(b) is unlawful

EPA proposes a new section 60.20a(b) of the revised implementing regulations to read:

> No standard of performance or other requirement established under this part shall be interpreted, construed, or applied to diminish or replace the requirements of a more stringent emission limitation or other applicable requirement established by the Administrator pursuant to other authority of the Act (section 112, Part C or D, or any other authority of this Act), or a standard issued under State authority. *The Administrator may specify in a specific standard under this part that facilities subject to other provisions under the Act need only comply with the provisions of that standard.*

83 Fed. Reg. at 44,803 (emphasis added). The first sentence of this proposed change follows the statutory requirement that where two or more standards under the Clean Air Act overlap, the more stringent standard applies. The second sentence, however, is patently unlawful, purporting to grant EPA authority to pick and choose which provisions of the statute to enforce. *See Regular Common Carrier Conference v. United States*, 820 F.2d 1323, 1331 (D.C. Cir. 1987) ("[I]t makes no sense to contend, as the Commission does, that an agency is free to pick and choose between statutory provisions on any ground it sees fit, with no congressional guidance and no rulemaking authority."). Combined with lack of a substantive, numerical emission limitation, this would permit EPA to undermine numerous other provisions of the Act and even grant individual states a license to violate the statute. There is no basis for inclusion of this second sentence of the proposed provision, and it should be stricken from any final rule.

4. EPA's proposed variance provisions appear designed to maximize source flexibility to obtain the least degree of emission reduction, thereby undercutting section 111(d)'s purpose to address endangerment from existing sources

The proposed rule would remove the distinction between health-based and welfare-based pollutants while authorizing expanded use of the applicable variance provisions, thus permitting greater and more numerous variances of requirements for any pollutants. The proposed rule would add a broader variance provision that would allow states to consider "remaining useful life. . . and other factors," in granting variances from standards of performance. The factors for consideration would be largely retained from the existing regulations and for this particular class of facilities would include: (1) unreasonable cost of controls resulting from plant age, location or basic process design; (2) physical impossibility of installing necessary control equipment, or (3) other facility-specific factors such as expected life of the

source, payback period for investments, the timing of regulatory requirements and "other unit-specific criteria." 83 Fed. Reg. at 44,766. However, the use of these factors, when combined with broader latitude for states to grant variances and the lack of an overall emissions standard for the state, would fundamentally weaken the requirements of section 111(d). (C-58).

The proposed rule states that "Congress explicitly envisioned under section 111(d)(1)(B) that states could implement standards of performance that vary from EPA's emissions guidelines under appropriate circumstances," 83 Fed. Reg. at 44,773, and therefore proposes to allow states to (1) establish a less stringent standard of performance for an affected facility, (2) establish "a compliance schedule that is longer than that contemplated in EPA's final emission guideline," or (3) determine that "no measures in the candidate technologies are applicable." 83 Fed. Reg. at 44,766. In other words, EPA proposes to allow states to make individualized decisions that could require little to no emissions reductions from some or all of their sources. But EPA's cannot lawfully use the "remaining useful life" and related factors as a way of authorizing states to avoid sufficiently controlling pollution that is endangering public health and welfare. (C-22, C-57).

EPA's proposed new variance provision would permit the exception to swallow the rule. Section 111(d)(1)(B) permits a state plan to "take into consideration" various factors such as the "remaining useful life" of a source to when "applying a standard of performance" to that source. The statute does not permit a state to provide total exemption from the standard of performance for sources or establish individualized standards of performance that collectively fail to meet EPA's emission guideline. Furthermore, in light of the fact that EPA has concurrently proposed to avoid establishing an overall state emission limitation, the proposed variance provisions have the potential to completely avoid requiring *any* emissions reductions. Indeed, coupling this new variance provision to an already ad hoc, source-specific standard of performance could guarantee no meaningful emission reductions—in essence, establishing no meaningful standard from which variances are necessary. (C-57, C-58).

EPA also ignores its prior interpretation of the "remaining useful life" factor under the Clean Power Plan, which harmonized the need for state plan flexibility (and the statutory command to provide certain unit-level flexibility) with the requirement that EPA limit pollutants that endanger public health and welfare. (C-57). The Clean Power Plan established emission guidelines that left to the states the design of the specific requirements for each affected power plant in applying standards, such that "the state may make adjustments to a particular facility's

requirements on facility-specific grounds, so long as any such adjustments are reflected (along with any necessary compensating emissions reductions to meet the state goal) in the state's CAA section 111(d) plan submission." *Id.* EPA found that "remaining useful life and other facility-specific considerations do not provide a basis for adjusting the CO_2 emission performance rates, or the state's rate-based or mass-based CO_2 emission goals, nor do they affect the state's obligation to develop and submit an approvable CAA section 111(d) plan that adopts the CO_2 emission performance rates or achieves the goal by the applicable deadline." 80 Fed. Reg. at 64,871. Thus, EPA provided states with flexibility to design standards that would avoid or diminish concerns about facility-specific factors such as remaining useful life and provide for state-designed systems of emissions reduction that apportioned any burdens equitably among sources, but would still achieve emissions reductions required by EPA's presumptive emission standard. (C-25).

In the Clean Power Plan, EPA found that the reference in section 60.24(f) of the existing implementing regulations to "[u]nreasonable cost of control result from plant age" implements the statutory provision on remaining useful life. 80 Fed. Reg. at 64,870. EPA then specified presumptive standards of performance that were to be implemented by *classes* of existing sources within a specific source category, but did not require this implementation at the unit level without trading. *Id.* The Clean Power Plan anticipated that many (if not all) states would establish some form of marketable credits or permits that would result in rate-based trading with repeating compliance periods. EPA found that buying emissions rate credits would avoid excessive up-front capital expenditures that might be unreasonable for a facility with a short remaining useful life, and would reduce the potential for stranded assets. *Id.*

EPA now claims that allowing broader averaging or trading would render superfluous the statutory language authorizing states to consider existing sources' remaining useful life when applying standards of performance. 83 Fed. Reg. at 44,767. EPA fails to reconcile this new purported concern with its prior findings. *See Fox Television*, 556 U.S. at 549 ("when an agency seeks to change [its] rules, it must focus on the fact of change and explain the basis for that change"); *see also Nat'l Cable & Telecommunications Ass'n v. Brand X Internet Servs.*, 545 U.S. 967, 981 (2005) ("Unexplained inconsistency is . . . a reason for holding an interpretation to be an arbitrary and capricious change from agency practice"). As noted above, EPA previously found that trading would enable states to consider the remaining useful life of a unit without undermining the achievement of meaningful emission reductions: "with trading, an affected EGU with a limited remaining useful life can

avoid the need to implement long-term emission reduction measures and can instead purchase . . . tradable instruments." 80 Fed. Reg. at 64,734–35. The States and Cities' experiences with emissions trading programs such as RGGI affirm EPA's prior findings. Trading benefits sources nearing the end of their useful life because it "reduces the overall costs of controls and spreads those costs among the entire category of regulated entities while providing a greater range of options for sources that may not want to make on-site investments for controlling their emissions." *Id.* at 64,734.

In contrast, the proposed rule ignores the need for overall emissions reductions by jettisoning both an overall state emissions limit and potentially the trading mechanism that apportions emissions reductions equitably among covered sources. (C-25, C-26). The facility-specific factors EPA proposes states be able to consider are apparently designed to undermine any actual effort to reduce emissions, as evidenced by EPA's proposal that a default standard for an existing source with a short remaining useful life might be "business as usual" with an emission standard only applicable if that source did not shut down by some future—presumably "custom"—compliance deadline. 83 Fed. Reg. at 44,766. (C-24). Instead of simply allowing "business as usual," a standard of performance even for facilities with a short remaining useful life should still require such facility to meet a meaningful CO_2 emission rate—through trading or averaging, or other available measures—that reflects an equitable contribution to achieving an overall statewide emission standard. (C-24).

The proposed rule's application of the "remaining useful life" provision through the variance provisions —in direct contrast to the Clean Power Plan—is likely to adjust the CO_2 emission performance rates and compliance deadlines of regulated units as well as the state's overall emissions performance based on facility-specific factors (C-57). Thus, the proposed variance provisions will necessarily lower the amount of emissions reductions achievable and delay compliance with the standards of performance. This approach is directly contrary to EPA's reasonable prior interpretation of these factors under the Clean Power Plan, and would violate the statutory command that state plans actually require existing sources to control pollution that is endangering public health and welfare. 42 U.S.C. § 7411(a)(3), (b)(1), (d). EPA fails to explain why its previous interpretation of the variance factors—which provided states with flexibility without undermining the statute's directive to reduce pollution endangering health and welfare—should be reversed. It cannot lawfully do so. *Fox Television*, 556 U.S. at 515-16.

V. POLLUTION IMPACTS OF THE PROPOSED RULE

EPA's own analysis shows that the proposed rule would increase air pollution compared to the Clean Power Plan. Because the modeling fails to account for the broad discretion states would have in requiring heat rate improvement projects and the ability of power plant companies to undertake projects that do not improve heat rate yet avoid complying with New Source Review, it also likely overstates any emission benefits from the proposed rule. EPA's modeling also shows that emissions of carbon dioxide and several other pollutants would increase in several states compared to no rule at all. The agency's analysis further demonstrates that this additional pollution will have a human toll, especially in our most vulnerable communities: thousands of additional deaths and illnesses that would be avoided if EPA implemented the Clean Power Plan. In addition to harms to human health, the increase in pollutants such as NOx and SO_2 will also adversely public welfare in the States and Cities. Finally, increased CO_2, NOx, and SO_2 emissions from the proposed rule once finalized would be additive to pollution likely to result from other EPA deregulatory actions, including those in the oil and gas and light-duty motor vehicle sectors.

The increased pollution the proposed rule would allow is further evidence that the agency's BSER revised determination discussed above is unlawful. Moreover, the proposed rule fails to satisfy EPA's statutory obligation under section 111(d) to address dangerous pollutants as well as contravening the Act's fundamental goal "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of the population." 42 U.S.C. § 7401(b)(1).

A. EPA Admits that Air Pollution Under the Proposed Rule Would Be Higher Compared to Under the Clean Power Plan

EPA's own RIA for the proposed rule shows that its implementation would result in more carbon pollution than under the Clean Power Plan. EPA estimates that CO_2 emissions from the power sector would be 47-61 million short tons more under the proposed rule in 2030 compared to the Clean Power Plan. 83 Fed. Reg. at 44,784, Tbl. 6. In addition, as discussed below, the agency's estimate likely exaggerates any emission reduction benefits from its proposed rule.

When EPA issued the final Clean Power Plan in 2015, it required meaningful (but not especially stringent) emission reductions from the power sector. *See* 80 Fed. Reg. at 64,718 (agency established moderate emission goals, not reductions based on the maximum degree of stringency achievable). EPA estimated that by 2030, the

Clean Power Plan would reduce approximately 415 million short tons of CO_2 nationally compared to a no policy scenario. *See id.* at 64,924, Tbl. 15 and 16. By contrast, EPA estimates that the proposed rule would result in only a 13-27 million short ton reduction of CO_2 by 2030, compared to a no policy scenario. 83 Fed. Reg. at 44,784, Tbl. 7. These national tonnage reductions are not just small compared to the Clean Power Plan, but also pale in comparison to power plant emission reductions in several individual states, according to EPA's own fact sheet. In six states (including Illinois and Pennsylvania), the power sector reduced CO_2 emissions during the 2006-16 period by more than the largest CO_2 emission reductions shown in EPA's modeling for the proposed rule nationally (27 million short tons), while in another dozen states (including Iowa, Maryland, New York, and North Carolina), emissions have fallen by at least the 13 million short tons, which is the smaller end of EPA's estimate. *See* EPA Fact Sheet, Proposed Affordable Clean Energy Rule – CO_2 Emission Trends, at 3-4.

To shift focus away from these minimal (if any) emission reductions, EPA argues that CO_2 emissions in 2030 compared to 2005 levels would not be much different under its proposed rule compared to under the Clean Power Plan. *See e.g.*, EPA Fact Sheet, Proposed Affordable Clean Energy Rule – Comparison of ACE and CPP at 1 ("The ACE Rule continues the downward CO_2 trend, pushing CO_2 emissions to around 34% below 2005 levels (similar to CPP)."). But even if EPA's emission estimates for its proposed rule were accurate—which they are not—that comparison would still be misleading. As the tonnage figures cited above indicate, when it promulgated the Clean Power Plan, EPA underestimated the rate by which power companies would continue to shift away from coal-based electricity generation to gas and renewables even prior to any compliance deadlines being in effect. Indeed, EPA made this very point last year. *See* CPP Reconsideration Denial at 22 ("[T]he trends toward low- and zero-emitting energy, upon which the CPP builds, continue unabated, and, in fact, have accelerated since the EPA promulgated the CPP."). Relatedly, EPA found that the costs of reducing carbon pollution had declined significantly since EPA promulgated the Clean Power Plan. *Id.* at 24-26.

EPA's statutory obligation to address endangerment from power plant pollution is not met by requiring reductions that are commensurate with those under the Clean Power Plan; it is to establish meaningful emission reductions to address that endangerment. *See Sierra Club v. Costle*, 657 F.2d 298, 326 (D.C. Cir. 1981); *see also* CPP Reconsideration Denial at 28 ("[S]ection 111(d) is designed to ensure that standards are set on existing sources of dangerous pollutants, including carbon dioxide, to guarantee reductions based on what is achievable, and not merely

based on what is expedient.") (citing Legal Mem. at 18-26). EPA's decision to re-open the Clean Power Plan rulemaking triggered its obligation to consider these industry trends in issuing a replacement rule that meaningfully addresses harms from power plant carbon pollution. *Id.* (C-1). In addition to the new evidence from the power sector showing that deeper cuts to carbon pollution than required by the Clean Power Plan are readily achievable, EPA also has more compelling scientific evidence that prompt and aggressive reductions are necessary to avoid catastrophic harm to public health and welfare. *See* Section I.A, *supra*; CPP Reconsideration Denial at 21-22 (describing the urgency needed to cut greenhouse gas emissions in order to limit global warming to below 2 degrees C and noting that "a delay in reducing emissions will . . . make[] achieving any given temperature target more difficult with each passing year"). Thus, in light of these changed circumstances, EPA's decision to devise a replacement rule that the agency admits falls short of even the moderate CO_2 reductions under the Clean Power Plan violates its obligation under section 111 of the Clean Air Act. *See Sierra Club v. Costle*, 657 F.2d at 326.

EPA further acknowledges that the proposed rule would cause increased emissions of nitrogen oxides and sulfur dioxide compared to the Clean Power Plan. Power plants would emit 32,000-39,000 more tons of NOx and 45,000-53,000 more tons of SO_2 in 2030. 83 Fed. Reg. at 44,784, Tbl. 6. As discussed below, this additional pollution is likely to cause hundreds or thousands of premature deaths and illnesses.

B. EPA's Illustrative Modeling Fails to Accurately Reflect the Realities of the Proposed Rule, Thereby Likely Overstating Any Emission Benefits from It

The illustrative modeling EPA relies on in the RIA also likely overstates any emission benefits from the proposed rule. The illustrative 2-percent and 4.5-percent across-the-board heat rate improvements—which EPA cites for the proposed rule's emission reductions—do not reflect an accurate picture of the proposed rule's provisions. Specifically, the modeling fails to account for the likelihood that state plans will not require sources to achieve emission reductions EPA contends will occur with heat rate improvements of 2-4.5 percent. This scenario could well occur in at least some states as a result of the aspects of the proposed rule—discussed in Section IV—that would give wide discretion to states in deciding (i) whether to require each coal-fired power plant to conduct one or more heat rate improvement projects designated by EPA as "candidate technologies," (ii) to what extent the power plant must achieve a lower emission rate after completing a heat rate

improvement project, and (iii) the compliance period for the plant to achieve the emission rate. *See* Section IV.B.2.b, *supra*. As discussed above, not only is EPA declining to set an overall emissions limitation for states to meet, it is also proposing that states can utilize a broad variance provision. Thus, even if one assumes that heat rate improvement projects on the scale reflected in EPA's modeling will result in emission reductions (as discussed elsewhere, a questionable proposition), the wide discretion EPA is proposing to give to states regarding such projects makes those benefits speculative.

In addition, because EPA's illustrative modeling assumes that power plants will react equally to its proposed rule (either by undertaking heat rate improvement projects or retiring), *see* RIA at 3-9, it fails to reflect the realities of the electric generating market. *See Appalachian Power Co. v. EPA*, 249 F.3d 1032, 1053 (D.C. Cir. 2001) (rejecting EPA modeling where it lacked "a rational relationship to the real world"). As discussed in ***Exhibit E***, an initial analysis of this aspect of the proposed rule by Susan Tierney of the Analysis Group, it is likely that power plants will react differently to the proposed rule's exemption from New Source Review pollution control requirements depending on their location. Power plants subject to traditional cost-of-service regulation or are publicly or cooperatively owned are more likely to undertake heat rate improvement projects (regardless of whether a state requires such projects in its section 111(d) plan) than merchant plants in competitive (restructured) markets. *Id.* at 13-17. And because states where cost-of-service regulation or public/cooperative ownership dominate have a majority of the nation's coal-fired power plants, it is also more likely that those states will include heat rate improvement projects their utilities are interested in performing in their section 111(d) plans. *Id.* at 8-12. As Tierney notes, states that require plants to undertake heat rate improvement projects will facilitate the ability of power plant owners to obtain rate recovery from ratepayers because owners will be able to argue that they are undertaking the projects to comply with Clean Air Act requirements. *Id.* As noted elsewhere, EPA's modeling fails to adequately evaluate the local and regional impacts of the proposed rule. *Id.*; *see Flyers Rights Educ. Fund, Inc. v. Fed. Aviation Admin.*, 864 F.3d 738, 744 (D.C. Cir. 2017) ("Studies cannot corroborate or demonstrate something that they never mention or even indirectly address"); s*ee State Farm*, 463 U.S. at 43. That failure is magnified by the likelihood that the economics and incentives driving power plant owner decisions vary depending on their power plant ownership and location.

C. The Proposed Rule Could Increase Emissions in Several States Compared to a No Replacement Scenario

EPA's own data also shows that air pollution will increase in at least some areas more under its replacement rule than under a "business-as-usual" (*i.e.*, no Clean Power Plan or replacement) scenario. Such a result should not be surprising given that EPA concedes that: (1) emissions could increase at particular plants following heat-rate improvement projects due to the rebound effect, *see* 83 Fed. Reg. at 44,761; (2) annual emissions of CO_2, NOx, and SO_2 could increase because power plants will be able to avoid New Source Review permitting and pollution control requirements, *see id.* at 44,781-82; and (3) it is not establishing an overall level of CO_2 emission reduction that power plants in each state will have to achieve, *see id.* at 44,764.

As noted below, see Section VI.2.a, *infra*, the modeling that EPA has used to evaluate the emission impacts of the proposed rule is insufficient to gauge state-by-state effects. That being said, EPA's modeling predicts that emissions of CO_2, NOx, and/or SO_2 will increase in a number of states by 2030, including California (CO_2), Massachusetts (CO_2), Maryland (CO_2, NOx, and SO_2), North Carolina (CO_2, NOx, and SO_2), and Virginia (CO_2, NOx, and SO_2).[87] That emissions could increase compared to business-as-usual under a proposed replacement rule based solely on heat-rate improvements is further supported by an analysis prepared by Resources for the Future (RFF). The RFF analysis, Carbon Standards Examined: A Comparison of At-the-Source and Beyond-the-Source Power Plant Carbon Standards (Aug. 2018) (attached hereto as ***Exhibit F***), analyzed a theoretical "inside the fenceline" regulation for power plants compared to one that allowed generation shifting and also compared to a no-regulation scenario. RFF found that emissions under an "inside the fenceline" rule would likely be greater in 2030 than a no-regulation scenario in eight states (including Connecticut, New Jersey, Oregon, and Washington) for CO_2, in eight states (including New Jersey, Oregon,

---

[87] *See* EPA, *Analysis of the Proposed ACE Rule*: *IPM Run Files*, *available at* https://www.epa.gov/airmarkets/analysis-proposed-ace-rule (for each scenario, download zip file, then see "State Emissions" file, RPE folder containing "RPE" file and RPT folder containing "Environmental Measures" file); *see also* Rama Zakaria, Envtl. Def. Fund, *The Trump Administration's Clean Power Plan replacement—for many states, worse than doing nothing*, Climate 411 Blog (Sept. 14, 2018), *available at*: http://blogs.edf.org/climate411/2018/09/14/the-trump-administrations-clean-power-plan-replacement-for-many-states-worse-than-doing-nothing/?_ga=2.244396869.1313362570.1538742744-941044863.1536661032.

Pennsylvania, and Washington) for NOx, and in six states (including Connecticut) for SO_2. RFF Analysis at 5-11.

Despite having conceded the predicates that could lead to actual emission increases and its own modeling showing increased pollution in some states, EPA has failed to even address this possibility and its ramifications for the agency's proposed rule. This failure is inconsistent with the agency's obligations under the Clean Air Act. *See American Lung Ass'n,* 134 F.3d at 392 (failure to consider public health effects of rulemaking rendered EPA Administrator unable to fulfill duty under Clean Air Act); *see State Farm,* 463 U.S. at 43.

D. Increased Air Pollution Will Result in Numerous Harms to the States and Cities

1. More pollution will harm public health by causing more premature deaths and illnesses compared to the Clean Power Plan

The additional air pollution EPA predicts will occur under its proposed rule will mean that hundreds or thousands more people will die prematurely, suffer asthma attacks, and miss school and work. According to the RIA, the proposed rule would result in up to an additional 1,630 premature deaths, 120,000 asthma attacks, 140,000 missed school days, and 48,000 lost work days in 2030 compared to under the Clean Power Plan. RIA at 4-33, Tbl. 4-6. Furthermore, as discussed above, *see* Section IV.B, *supra*, and below, *see* Section VI.B, *infra*, there are several reasons why these figures may understate the negative health impacts from a replacement rule.

The D.C. Circuit has previously admonished EPA that in light of the high stakes for public health in agency rulemakings, it has "the heaviest of obligations to explain and expose every step of its reasoning." *American Lung Ass'n*, 134 F.3d at 392. Here, EPA has chosen instead to play coy. If it is the agency's position that the statute precludes the more protective Clean Power Plan, then it should not be objecting to the D.C. Circuit ruling on the Plan's legality. If instead it is EPA's position that it is simply exercising its discretion to adopt a different regulation under section 111(d) that it believes is better policy under the Clean Air Act, it must fully explain its reasoning why its proposed replacement is lawful despite the agency's own analysis showing that it will result in premature deaths, asthma attacks, and missed school and work days for thousands of people compared to the law on the books. *Id.* at 392; *Fox Television*, 556 U.S. at 515-16.

2. More pollution will cause disproportionate harm to environmental justice communities

The increase in deaths and illnesses EPA predicts will occur as a result of its proposed rule will fall disproportionately on environmental justice communities. In the Clean Power Plan rulemaking, EPA found that "[l]ow-income communities and communities of color already overburdened by pollution are disproportionately affected by climate change and are less resilient to adapt or to recover from climate-change impacts." 80 Fed. Reg. at 64,670. EPA further recognized that because the Clean Power Plan provided states and power plants flexibility in meeting the required emission limits, some plants might not decrease their emissions, but instead comply through other means (such as trading emission credits or purchasing emission allowances). EPA also found that "communities in closest proximity to power plants . . . include a higher percentage of communities of color and low-income . . . than the national averages." *Id.* at 64,670.

Therefore, EPA sought to mitigate these impacts by establishing the Clean Energy Incentive Program (CEIP) to provide incentives to invest in renewable energy and demand-side energy efficiency to aid those overburdened communities. Under the program, states could award allowances and emission reduction credits for early investments in renewable energy and energy efficiency implemented in low-income communities. *Id.* EPA also required that states include in their initial and final state plan submittals a description of how they would engage with vulnerable communities in developing their plans to limit power plant pollution. *Id.*

EPA has not contested its previous findings that environmental justice communities will disproportionately bear the burden of pollution from power plants. But, in its proposed rule, the agency has made the situation worse in two respects. First, as it admits, that pollution will be greater under its proposed rule compared to the Clean Power Plan. Second, EPA does not propose to continue the CEIP, nor has it proposed to establish any alternative programs to mitigate the pollution burden on environmental justice communities. EPA cannot simply ignore an aspect of the problem it has previously identified. *State Farm,* 463 U.S. at 43.

3. More pollution will harm public welfare in the States and Cities in myriad ways

The proposed rule's emission increases will also adversely affect public welfare. The Clean Air Act states that effects on welfare include, but are not limited to, "effects on soils, water, crops, vegetation, manmade materials, animals, wildlife, weather, visibility, and climate, damage to and deterioration of property, and

hazards to transportation, as well as effects on economic values and on personal comfort and well-being." 42 U.S.C. 7602(h). In the Clean Power Plan proposal, EPA summarized some of the adverse impacts climate change has on public welfare:

> Climate change caused by human emissions of GHGs also threatens public welfare in multiple ways. Climate changes are expected to place large areas of the country at serious risk of reduced water supplies, increased water pollution, and increased occurrence of extreme events such as floods and droughts. Coastal areas are expected to face increased risks from storm and flooding damage to property, as well as adverse impacts from rising sea level, such as land loss due to inundation, erosion, wetland submergence and habitat loss. Climate change is expected to result in an increase in peak electricity demand, and extreme weather from climate change threatens energy, transportation, and water resource infrastructure.

79 Fed. Reg. 34,830, 34,842 (June 18, 2014). These types of adverse impacts on the States' and Cities' welfare are detailed in Appendix A, attached hereto and cited below as A-xx. A few of those include:

- Sea Level Rise. Climate change has caused and will continue to cause the sea level to rise, magnifying the effects of storm surges and high tides, increasing shoreline erosion, and damaging or destroying coastal property and infrastructure in states and communities such as California (A-3, A-10 to A-11), Connecticut (A-13 to A-14), Delaware (A-14), Hawaii (A-14 to A-16), Maryland (A-23 to A-24), Massachusetts (A-27 to A-28), New York (A-36 to A-38), North Carolina (A-39 to A-43), Oregon (A-44), Rhode Island (A-54), Virginia (A-56), and Washington (A-57). Since 1900, the sea levels have risen by as much as 7 inches in San Francisco (A-10), 12 inches in the Northeast (A-13, A-36, A-66), 13 inches in Hawaii (A-15), and 14 inches in Virginia (A-56). Rising sea levels have increased the frequency of record-setting high tides, or "king tides," which damage property and infrastructure and overwhelm sewer systems in places such as Hawaii (A-14 to A-16), Massachusetts (A-26 to A-27), and South Miami, Florida (A-69 to A-70). Predictions for future sea level rise are even more dire: up to 2.1 feet by 2050 in Maryland (A-23), 6-feet by 2100 in New York (A-36), 3.25 feet in the next century in North Carolina (A-39), 4.5 feet by 2100 in Oregon (A-44), 6.6 feet by 2100 in Rhode Island (A-54), and 5 feet by 2100 in Washington (A-57). If left unchecked, sea level rise

will cause billions of dollars of damages to the States and Cities (A-11, A-27, A-56 to A-57, A-72).

- Flooding. Climate change causes more frequent extreme rainfall events and rising ocean levels that have caused or will cause increased flooding in places such as California (A-11), Connecticut (A-13), Delaware (A-14), Hawaii (A-16), Illinois (A-16 to A-17, A-63), Iowa (A-20), Maryland (A-23), Massachusetts (A-26 to A-27), New York (A-34 to A-37, A-67), Oregon (A-44), Rhode Island (A-53), the District of Columbia (A-59 to A-60), Boulder, Co. (A-51), Philadelphia (A-68 to A-69), South Miami, Florida (A-70 to A-71), and Broward County, Florida (A-71 to A-72). Once rare flooding events are occurring more frequently: North Carolina has experienced two 500 to 1,000 year floods in the last two years (A-40 to A-41); Minnesota has experienced three 1,000 year floods since 2004 (A-31); in Massachusetts, a 100-year flood is occurring every 60 years, while a 50-year flood is occurring 30 years (A-27 to A-27). In January 2018 the storm surge from a powerful winter storm caused major coastal flooding and resulted in a high tide in Boston of 15.16 feet, the highest tide recorded since records began in 1921 (A-26 to A-27). By 2050, Seattle, Washington could experience a 1-in-100 year flood every year (A-57).

- Droughts and Heat Waves. Increased temperatures associated with climate change have caused or will cause increased droughts and heat waves in places such as California (A-1), Connecticut (A-13), Iowa (A-19), Maine (A-22), Massachusetts (A-26), Minnesota (A-31), New Mexico (A-32), North Carolina (A-41), Oregon (A-43 to A-44), Pennsylvania (A-49 to A-50), the District of Columbia (A-60), Boulder County, Co (A-62), Chicago (A-63), and New York City (A-67). California recently experienced a historic, five-year drought that reduced reservoirs to record lows, threatened the livelihood of farmers and fisherman and killed 129 million trees (A-1, A-9 to A-10). A 2012 drought in Iowa cost more than $250 million when the scarcity of water led to narrowed navigation channels, forced closure of locks, and caused dozens of barges to run aground in the Mississippi River. (A-21). Heat waves have caused hundreds of deaths in California (A-5) and Illinois (A-19). Heat waves are also expected to increase hospitalization and deaths caused by heat-related illnesses, and to stress the power grid and infrastructure, especially in urban environments such as the District of Columbia (A-60), Chicago (A-63), Los Angeles (A-65), New York City (A-67), and Philadelphia (A-68 to A-69).

- Wildfires. As a result of increased temperature and drought conditions, wildfires are occurring more frequently and are more severe in places like California (A-2), North Carolina (A-41), Oregon (A-46), Washington (A-59) and Boulder County, CO (A-61 to A-62). In 2017, the worst wildfire season on record in California killed dozens of people, destroyed thousands of homes, forced hundreds of thousands of evacuations, and burned more than half-a-million acres (A-2). The 2017 wildfire season surpassed the previous worst year on record in California: 2015. *Id.* In between these two record-setting years, the 2016 Soberanes wildfire was the most expensive single wildfire in U.S. history, costing more than $250 million to extinguish over the course of three months. *Id.* In North Carolina, in October and November of 2016, drought conditions resulted in thirty fires scorching 80,000 acres (A-41). In Washington, increases in summer temperatures and earlier snow melt are predicted to result in a 300-percent increase in area burned by wildfires annually in the eastern part of the state, and up to a 1,000-percent increase in the western part of the state (A-59).

- Air Quality. Rising temperatures can lead to increases in the formation of air pollution, including ground-level ozone or fine particulates, diminishing air quality in places such as California (A-5, A-65), Delaware (A-14), Iowa (A-21), Massachusetts (A-26), New Mexico (A-34), New York (A-38), North Carolina (A-41), Oregon (A-47 to A-48), and Pennsylvania (A-52, A-69). Diminished air quality has a variety of negative health consequences, including diminished lung function, increased emergency room visits, and death (A-26, A-38, A-52). Higher temperatures also cause plants to produce more pollen, which can exacerbate asthma and allergies (A-26). Wildfires caused by climate change in states like California and North Carolina negatively affect air quality in those states (A-2, A-40), as well as in downwind states such as Minnesota (A-31).

- Agricultural Impacts. The hotter summers, milder winters, droughts, extreme rainfall, and other unpredictable impacts of climate change wreak havoc on farms in places such as California (A-1, A-7 to A-8), Illinois (A-15 to A-16), Iowa (A-21), Maryland (A-24), North Carolina (A-42), and Pennsylvania (A-52). In the Central Valley of California, the recent drought cost the agriculture industry $2.7 billion and 20,000 jobs in

2015 alone (A-1). Rising temperatures could result in $150 million in annual losses for Maryland's agricultural industry by 2050 (A-24).

- Infectious Diseases. By expanding the habitat of disease-carrying insects, climate change has increased and will continue to increase the incidence and spread of infectious diseases in locations such as Iowa (A-22), Massachusetts (A-28), Minnesota (A-29), North Carolina (A-41), Pennsylvania (A-52), Vermont (A-56), and Virginia (A-57). In particular, milder winters contribute to a rise in deer populations and in the number of ticks able to survive the winter, resulting in sharp increases in the tick-borne illnesses like Lyme disease in places such as Massachusetts (A-28), Vermont (A-56), and Virginia (A-57). Similarly, the mosquito-borne West Nile disease – transmission of which is increased by warmer temperatures – has become endemic in Pennsylvania (A-52).

- Other Economic Impacts. The climate change impacts described above will cause a host of secondary economic impacts on the States and Cities. The erosion of beaches and increases in unpredictable extreme weather will reduce tourism in places like Hawaii (A-15 to A-16), Maryland (A-24), and North Carolina (A-42). The increase in winter temperatures will inhibit or destroy the winter sports industry in places such as Maine (A-22), Maryland (A-24), Pennsylvania (A-52 to A-53) and Vermont (A-55 to A-56). Industries as diverse as lobster trapping in Maine (A-22), cold-water-ocean fishing in Massachusetts (A-28), oyster farming in Oregon (A-45), and maple sugaring in Vermont (A-56) could also be negatively impacted.

Regarding another welfare effect, impacts on parks and wildlife areas, a recent study concluded that national parks experience "disproportionate magnitude" of climate change impacts compared to the U.S. as a whole. Patrick Gonzalez et al, *Disproportionate magnitude of climate change in United States parks*, 2018 Environ. Res. Lett. 13 at 1 (attached hereto as ***Exhibit G***). This conclusion further bolsters the conclusions of an extensive study done by the National Parks Service examining historical records from 1901-2012, which showed that parks have experienced the extreme warm end of historical temperatures.[88]

---

[88] William B. Monahan & Nicholas A. Fisichelli, *Climate Exposure of US National Parks in a New Era of Change.* PLoS ONE e101302, 1 (2014), *available at*: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0101302

Climate change harms in parks and wildlife areas include direct impacts from temperature increases, sea level rise, wildfires, and more intense storms, and indirect impacts, such as impaired visibility due to hotter temperatures that facilitate the formation of visibility-impairing ozone pollution.[89] Damage to our parks and refuges not only denies our residents the enjoyment of these areas, it also reduces revenue to States and Cities from park visitation.[90]

As with the public health impacts addressed above, EPA has utterly failed to engage with its own rulemaking record from the Clean Power Plan on these adverse effects and how the proposed rule will address them.

4. The paltry emission reductions (if any) from implementation of the proposed rule cannot be squared with EPA's findings in the Clean Power Plan and other current EPA rulemakings regarding the urgent threat climate change poses and the need to demonstrate international leadership to facilitate other countries' committments to reduce greenhouse gas emissions

EPA's combined actions in the proposed rule of (i) revising its BSER determination to require little, or no, CO_2 emission reductions from power plants, *see* Section III, *supra*, and (ii) failing to set overall emissions limits for states to require power plants to meet along with giving states wide discretion in setting individual plant standards, *see* Section IV, *supra*, would undermine the basic congressional design of section 111(d): to address existing sources of pollution that are endangering public health and welfare. EPA admits that it must consider "'the amount of air pollution as a relevant factor to be weighed'" in promulgating a section 111(d) rule. *See* 83 Fed. Reg. at 44,755, n.16 (quoting *Sierra Club v. Costle*, 657 F.2d at 326)).

The agency also has not retracted or rebutted its findings in the Clean Power Plan rulemaking that climate change poses an existential threat that requires

---

[89] *See generally* Patrick Gonzalez, *Climate Change Trends, Impacts, and Vulnerabilities in US National Parks*, Science, Conservation, and National Parks 102 (2017), *available at*: http://www.patrickgonzalez.net/images/Gonzalez_2017_Climate_change_national_parks.pdf National Parks Conservation Association, *Unnatural Disaster: Global Warming and Our National Parks* (2007), *available at*: https://www.npca.org/resources/2382-unnatural-disaster-global-warming-and-our-national-parks

[90] National Parks Conservation Association, *Unnatural Disaster: Global Warming and Our National Parks, supra*, at 18.

prompt action. *See* 80 Fed. Reg. at 64,669 (noting the "compelling need for actions to begin the steps necessary to reduce GHG emissions from EGUs"); *id.* at 64,677 ("New scientific assessments since 2009 . . . highlight the urgency of addressing the rising concentration of CO_2 in the atmosphere"); *id.* at 64,686 ([recent] "assessments and observed changes make it clear that reducing emissions of GHGs across the globe is necessary in order to avoid the worst impacts of climate change, and underscore the urgency of reducing emissions now."). In fact, in the ongoing rulemaking that would roll back greenhouse gas emission standards and fuel economy standards for new motor vehicles,[91] EPA and the National Highway Traffic Safety Administration (NHTSA) acknowledge the stark realities of unabated climate change. Drawing on reports from expert scientific bodies, including the IPCC, the U.S. Global Climate Research Program, the National Research Council, and EPA's endangerment finding, NHTSA's draft Environmental Impact Statement[92] concludes temperatures are increasing, human influence is the primary cause and carbon dioxide emissions are the primary driver. NHTSA determined that under its no action alternative the current base case for CO_2 emissions will results in, for year 2100, an atmospheric CO_2 concentration of 789 parts per million, a global surface temperature increase of 6.27 degrees Fahrenheit and sea level rise of 30 inches. Dire consequences of this amount of climate change are further acknowledged in the document.

Nor has EPA withdrawn or changed its findings that although the United States cannot solve the problem of climate change alone, taking meaningful steps to address it is important to provide incentives to other countries to follow suit. *See id.* at 64,677 (Clean Power Plan "constitutes a major commitment—and international leadership-by-doing—on the part of the U.S.").

Yet in the proposed rule, the agency proposes no meaningful or serious emission reduction requirements. The agency never attempts to reconcile these paltry emission reductions with the threat of climate change. Nor does it even contend that such small measures would encourage other countries to follow suit with meaningful emission cuts. EPA's failure to reconcile its proposed rule with

---

[91] The "Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks," 83 Fed. Reg. 42,986 (Aug. 24, 2018).

[92] Draft Environmental Impact Statement for the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Year 2021–2026 Passenger Cars and Light Trucks. NHTSA. July 2018. Docket No. NHTSA-2017-0069. 500 pp.

these findings is contrary to the basic purpose of section 111(d) and arbitrary and capricious.

VI. EPA'S PROPOSED WEAKENING OF THE NEW SOURCE REVIEW PROGRAM

As part of its proposal to replace the Clean Power Plan, EPA also proposes to substantially revise its regulations implementing the PSD and nonattainment New Source Review programs (collectively, "NSR"), as they apply to power plant modifications. The Clean Air Act defines "modification" as "any physical change or change in the method of operation of, a stationary source which increases the amount of any air pollutant emitted by such source or results in the emission of any air pollutant not previously emitted." 42 U.S.C. § 7411(a)(4). The owner/operator of a plant that triggers the modification provision must obtain a preconstruction permit ensuring that its emissions following the modification will not cause or contribute to the exceedance of an applicable NAAQS and must operate the facility in compliance with BACT as determined by the permitting agency. 42 U.S.C. § 7475; *see also id.* § 7503 (setting forth similar requirements for facilities in nonattainment areas). NSR programs were intended by Congress to require pollution reductions at existing facilities otherwise grandfathered from emission limitations, when those facilities undertake modifications that increase overall pollution. *Alabama Power v. Costle*, 636 F.2d 323, 400 (D.C. Cir. 1979) (Clean Air Act does not provide "a perpetual immunity from all standards" because where "plants increase pollution, they will generally need a permit").

The NSR aspect of the proposed rule would effectively exempt power plant modifications from NSR permitting and pollution control requirements. In this context, EPA is misusing a section 111(d) rulemaking, which is intended to reduce dangerous air pollution, to allow power plants to pollute more. As discussed below, the proposed changes to NSR are inconsistent with the Clean Air Act and court precedent. Weakening NSR also will likely result in greater emissions of carbon dioxide, sulfur dioxide, and nitrogen oxides. Even if EPA's position that exempting power plants from NSR for modifications undertaken to comply with the proposed rule had merit, the scope of the proposed exemption is much larger, and would extend to all power plant modifications, regardless of whether they result in heat rate improvements made to comply with the proposed rule.

A. The Proposed Rule

EPA proposes to resurrect an abandoned proposal from more than a decade ago to make it easier for power plants to avoid triggering NSR permitting and

pollution control requirements. The proposal was the third rulemaking by EPA under President Bush to "reform" the NSR program. As EPA acknowledges in the proposed rule, the first of these rules was partially struck down in *New York v. EPA*, 413 F.3d 3, (D.C. Cir. 2005) (*New York I*). The second rule, which would have exempted equipment replacements under a certain cost threshold from complying with NSR, was wholly vacated by the D.C. Circuit a year later. *See New York v. EPA*, 443 F.3d 880 (D.C. Cir. 2006) (*New York II*).

The third rule, which EPA initially issued in 2005 and then supplemented in 2007, would have changed the test to determine whether a physical or operational change would increase pollution, thereby triggering the requirements to obtain a preconstruction permit and limit emissions based on BACT. 70 Fed. Reg. 61,081 (Oct. 20, 2005); 72 Fed. Reg. 26,202 (May 8, 2007). EPA proposed then, as it does now, to revise the test from one focusing on whether a facility's actual emissions would increase following the physical or operational change, to one focusing on whether there would be an increase in maximum hourly emissions. Although the proposal was the subject of two rounds of public comment, it was never finalized.

EPA admits that its purpose in unearthing its NSR proposal from a decade ago is to effectively exempt power plant modifications from the Act's NSR permitting and pollution control requirements. As EPA notes, to the extent heat rate improvements improve power plant efficiency, those plants "that operate at lower costs are generally preferred in the dispatch order by the system operator over units that have higher operational costs." 83 Fed. Reg. at 44,775. And, "[a]s the [power plant] increases its generation, to the extent the [plant] operates beyond its historical levels by a meaningful amount, it could result in an increase in emissions on an annual basis, as calculated pursuant to the current NSR regulations." *Id.* Because EPA intends to require that state plans compel coal-fired power plants to undertake heat rate improvement projects—specifically, seven listed "candidate technologies"—it wants to avoid having those projects trigger NSR permitting and pollution control requirements. *Id.*

EPA further acknowledges that it has created this problem through its "constrain[ed]" interpretation of the Act precluding the use of generation shifting measures, which under the Clean Power Plan would have given plants more flexibility to avoid triggering NSR by not increasing annual emissions. *See id.* ("concerns regarding the applicability of NSR take on even greater significance and may not be as easily avoided in the context of this proposed rule, which constrains the compliance options available in the CPP to within-the-fenceline measures and

may therefore more directly result in individual sources making [heat rate improvements]").

To solve this self-created problem, EPA proposes (as it did in 2005) to amend its NSR regulations to include another emissions test—one based on increases in maximum hourly emissions—that power plant projects would first have to fail before needing to evaluate whether the project would increase annual emissions, triggering NSR. As discussed below, EPA has proposed two different variations on this maximum hourly emissions test: a maximum hourly "achievable" test and a maximum hourly "achieved" test. Only projects that would result in a power plant exceeding one of these maximum hourly tests, compared to the past five years, would need to be evaluated for whether annual emissions would be expected to increase after the project. The agency anticipates that, regardless of which of the proposed tests it adopts, "fewer" power plants would trigger NSR requirements. *Id.* at 44,782.

As discussed below, based on the record from the last time EPA proposed a similar emissions test, few, if any, power plant modifications would have to obtain an NSR permit or install pollution controls, even if the modification would result in hundreds or thousands of additional tons of pollution yearly. Not only does the proposed rule call for exempting "candidate technology" heat rate improvement projects in state plans from NSR, it would allow *any* power plant modifications to use the maximum hourly emissions test. *Id.* at 44,781 ("EPA is proposing that this NSR hourly emissions test would apply to all [power plants] . . . [but] soliciting comment on whether to confine the applicability of the hourly test to . . . only the affected [power plants] that are making modifications to comply with their state's standards of performance pursuant to these section 111(d) emission guidelines.").

B. States and Cities' Comments

The proposed NSR changes would be unlawful under the Clean Air Act. Furthermore, they would lead to increased emissions of carbon dioxide, nitrogen oxides, and sulfur dioxide in the near and long terms. EPA need look no further than its own NSR enforcement cases to confirm that conclusion. Finally, the revision does not withstand scrutiny even on its own terms because EPA has not limited the NSR exemption to power plant modifications done to comply with the proposed rule, but has expanded it to include all power plant projects, regardless of whether they improve the heat rate of plants.

1. The proposed changes weakening NSR are inconsistent with the Clean Air Act

As EPA correctly noted more than a decade ago, an NSR test based on maximum hourly emissions is "nothing more than a fool-proof way to avoid PSD review." United States' Reply Memorandum in Support of its Motion for Partial Summary Judgment on Emissions Test and in Opposition to Cinergy's Cross-Motion (May 31, 2005) in *United States v. Cinergy Corp.* at 2, 18, attached as ***Exhibit H***. Both variations on the test proposed by EPA here—a maximum hourly "achievable" emissions test and a maximum hourly "achieved" emissions test—are inconsistent with the statutory text and purpose.

a. EPA's proposed tests triggering NSR only if a power plant increases its maximum hourly emissions are inconsistent with the statute

Basing NSR applicability for modifications on whether a power plant's maximum hourly emissions will increase is contrary to the statutory language. As discussed above, the statutory trigger for a modification is "any physical change or change in the method of operation of, a stationary source which increases the amount of any air pollutant emitted by such source." 42 U.S.C. § 7479(2)(c) and § 7501(4) (incorporating the definition set forth in § 7411(a)(4)). Congress did not require that the "maximum" amount of emissions emitted by such source be exceeded in order to trigger NSR. By contrast, in other NSR provisions Congress did use the word "maximum" in the context of emission increases. *See* 42 U.S.C. § 7473 (referring to "maximum allowable increases" of emissions) and § 7475(a)(3) (requiring the owner/operator of the facility to demonstrate that emissions will not cause or contribute to "air pollution in excess of any (A) maximum allowable increase or maximum allowable concentration" of any pollutant); *cf. id.*, § 7479 (defining BACT as "an emission limitation based on the maximum degree of reduction of each pollutant subject to regulation under this chapter"). The absence of the word "maximum" in section 111(a)(4) should therefore be given effect. *See New York I*, 413 F.3d at 39-40.

EPA's proposed addition of a maximum hourly test while retaining the existing actual emissions test (with the latter only being used if a project would increase maximum hourly emissions) also runs afoul of the statutory definition of modification. The modification definition's phrase "increases the amount of pollution emitted" refers to "amount" in the singular, not the plural "amounts." Yet, the replacement proposal provides that NSR only applies to modifications at power

plants when a modified emissions unit increases the *amounts* (both maximum hourly and actual annual) of pollution. Congress' use of the singular "amount" should be given effect. *Compare* 42 U.S.C. § 7473(b)(1) (using the term "amounts" in section 163(b)(1) in referring to maximum allowable increases in sulfur dioxide and particulate matter over baseline concentrations); *cf. South Coast Air Quality Mgmt. Dist. v. EPA*, 472 F.3d 882, 894 (D.C. Cir. 2006) ("[I]t is generally presumed that Congress acts intentionally and purposely when it includes particular language in one section of the statute but omits it in another") (citation omitted); *Shays v. FEC*, 414 F.3d 76, 108 (D.C. Cir. 2005) (agency cannot add element to express statutory definition).

Consistent with that plain language of the statute, EPA's entire NSR regulatory program defines emissions on an annual basis. As the Supreme Court has noted regarding the PSD regulations:

> [W]hen a rate is mentioned, as in the regulatory definitions of the two terms, "significant" and "net emissions increase," the rate is annual, not hourly. Each of the thresholds that quantify "significant" is described in "tons per year," [40 C.F.R.] § 51.166(b)(23)(i), and a "net emissions increase" is an "increase in actual emissions" measured against an "average" prior emissions rate of so many "tons per year," §§ 51.166(b)(3)(i) and (21)(ii). And what is further at odds with the idea that hourly rate is relevant is the mandate that "[a]ctual emissions shall be calculated using the unit's actual operating hours," § 51.166(b)(21)(ii), since "actual emissions" must be measured in a manner that looks to the number of hours the unit is or probably will be actually running. What these provisions are getting at is a measure of actual operations averaged over time, and the regulatory language simply cannot be squared with a regime under which "hourly rate of emissions," 411 F.3d, at 550 (emphasis deleted), is dispositive.

Environmental Defense v. Duke Energy Corp., 549 U.S. 561, 577-78 (2007); *see also*, *e.g.*, 40 C.F.R. §§ 52.21(b)(21)(ii), (b)(3) (additional references to annual emissions in EPA's PSD regulations); 40 C.F.R. §§ 51.165(a)(1)(vi)(A), (a)(1)(x)(A) & (B), (a)(1)(xxxv), (a)(1)(xxxv)(A)(*4*), (a)(1)(xxxv)(B)(*5*) (analogous references to annual emissions in EPA's NNSR regulations). The proposed rule does not remove this reliance on annual emissions as the metric relevant to the NSR regulations, and

does not provide any reasonable explanation of a new maximum hourly test's consistency with that pervasive construction of the statutory NSR requirements.

Furthermore, because EPA's maximum hourly "achievable" test is not a measure of actual emissions, it is foreclosed by the D.C. Circuit's decision in *New York I* that "the CAA unambiguously defines 'increases' [under section 111(a)(4)] in terms of actual emissions." 413 F.3d at 39. In invalidating EPA's "clean unit" test, the court rejected EPA's argument that NSR applicability can be determined based on whether the physical or operational change would increase allowable emissions. The court cited the plain meaning of the word "emitted" as referring to pollution that a source has actually generated. *Id.* at 39-40. In addition, the word "amount" as used in the phrase "the *amount* of any air pollutant *emitted* by [the] source" further compelled the conclusion that Congress intended the emissions test to focus on whether the change would result in increased actual emissions. *Id.* at 40 (emphasis original); *see also Alabama Power v. Costle*, 636 F.2d at 354 (in enacting NSR, "Congress was concerned with . . . major actual emitters of air pollution"). Similar to the clean unit test, a maximum hourly achievable test would not be a measure of a source's actual emissions prior to and after the change; instead, it would measure emission increases by examining what a power plant *could* emit after a change. That interpretation of the statute is foreclosed by *New York I*. Any assertion by EPA that deference under *Chevron*, 467 U.S. 837, may apply to EPA's new interpretation of the NSR provisions of the Act, *see*, *e.g.*, 83 Fed. Reg. at 44780, has no merit, as the proposed new NSR hourly rate test is contrary to the statutory language and purpose as discussed in these comments.

Recognizing the legal vulnerability of adopting such a test, EPA seeks comment on its assertion from the 2007 proposed rule that an "achievable" test "is equivalent to a measure of actual emissions because 'for most, if not all EGUs, the hourly rate at which the unit is actually able to emit is substantively equivalent to that unit's historical maximum hourly emissions.'" 83 Fed. Reg. at 44,781 (quoting 72 Fed. Reg. 26,202, 26,219 (May 8, 2007)). EPA has failed to provide any evidence that if this ever was the case, it is so now, more than a decade later. Indeed, the fact that the agency is also seeking comment on "whether recent changes to the energy sector have rendered [this assumption] invalid (C-63)," 83 Fed. Reg. at 44,781, signals that EPA has doubts itself. These doubts would appear to be well-founded given the trend since 2007 that the U.S. has moved to higher utilization of cleaner generation with gas and renewable energy and lower utilization of coal-fired power plants. *See*, *e.g.*, M.J. Bradley & Associates, LLC, Issue Brief: Coal-Fired Electricity Generation in the United States and Future Outlook at 2-3 (Aug. 28, 2017), *available at*:

https://www.mjbradley.com/sites/default/files/MJBAcoalretirementissuebrief.pdf; Energy Information Administration, Average utilization for natural gas combined-cycle plants exceeded coal plants in 2015 (April 4, 2016), *at* https://www.eia.gov/todayinenergy/detail.php?id=25652.

EPA also seeks comment on the related question of "whether if, practically speaking, maximum achieved and maximum achievable hourly rates are equivalent for most if not all EGUs, EPA has the flexibility under the CAA to implement an hourly achievable emissions test for NSR (C-64)." 83 Fed. Reg. at 44,781. The simple answer is "no." The statutory definition of modification requires application of NSR to "any" physical or operational change that will result in increased pollution. 42 U.S.C. § 7411(a)(4); *see New York II*, 443 F.3d at 885 (EPA lacked the authority to exempt physical changes below a certain cost threshold where Congress used the expansive term "any" to refer to changes that increased emissions). EPA therefore lacks the "flexibility" to exempt certain changes from NSR through use of its maximum hourly emissions test.

Analysis of the emission reductions currently available under NSR demonstrates that "practically speaking," EPA's proposed maximum hourly rate test, in either the "achieved" or the "achievable" forms, would forfeit large pollution reductions that would likely be required upon modification of power plants under current NSR regulations. Ranajit Sahu, Ph.D., an expert in power plant design, operation and emission generation, analyzed emissions reductions currently available from the application of BACT emissions standards under the PSD provisions to coal-fired electric generating units. Under EPA's proposed maximum hourly rate test, effectively none of these generating units would be subject to BACT or the more stringent "lowest available emissions rate" (LAER) under the nonattainment-new-source-review provisions of the Act. Thus, this analysis provides at least a ballpark estimate of the total amount of emissions reductions no longer available from power plants undertaking modifications should EPA finalize the proposed NSR changes.

For emissions of sulfur dioxide and nitrogen oxides from U.S. pulverized coal generating units not currently scheduled for retirement, he calculated the difference between (a) actual 2017 emissions and (b) hypothetical 2017 emissions using the actual 2017 heat input for the units but a representative BACT emissions rate per million Btus of heat input. *See* Excel Workbook of Ranajit Sahu, Ph.D., Tab "Analysis," attached as ***Exhibit I***. That analysis showed that the application of BACT to power plants not currently controlling emissions to representative BACT or LAER emission rate levels would have reduced sulfur dioxide emissions by over

800,000 tons and nitrogen oxide emissions by almost 500,000 tons. *See id.*, Tab "Analysis," Row 628, Columns AC, AD, AG & AH.

Of course, not all coal-fired power plants will in the future undertake modifications that would trigger NSR requirements under EPA's existing regulations, and implementation of such modifications and accompanying pollution control requirements could change the heat input and thus the emissions levels that Dr. Sahu calculated. Nonetheless, Dr. Sahu's analysis provides an order-of-magnitude estimate of the very large amount of potential emissions reductions that EPA's proposed NSR changes would eliminate—emissions reductions that Congress enacted the statute to provide.

b. The proposed changes are inconsistent with the purposes of the NSR program

EPA's proposed weakening of the NSR program to accommodate its narrow view of the "best system of emission reduction" under the NSPS program also ignores the fact that Congress added NSR in 1977 because it concluded that the existing NSPS program was *insufficient* to address air pollution from power plants and other major stationary sources. *See*, *e.g.*, S. Rep. No. 95-127 at 55 (1977); 123 Cong. Rec. 18022 (June 8, 1977) ("record to date" under NSPS had been "disappointing") (Sen. Muskie); *see also Wisconsin Elec. Power Co. v. Reilly*, 893 F.2d 901, 904 (7th Cir. 1990) (NSPS program had "varying degrees of success in controlling pollution in different parts of the country"). Congress understood, for example, that modified coal-fired power plants located in relatively unpolluted areas could comply with NSPS emission limits and still generate enough pollution to degrade local air quality, *CAA 1977 Legis. History* at 723-28 (statements of Sen. Muskie, chief Senate sponsor of the 1977 amendments); *see Alaska Dept. of Env'l Conservation v. EPA*, 540 U.S. 461, 471 (2004) ("Before 1977, no CAA provision specifically addressed potential air quality deterioration in areas where pollutant levels were lower than the NAAQS.").

Accordingly, Congress enacted the NSR provisions to maintain (in the case of PSD) and improve (in the case of nonattainment NSR) air quality in areas where new or modified plants are located. In contrast to emission standards under the NSPS program, which are based solely on the particular type of equipment or facility emitting the pollutants, the NSR program establishes emission limitations on a case-by-case basis taking into account site-specific factors such as the specific environmental impact a new or modified source will have upon the area where it will be located. *See* 57 Fed. Reg. 32,314, 32,315-16 (July 21, 1992). EPA's proposed

weakening of NSR to accommodate its constrained view of its authority to establish emission guidelines under the NSPS program ignores this statutory structure and history.[93]

EPA's proposed changes are also inconsistent with the specific goals of the NSR program set forth in section 160 of the Act. Throughout the replacement proposal, EPA says nothing about the purpose of the NSR program, instead treating the program as an impediment to the Administration's policy of seeking to increase the use of coal-fired power plants for electricity generation. But Congress' express intent cannot be swept away by EPA's misguided policy choices.

In section 160, Congress set forth several specific goals regarding the PSD program:

- to protect public health and welfare from exposure to pollution, notwithstanding attainment of the NAAQS;
- to preserve, protect, and enhance the air quality in national parks and other areas of special national or regional natural, recreational, scenic, or historic value;
- to insure that economic growth will occur in a manner consistent with the preservation of clean air;
- to assure that emissions from any source in any state will not interfere with any applicable state plan to prevent significant deterioration of air quality for any other states; and
- to assure that any decision to permit increased air pollution is made only after careful evaluation of all the consequences of such decision and after adequate procedural opportunities for informed public participation in the decisionmaking process.

42 U.S.C. § 7470(1)-(5).

EPA fails to acknowledge these express Congressional goals, much less make any attempt to explain how weakening the NSR program is consistent with any of them. As discussed above, the proposed rule would lead to more air pollution than the Clean Power Plan and could also result in in greater emissions of several

[93] EPA's case for having the NSPS provisions effectively trump NSR emission limits is further undermined by the replacement proposal's lack of presumptive emission limits and wide leeway given to states to establish the level of emission standards and compliance deadlines. *See* Section IV.B, *supra*.

pollutants in several states than a repeal of the Clean Power Plan. As set forth above, the additional emissions of pollutants such as nitrogen oxides and sulfur dioxide from power plants is inconsistent with the Congressional goals of protecting public health and welfare from exposure to air pollution, notwithstanding attainment with the NAAQS for ozone and particulate matter. 42 U.S.C. § 7470(1). Likewise, greater emissions of NOx and SO_2 from power plants will undermine efforts to preserve and enhance visibility at national and state parks and hinder downwind states' ability to assure that emissions from upwind sources does not degrade their clean air.

Moreover, more air pollution from coal-fired power plants will make it more difficult for states to ensure that economic growth occurs while preserving clean air (or attaining the NAAQS). The legislative history demonstrates that such a result would be at odds with Congress' intent in the 1977 Amendments that the PSD program, for example, would promote economic growth by ensuring that existing sources, if modified, would not consume all available PSD increments, thereby preventing new sources from constructing in an area:

> In the long run, the growth potential of these clean-air areas may be quickly filled without a reasonable policy to prevent significant deterioration. The first new source built in an area would often absorb the entire available air resource, leaving no capacity for future expansion or growth. Under the policy to prevent significant deterioration in this bill, the growth options should be enlarged. This is because the provision requires that any major source be constructed to utilize the best available control technology. This should usually leave room for additional growth.

S. Rep. No. 95-127, at 31 (1977); *see* 42 U.S.C. §§ 7473, 7479(4) (air quality increments are set by reference to a baseline concentration that includes all actual emissions from facilities in that area). Accordingly, by effectively excluding coal-fired power plants, many of which are now uneconomic to run, from NSR requirements, the proposed rule would allow those plants to use up all of the PSD increment and thus create an obstacle for construction of new and expanded economic facilities in other industrial segments that remain subject to those requirements.

And, by enabling coal-fired power plant owners to extend the lives of their facilities while avoiding the requirements to obtain an NSR permit and limit the modified plant's emissions to BACT levels, the replacement proposal would conflict with the goal of assuring that any decision to permit increased air pollution is made only after careful evaluation of all the consequences and input by the public. Here too, the legislative history demonstrates that EPA's approach is contrary to what Congress intended. The Senate Committee explained that it should be up to the community where a source is proposed to be constructed to decide whether to allow the source to increase emissions such that the increment would be consumed. *See* S. Rep. No. 95-127, at 31 (1977) ("If, under the design which a major facility proposes, the percentage of the increment would effectively prevent growth after the proposed major facility was completed, the State or community could refuse to permit construction, or limit its size. This is strictly a State or local decision: this legislation provides the parameters for that decision."). By enabling facilities to skip the permitting process, EPA's proposal also undermines this goal.

In addition, the proposed NSR changes create an uneven, inequitable distribution of emission reduction requirements that is inconsistent with the statutory structure and purpose. The NSR statutory provisions apply to a variety of large stationary sources. *See*, *e.g.*, 42 U.S.C. § 7479(1) (defining "major emitting facility" subject to PSD requirements to include many types of facilities in other industrial sectors other than power plants); 42 U.S.C. §§ 7602(j) & (z) (defining "major stationary sources" subject to nonattainment NSR as all nonmobile sources emitting more than a certain threshold of air pollutant). The proposed rule's maximum hourly emissions test would virtually eliminate NSR requirements for power plant modifications while leaving those requirements in place for other industries subject to NSR, contrary to the even-handed statutory definitions.

The elimination of those NSR emissions reductions from power plants—among the largest emitters of pollutants such as sulfur dioxide and nitrogen oxides—could also increase the amount of emissions reductions required from other categories of sources, including perhaps smaller sources with fewer financial resources, for NAAQS attainment and regional haze reduction purposes under other provisions of the Clean Air Act. And the sudden, virtual elimination of NSR requirements that would result from addition of the maximum hourly rate test would create inequities for power plants that have previously complied with NSR when undergoing modifications that would have increased annual emissions.

c. Weakening NSR requirements will extend the grandfathering of poorly-controlled power plants, undermining the purpose of the modification provision

The proposed changes to the NSR program are also inconsistent with the purpose of the statute's modification provision. Congress partially "grandfathered" sources built before August 1977 from NSR requirements. Instead of requiring that existing sources that intended to operate past that time be retrofitted with state-of-the-art pollution controls, Congress decided that these facilities would have to obtain a permit and limit their emissions to BACT or LAER levels if they were modified in a way that would increase their emissions. The utility industry represented that many existing plants had limited useful lives and therefore would shut down within a relatively short time. *See*, *e.g.*, H.R. Rep. No. 94-1175 at 159 ("electric utility industry" testified that "it is imprudent to backfit FGD [a control technology] into existing plants, especially older units facing retirement within 10-15 years"); S. Rep. No. 95-127 at 128 (1977) ("There are in the United States approximately 200 old coal-fired power plants over 20 years of age. * * * Most will be totally phased out of operation in the next 5 to 20 years.") (additional views of Sen. Baker). In the words of Senator Patrick Leahy:

> Back in 1977, New Source Review was a part of an agreement to give corporate energy companies a temporary, and I emphasize a temporary, grace period before they adopted modern Clean Air Act standards at their facilities. I was here at the time, and I remember the negotiations that went on between both Democrats and Republicans, the industry and the Administration. We worked out a compromise, and the understanding of the compromise was that everybody would keep their word, including whoever might be in the Administration. The Clean Air Act exempted or grandfathered pre-1977 industrial facilities from immediate installation of modern pollution controls, requiring them to do so only when they made significant modification to their sites. It was a fair and generous concession that gave corporate energy companies the benefit of the doubt.

Joint Hearing Before the Committee on Environment and Public Works and the Committee on the Judiciary, 107th Senate, July 16, 2002. Thus, the 1977

Amendments that created the NSR programs reflected a compromise among many stakeholders, including the utility industry.

The limited nature of grandfathering intended by Congress was underscored by the D.C. Circuit in its seminal decision in *Alabama Power*, 636 F.2d 323. In reviewing EPA's first PSD regulations following the 1977 Amendments, the court held that EPA's exemption for projects that increased emissions by less than 100 or 250 tons per year was contrary to the Act's "clear language," explaining that:

> Implementation of the statute's definition of "modification" will undoubtedly prove inconvenient and costly to affected industries; but the clear language of the statute unavoidably imposes these costs except for de minimis increases. The statutory scheme intends to "grandfather" existing industries; but the provisions concerning modifications indicate that this is not to constitute a perpetual immunity from all standards under the PSD program. If these plants increase pollution, they will generally need a permit.

Id. at 400; *New York I*, 413 F.3d at 27 (citing *Alabama Power*); *see also Wisconsin Elec. Power Co. v. EPA*, 893 F. 2d at 909-10 (rejecting interpretation of modification definition that would "open up vistas of indefinite immunity" from NSR requirements); *In re Tennessee Valley Authority*, 2000 EPA App. LEXIS 25, *79 (EPA Env. App. Bd. 2000) ("[T]he structure of the Act reflects that this grandfathering was envisioned as a temporary rather than permanent status, in that existing plants were required to modernize air pollution controls whenever they were modified in a way that increased emissions.").

It is well-established that coal-fired power plant owners have sought to thwart Congress' intent by modifying their plants in ways that significantly increase their annual pollution without obtaining an NSR permit or limiting their emissions to BACT levels. At the time the 1977 Amendments became law, large coal-fired power generating units built in the 1960s and 1970s were designed for a nominal 30-40 year life. So it was reasonable for Congress to assume that over the following decade or so, many if not all of the existing power plants would either shut down or be retrofitted with BACT- or LAER-level controls so that they could continue to operate.

But that did not happen. By the mid-1980s, extending the life of existing coal-fired generating units was thought to be more attractive economically than building new sources of generation. As the Congressional Research Service found:

> Into the 1970s, coal-fired electric generating facilities were built with a projected useful life of 30-40 years. Over time a powerplant's efficiency declined, until it would be replaced or put on standby for use during emergencies. As the CAA evolved, it established stringent pollution control requirements on newly constructed facilities, but not on older ones unless they underwent a modification that increases emissions (or emitted pollutants that exceeded health-based air quality standards). By the early 1980s, however, it became technically feasible to refurbish a powerplant to preserve its efficiency, so plants could continue in regular operation.
>
> Thus, "life extension" became more advantageous than building new facilities that would incur capital and operating costs of CAA-required pollution controls.

CRS, Clean Air: New Source Review Policies and Proposals, Feb 25, 2003, at Summary, *available at* https://www.everycrsreport.com/reports/RL31757.html.[94]

Many of the coal-fired power plants that did undertake such modifications to extend their life did not notify the relevant permitting authority of the work or otherwise obtain an NSR permit imposing BACT or LAER emissions limitations. These circumstances led to dozens of enforcement cases brought by EPA and states under the Clean Air Act to address harms to public health and the environment. *See* Section VI.B.2, *infra*. As the National Academy of Public Administration noted in its report to Congress on the NSR program, "grandfathering has clearly persisted longer than Congress envisioned or intended." National Academy of Public Administration, *A Breath of Fresh Air: Reviving the New Source Review Program* (Apr. 2003) at 91, available at:

---

[94] *See also* EPRI, Proceedings: Advances in Life Assessment and Optimization of Fossil Power Plants, June 2002, at v (noting the "great importance" of technology for extending the life of fossil-fuel power plants), *available at* https://www.epri.com/#/pages/product/1006965/?lang=en-US.

https://www.napawash.org/uploads/Academy_Studies/03_02ABreathofFreshAirRevivingtheNewSourceReviewProgram.pdf.

Here, the very purpose of EPA's changes to the NSR program is to facilitate extended grandfathering of existing power plants from NSR requirements. *See* 83 Fed. Reg. at 44,777, 44,782 (with the proposed changes under which "fewer sources will trigger major NSR," EPA is "addressing the time delays and costs that can result from NSR requirements"). Furthermore, EPA cites evidence from a 2014 study that nearly 80 percent of power plants emit at higher levels of NOx or SO_2 than would likely constitute BACT levels, *id.* at 44,755, indicating that the agency believes that many existing power plants lack state-of-the-art controls. Dr. Sahu's analysis discussed above is consistent with that conclusion. *See Exhibit I.* In light of the evidence cited above, "[t]here is no reason to believe that such a result was intended by Congress." *WEPCo*, 893 F.2d at 909-10.

The proposed NSR restructuring by EPA would allow repeated future modifications in the existing coal-fired power plant fleet without triggering NSR and therefore without requiring BACT or LAER. That negation of NSR requirements triggered by power plant modifications for most if not all power plants would in turn create an incentive for those plants to undertake such modifications with the result that power plants with high emissions rates that otherwise would retire due to their deteriorated condition would continue to operate—and generate emissions—for years.

Aging power plants require much more maintenance to keep them running safely, which means they are typically available to generate electricity for fewer hours each year than more modern ones.[95] NSR modifications rectify those maintenance problems, thus allowing the plants to operate more hours, and generate a greater amount of electricity and emissions per year. Those annual emissions increases would trigger NSR requirements under the current rules.

It would be almost impossible to trigger NSR under the maximum hourly emissions test contemplated in the proposed rule, however, as many of these

[95] Most components in a coal-fired power plant will show wear and tear as a result of prolonged operation and eventually need replacing. Power plant components are subjected to high pressures and temperatures, repeated cycles of heating and cooling, constant exposure to steam and corrosive impurities including sulfur. The result is a range of damage including creep, fatigue, erosion and corrosion. Boiler tubes and drums, main steam lines, turbine blades and forgings, scrubbers and generator winding supports are among the expensive items that need replacing.

modifications increase annual emissions without increasing the maximum hourly emissions rate. Accordingly, under the Proposed Rule, few if any modifications would trigger NSR for existing coal-fired generating units in the future, and annual emissions from plants undertaking modifications would be higher—because not subject to NSR requirements—than they would be under the current regulations.

But the proposed NSR revisions are contrary to the statutory purpose not only because they would increase *annual* emission amounts from modified power plants over the amounts those plants would emit under the current NSR regulations, but also because by incentivizing modifications that would extend the lives of older plants, this would result in increasing the *number of years* during which they polluted at their uncontrolled, high levels. Courts have "long recognized that '[i]f the repair or replacement of a problematic component renders a plant more reliable and less susceptible to future shut-downs, the plant will be able to run consistently for a longer period of time,' burning more coal and emitting more pollution. *United States v. Ameren Missouri*, 229 F. Supp. 3d 906, 915 (E.D. Mo. 2017) (quoting *United States v. Ala. Power Co.*, 730 F.3d 1278, 1281 (11th Cir. 2013) and citing *United States v. Ohio Edison*, 276 F. Supp. 2d 829, 834-35 (S.D. Ohio 2003)).

Nothing in the record indicates that EPA took this life-extending consequence of the proposed NSR changes into account in any of its analyses of the impacts of the proposed rule. This is another way in which EPA's analysis is inadequate, because the analysis fails to reflect important, relevant facts and as a result provides inaccurate results that likely underestimate the emissions, and thus the health and environmental, impacts of the proposal.

d. EPA's perceived need to create an exemption for heat rate improvement projects from NSR is further evidence that its revised BSER determination is inconsistent with the Clean Air Act

EPA's belief that it needs to weaken the NSR program in order to conform it to the agency's admittedly "constrain[ed]" view of systems of emission reduction under the NSPS program contravenes the statute and is arbitrary and capricious decisionmaking. EPA's conclusion that heat rate improvement projects could in fact result in greater annual air pollution (a finding made in the Clean Power Plan rulemaking and affirmed in the proposed rule), 83 Fed. Reg. at 44,775, should have prompted the agency to re-examine its selection of heat rate improvements as the BSER. In addition, EPA is required under the statute to consider the "cost" of

pollution reduction in determining the BSER, *see* 42 U.S.C. § 7411(a)(1), and that would logically include the costs incurred by a power plant in complying with NSR pollution control requirements (C-59). EPA has ignored that cost in making its BSER determination here, which it cannot do under section 111(a)(1).

e. EPA's contention that minor NSR permitting can mitigate air pollution increases resulting from facilities avoiding major NSR is unsupported by the record

EPA contends that "even if a source undertaking a heat rate improvement is not subject to major NSR requirements, it will often require a minor NSR permit from its permitting agency" and that the permitting agency "may potentially require the installation of air pollution controls." 83 Fed. Reg. 44,782. EPA does not explain the basis for either of these statements, much less demonstrate how minor NSR could effectively take the place of major NSR. In addition, as explained above, the weakening of NSR requirements applies not just to power plant modifications that improve heat rate, but to any projects. *See* Section VI.B.2, *supra*. Regardless, although state minor NSR permitting can provide a useful supplementary role, minor NSR programs vary in their rigor and sufficiency, none can secure emission controls on sources in upwind states that are contributing to cross-boundary pollution, and none can effectively substitute for the provisions Congress included in the Clean Air Act. EPA lacks the authority to allow power plants to avoid the Act's plainly stated major NSR requirements by virtue of the fact that some states may have minor NSR permitting programs that could conceivably mitigate some pollution increases. *See*, *e.g.*, *Massachusetts v. EPA*, 549 U.S. at 533 (holding that EPA could not refuse to comply with statutory requirement to regulate because other programs might address the same problem); *Colorado River Indian Tribes v. National Indian Gaming Comm'n*, 466 F.3d 134, 139 (D.C. Cir. 2006) (agencies are constrained "not only by the ultimate purposes Congress has selected, but by the means it has deemed appropriate and prescribed, for the pursuit of those purposes"). Furthermore, it is not clear that minor NSR programs under Clean Air Act section 110(a)(2)(C) could address PSD issues as opposed to attainment or maintenance issues. *See* 42 U.S.C. § 7410(a)(2)(C) (authorizing program to "assure that [NAAQS] are achieved").

2. The proposed changes weakening NSR will lead to more air pollution

a. EPA has failed to adequately analyze the impacts of its proposed NSR changes to public health and welfare

EPA's justification for the proposed rule is also arbitrary and capricious because it does not present meaningful analysis of an important issue: the local impacts on public health and the environment, both in the area where a power plant emits pollutants and in downwind areas, that would come about as a result of the increased emissions of conventional pollutants under the proposal.

EPA's RIA and other materials in the record demonstrate EPA's incomplete and inadequate effort to show the impacts that heat rate improvements required under the proposed rule or other modifications that would now avoid NSR would have through increased power plant emissions of nitrogen oxides and sulfur dioxide. EPA's efforts consisted of generating several air quality modeling "scenarios" based on different assumptions regarding carbon pollution regulation on power plants: one scenario assumes no federal regulation under section 111(d), another scenario assumes implementation of the Clean Power Plan, and three scenarios assume different levels of heat rate improvements. *See* 83 Fed. Reg. at 44,783. Each of the three heat rate improvement scenarios reflects different assumptions about future conditions. The first assumes a 2-percent heat rate improvement at all power plants subject to the replacement proposal at an average cost of $50 per kilowatt of capacity and does *not* incorporate the proposed changes to the NSR program. The second scenario reflects a 4.5-percent heat rate improvement at an average cost of $50 per kilowatt of capacity, and *does* incorporate the proposed NSR changes. The third scenario reflects a 4.5-percent heat rate improvement at a higher average cost of $100 per kilowatt of capacity and also incorporates the proposed NSR changes.

EPA calculated the difference between a baseline emissions level, using the amount of emissions under the Clean Power Plan, and each of the three alternative heat rate scenarios. EPA performed each of the analyses comparing these scenarios on a national basis, and concluded, among other things, that the proposed rule would result in more emissions nationally of nitrogen oxides and sulfur dioxide by tens of thousands of tons each year under every one of the three scenarios as compared to the Clean Power Plan. 83 Fed. Reg. at 44,784.

But for conventional pollutants like NOx and SO_2, which are harmful pollutants on their own and also contribute to formation of fine particulate matter

and/or ozone, the ultimate effects on human health and the environment will vary by location. In some cases, the conventional pollutants will only impact public health and the environment in the locality where the power plants emit them; in other cases, those pollutants can also impact public health and the environment far downwind and even across state lines, a phenomenon known as pollutant transport. Thus, for example, increased emissions in Houston lead to worse air quality in that area, and increased emissions in Indiana and West Virginia could (in addition to impacting those areas) lead to worse air quality downwind in Maryland, New York, and other downwind states. *See*, *e.g.*, Evan Couzo, *et al.,* Houston's rapid ozone increases: preconditions and geographic origins, 10 Environmental Chemistry 260 (June 28, 2013);[96] 81 Fed. Reg. 74,504, 74,539 (Oct. 26, 2016) (Table V.E-3) (showing linkages between emissions in Indiana and West Virginia and ozone levels in Harford County, Maryland, and Richmond and Suffolk Counties, New York).

Nowhere in the record, however, did EPA provide a detailed, accessible analysis evaluating the local impacts of the increased emissions of conventional pollutants either in the area where the power plants are located or in any downwind areas. The national figures that EPA relies on therefore mask any localized "hot spots" where particularly large impacts on air quality, and thus public health and the environment, may occur. Although EPA did provide state-by-state emissions calculations, as noted above, it did not analyze (with a few limited exceptions, noted below) pollution hot spots. Moreover, compliance with the NAAQS is generally evaluated on a county-by-county basis, not state-wide.

EPA did include in the record several maps illustrating, on a localized basis, (a) the estimated differences in ambient fine particulate matter and ozone levels between the four scenarios and the Clean Power Plan base case for one year (2025), and (b) the estimated difference in premature deaths due to such differences. *See* RIA at 4-30, 4-39. But EPA provided no explanation or discussion of these results and no maps showing the difference between the proposed rule scenarios and the Clean Power Plan in 2030, and no underlying data in any conveniently accessible form in the on-line record. Without the underlying data, the single-page premature death impacts maps—or the even smaller air quality maps—do not provide a

---

[96] *Available at:* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3763807/pdf/nihms503776.pdf; Xue Xiao, *et al.*, Highly nonlinear ozone formation in the Houston region and implications for emission controls, 115 Journal of Geophysical Research D23309 (Dec. 9, 2010), *available at:* https://nph.onlinelibrary.wiley.com/doi/pdf/10.1029/2010JD014435.

sufficient basis to adequately evaluate the impacts. This lack of data is all the more important in that the figures do appear to show localized areas where the proposed rule would significantly worsen air quality and increase premature deaths, but without more detailed analysis and data it is impossible to draw any more specific conclusions about these important—literally life or death—issues.

EPA has a responsibility under the Clean Air Act and under basic principles of administrative law to evaluate these important issues and impacts and explain its reasoning for why it is proposing its replacement rule despite them. Nothing in the RIA evaluates the extent to which these changes in emissions and air quality would affect attainment of any relevant NAAQS in any county. The central purpose of the NSR provisions is to address air quality and the accompanying health and environmental impacts: the purpose of the PSD provisions is to prevent deterioration of air quality even if the NAAQS have been attained, and the purpose of the nonattainment NSR provisions is to improve air quality when the NAAQS have not been attained. *See*, *e.g.*, 42 U.S.C. § 7470(1) (one purpose of the PSD program is "to protect public health and welfare from any actual or potential adverse effect which . . . may reasonably be anticipate[d] to occur from air pollution"); 42 U.S.C. § 7470(2) (one purpose of PSD program is "to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional . . value); 42 U.S.C. § 7470(3) (one purpose of PSD program is "to insure that economic growth will occur in a manner consistent with the preservation of existing clean air resources); 42 U.S.C. § 7470(5) (one purpose of the PSD program is "to assure that any decision to permit increased air pollution in any area to which this section applies is made only after careful evaluation of all the consequences of such a decision). Both the PSD and the NNSR provisions also require consideration of air quality impacts in permitting decisions. *See¸ e.g.*, 42 U.S.C. § 7475(a) (requiring, as part of PSD permitting decisions, that the permitted facility not cause or contribute to emissions exceeding the NAAQS in any area and that an analysis of any air quality impacts for the area as a result of growth associated with the facility be performed); 42 U.S.C. § 7503(a)(1) (requiring emissions analysis to demonstrate that emissions reductions from the permitted modification and other sources will be less than total emissions from existing sources). And EPA has an obligation to notify states of necessary revisions to attainment or nonattainment designations based on air quality planning and control considerations or any other air quality-related considerations the EPA Administrator may deem appropriate. 42 U.S.C. § 7407(d)(3).

In this context, EPA's failure to analyze and provide detailed, accessible analysis of the local impacts of the acknowledged emissions increases that would result from the proposed rule on air quality, including NAAQS attainment, and on public health and the environment more generally, constitutes neglect of an important aspect of the problem and is therefore arbitrary and capricious. *State Farm*, 463 U.S. at 43; *AEP Texas North Co. v. Surface Transp. Bd.*, 609 F.2d 432, 440-41 (D.C. Cir. 2010) (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); *Public Citizen v. Federal Motor Carrier Safety Admin.*, 374 F.3d 1209, 1216-17 (D.C. Cir. 2004) (agency action arbitrary and capricious where agency failed to address a statutorily mandated factor).

Finally, EPA appears to have relied exclusively on the Integrated Planning Model (IPM) to evaluate emissions impacts from the proposed rule, including its proposed weakening of the NSR program. *See* RIA at 3-1. The agency appears to have ignored the warnings of a 2006 National Research Council report that EPA not rely solely on IPM in assessing the air quality impacts to regulatory changes to the NSR program: "We caution that IPM or similar models cannot be used as the sole basis for predicting the effects of the NSR rule changes on electricity generating-facility emissions." National Research Council, New Source Review for Stationary Sources of Air Pollution (National Academies Press 2006) (attached hereto as ***Exhibit J***) at 253. The study, sponsored by EPA, examined previous attempts by EPA to weaken the NSR program, and concluded that IPM is not well suited for localized analyses of changes to NSR: "IPM is a tool for estimating national, or perhaps regional, patterns of emissions, which are important to public health but can overlook significant local variations in effects on a smaller geographic scale." *Id.* at 254; *see also id.* at 257 ("Because of the limitations in IPM, emissions could not be assessed at the level of the generating unit, and any effective strategy must be designed and implemented to guard against potential pitfalls, such as worsening air quality in a particular local area."). The report stated that "[i]f any future assessments of the effects of the NSR rule changes are to be made, the committee recommends that both empirical analysis (that is, of permitting data or investment activities) and modeling (that is, of sectoral responses to regulatory changes or air-quality effects of emission changes) be used." *Id.* at 249; *see also id.* at 260 ("Bottom-up sectoral models of the electric-power industry, such as IPM, should be refined to account better for the influence of NSR and related regulations on plant-level decision making."). Especially in light of the purpose of the NSR program to protect local air quality, it would be arbitrary and capricious for EPA to rely on IPM as the

basis for concluding that any emissions increases are likely to be minimal, and of no concern to public health and welfare.

b. EPA's enforcement cases demonstrate that an NSR emissions test based on maximum hourly emissions will exempt projects that substantially increase annual pollution from Clean Air Act pollution control requirements

EPA's failure to adequately analyze the emissions impacts of weakening NSR is further underscored by the evidence amassed from nearly twenty years of enforcing NSR requirements that the modifications EPA seeks to exempt lead to large increases in air pollution. Both the courts and EPA as litigant have repeatedly acknowledged that modifications to power plants—including potential heat-rate improvement projects, such as economizer replacements—that do not increase the maximum hourly emissions rate can nonetheless lead to large emissions increases through increased utilization of modified generating units. In the cases, EPA found that the power plants performed modifications resulting in hundreds and even thousands of tons of increased annual emissions without obtaining NSR permits or installing pollution controls, thus thwarting the congressional goal of triggering NSR when emissions increase. Many of the States, as well as EPA's own enforcement office, brought this fact to EPA's attention when it initially proposed to change the NSR emissions test in 2005 and 2007. See Comments of New York Attorney General Eliot Spitzer *et al.* on Proposed Rule re. Prevention of Significant Deterioration and Non-attainment New Source Review Requirements: Emissions Test for Electric Generating Units 70 Fed. Reg. 61,081 (Oct 20, 2005), EPA-HQ-OAR-2005-0163-0141 (Feb. 16, 2006); Comments of New York Attorney General Andrew M. Cuomo *et al.* on Supplemental Notice of Proposed Rulemaking for Prevention of Significant Deterioration and Non-attainment New Source Review: Emissions Increases for Electric Generating Units 72 Fed. Reg. 26,202 (May 8, 2007), EPA-HQ-OAR-2005-0163-0318 (Aug. 8, 2007).[97] Enforcement cases brought by EPA after 2005 further affirm this conclusion.

With respect to the enforcement cases brought prior to EPA's previous proposal in 2005 (as supplemented in 2007), we highlight five here. In the enforcement case against Ohio Edison in 1999 for modifications of the Sammis power plant, brought by EPA and several of the States, one of the modifications

[97] Copies of these two sets of rulemaking comments with accompanying exhibits are being re-filed in this rulemaking docket.

increased sulfur dioxide emissions by over 12,000 tons per year and nitrogen oxides by over 3,700 tons per year, amounts orders of magnitude higher than the 40-ton *de minimis* levels for attainment areas. *See United States v. Ohio Edison Co.*, 276 F. Supp. 2d 829, 882 (S.D. Ohio 2003). With respect to another modification, the court found that Ohio Edison should have projected a 5,200-ton emissions increase in sulfur dioxide. The court also held that five of the modifications did in fact increase emissions by more than 1,000 tons per year. *See id*. As discussed in the expert reports submitted in the case by EPA and the States, excess emissions from the Sammis plant caused significant harm to public health and the environment. *See* Expert Report of George D. Thurston, Sc. D. (Oct. 15, 2003) at 31-32; Expert Report of Dr. Charles T. Driscoll (undated) at v-vii (excerpts of these reports are attached hereto as ***Exhibit K***).

Similarly, in EPA's enforcement case against the Tennessee Valley Authority ("TVA"), the EPA Appeals Board found TVA modified its facilities on 13 different occasions without obtaining an NSR permit. *In re TVA*, 2000 EPA App. LEXIS 25. The Appeals Board concluded that TVA should have projected that actual emissions would increase significantly as a result of these upgrades – thereby triggering NSR – and further that subsequent data showed that emissions did in fact increase as a result of 10 of the 13 modifications. 2000 EPA App. LEXIS 25, at *197-98, *217.

In three other EPA enforcement cases brought during the late 1990s and early 2000s – those involving plants owned and operated, respectively, by American Electric Power ("AEP"), Cinergy, and Duke Energy – EPA filed litigation on the basis of its findings that these companies made changes to their plants that triggered the NSR requirements because of the resulting increase in actual emissions. With respect to the AEP power plants, for example, EPA found that:

> As a result of Defendants' continued operation of these plants following these unlawful modifications, and in the absence of appropriate controls, massive amounts of sulfur dioxide, nitrogen oxides, and particulate matter have been, and still are being, released into the atmosphere aggravating air pollution locally and far downwind from these plants. Defendants' violations, alone and in combination with similar violations at other coal-fired electric power plants, have been significant contributors to some of the most severe environmental problems facing the nation today.

United States' Second Amended Complaint in *United States v. American Electric Power Service Corp.*, Case No. C2-99-1182 (S.D. Ohio) ¶ 3 (excerpt attached hereto as ***Exhibit L***).

In all five of these early NSR enforcement cases, the defendant utilities argued that because they had not increased their maximum achievable hourly emissions, they had not triggered the NSR requirements. In response, EPA took the position that such an emissions test would effectively render NSR a nullity for modifications because the provision would essentially never be triggered. For example, in the *Cinergy* case, EPA argued that determining NSR applicability using a maximum achievable hourly emissions test would allow upgrades to go forward causing massive emission increases:

> [T]he PSD annual emissions test which considers both hourly rate and hours of operation is consistent with the purposes of PSD because a project that enables a source to increase its hours of operation could *significantly increase total emissions to the ambient air without affecting hourly rates.* The interpretation advanced by the utility industry simply ignores this possibility. Instead, *an hourly rate test would turn a blind eye to potentially massive quantities of increased annual emissions* by simply assuming that hours of operation following a change will 'remain constant' so long as the hourly rate does not first change. A source could thus simply pretend that a project's [sic] would not affect future utilization, even when the purpose of the change would be to make the unit more available to operate on an annual basis than it was prior to the project. This would be, in essence, an actual-to-pretend-actual annual test.

Memorandum in Support of United States' Motion for Partial Summary Judgment on Emissions Test (Dec. 17, 2004) in *United States v. Cinergy Corp.*, Civil Action No. IP99-1693 (S.D. Ind.) at 34-35 (emphasis added) (excerpts attached hereto as ***Exhibit M***); *see also Exhibit H* at 18 (describing an emissions test that holds hours of operation and production rate constant as "nothing more than a fool-proof way to avoid PSD review").

EPA's position in the *Duke Energy* case further underscores the importance of maintaining the focus of the NSR program on annual emissions, not maximum hourly emissions. There, despite having found that Duke Energy had modified its

plants in such a way as to increase its annual emissions but had not obtained an NSR permit, enabling it to "illegally release[] massive amounts of air pollutants for years," EPA Press Announcement on Duke Energy at 1 (Dec. 22, 2000) (attached hereto as ***Exhibit N***), EPA stipulated to a dismissal of the case after the district court ruled that NSR applicability had to be determined by a maximum hourly achievable test, not a test based on increased annual emissions.[98] This stipulation was prompted by EPA's conclusion that, although it could establish "massive" emission increases under an annual emissions test, it could not make the required showing that *any* of the modifications in the case increased emissions under an a maximum hourly achievable test. *See* United States' Petition for Panel Rehearing and Petition for Rehearing *En Banc* in *United States v. Duke Energy Corp.*, Case No. 04-1763 (4th Cir.) (undated) at 4 (attached hereto as ***Exhibit O***).

Not surprisingly, in light of these cases, when EPA proposed in 2005 to change the NSR emissions test for modifications to one that measured whether a project would increase maximum hourly emissions, EPA's enforcement office argued that the maximum hourly rate test was unlawful. Then EPA air enforcement chief, Adam Kushner, wrote that "conflating the emissions test for triggering NSR with the NSPS emissions test is contrary to Congressional intent." *See* Memorandum from Adam Kushner to William Harnett (Aug. 25, 2005) ("Enforcement Memo") (attached hereto as ***Exhibit P***) at 2, n.1. More specifically, "[t]he 'achievable' test is a measure of the 'potential' emissions of a source (and not an accurate one at that) in the classic and historical use of that term." *Id.* at 9. EPA's air enforcement office concluded that "the effect of the rule is to make very few, if any, changes modifications that trigger NSR." *Id.* at 8.

The Enforcement Memo also supports our argument above, Section VI.B.1, *supra*, that the replacement proposal conflicts with Congress' directive that any decision to permit increased air pollution be made only after careful evaluation of all the consequences of such a decision, including an opportunity for public participation in the decision making process. The air enforcement office analyzed emissions data from EPA's Clean Air Markets Division from four coal-fired electricity generating units with known capacity increases both pre- and post-modification. One of the resulting "case studies" starkly illustrated the failure of the

[98] The district court's decision, which was affirmed by the Fourth Circuit, was reversed by the Supreme Court. *Environmental Defense v. Duke Energy Corp.*, 549 U.S. 561 (2007). The Supreme Court ruled that the lower courts erred in concluding that the modification test had to be the same under the NSPS and NSR programs.

"achievable" emissions test to catch "increases in existing capacity." In that example, the hourly "achievable" emissions rate was calculated to be *more than ten times higher* than the average hourly emission rate achieved in the five-year period prior to the change. Enforcement Memo at 3. As a result, EPA's air enforcement office concluded that "[a]ny increase in capacity or emissions caused by this change would not register because the comparison takes place at a level ten times higher than representative emission rates of the unit." *Id.* Based on its analysis, EPA's air enforcement office concluded:

> [E]ven where we have known capacity increases, the proposed test . . . does not fulfill the stated intent of the proposed regulation. Consequently, one can only conclude from application of the so-called "achievable" test that no "change" causing an emissions increase (capacity or otherwise) at an EGU would trigger NSR requiring the source to seek a pre-construction permit from its permitting authority and install pollution controls.

Id. at 5. EPA has never addressed its own enforcement office's concerns from a decade ago about changing the emissions test. Although EPA never finalized its 2005 proposal, it did adopt this test as a screening device in deciding whether to commence additional NSR enforcement cases. *See* Memorandum from Marcus Peacock, Deputy Administrator to Regional Administrators and State Environmental Commissioners (Oct. 13, 2005) at 2 (attached hereto as ***Exhibit Q***). Applying that screening tool, only one additional NSR enforcement case was brought during the Bush Administration, a lawsuit against a lawsuit against East Kentucky Power Cooperative. *United States v. East Kentucky Power Cooperative, Inc.*, Civ. Act. No. 04-34-KSF (E.D. Ky. filed Jan. 28, 2004).

Information compiled from EPA's more recent NSR enforcement cases (those filed or settled/decided after 2005) further confirms the concerns expressed by its enforcement office a decade ago about changing the NSR emission test for modifications. As in the earlier cases, the more recent cases involved numerous modifications undertaken at coal-fired power plants in which the owners failed to obtain an NSR permit or apply BACT to limit the modified plant's annual

emissions.[99] In the enforcement case brought against Alabama Power, for example, EPA alleged that the modifications to the power plant resulted in "massive" increases in annual emissions.[100] It did not, however, allege that the modifications involved increases in maximum hourly emissions.

Moreover, many of these recent cases in which EPA alleged modifications resulted in significant increases in annual pollution involved the replacement or redesign of economizers, one of the "candidate technologies" EPA has singled out in the proposed rule as the best system of emission reduction. *See* 83 Fed. Reg. 44,756-57, Tbl. 1. Those cases include:

- Duke Energy Corporation (Consent Decree entered Sept. 10, 2015);[101]
- Consumers Energy Company (Consent Decree entered Sept. 16, 2014);[102]
- Allete, Inc. dba Minnesota Power (Consent Decree entered July 16, 2014);[103]
- Wisconsin Public Services Corporation (Consent Decree entered Jan. 4, 2013);[104]
- Dairyland Power Cooperative (Consent Decree entered June 8, 2012);[105]

---

[99] The consent decrees are listed in EPA's website under Coal-Fired Power Plant Enforcement: https://www.epa.gov/enforcement/coal-fired-power-plant-enforcement (last visited Oct. 9, 2018)

[100] *See* Complaint, *United States v. Alabama Power Co.,* Case No. 01-cv-00152-VEH (N.D. Al. filed Jan. 12, 2001) (attached hereto as ***Exhibit R***).

[101] *See* Consent Decree, *United States v. Duke Energy Corp.*, Case No. 1:00 cv 1262 (M.D.N.C. filed Dec. 22, 2000); Amended Complaint, *id.*

[102] Complaint, *United States v. Consumers Energy Co.*, Case No. 14-cv-13580-SJM (E.D. Mich. filed Sept. 16, 2014).

[103] Complaint, *United States v. Allete, Inc.*, Case No. 14-cv-02911 (D. Minn. filed July 16, 2014).

[104] Complaint, *United States v. Wisc. Pub. Servs. Corp.*, Case No. 13-c-10 (E.D. Wis. filed Jan. 4, 2013).

[105] Complaint, *United States v. Dairyland Power Coop.*, Case No. 12-cv-00462 (W.D. Wis. filed June 28, 2004).

- Westar Energy Inc. (Consent Decree entered Jan. 25, 2010); and[106]

- Alabama Power Company (Consent Decree entered Apr. 25, 2006).[107]

The emissions increases from these and other similar modifications are subject to NSR by statute, and EPA's proposed exemption of these modifications is thus contrary to law. EPA's failure to even attempt to provide an explanation for its apparent change in view between the position taken in the enforcement cases and its position in the replacement proposal renders the proposal arbitrary and capricious.

c. The proposed rule would violate the statute's anti-backsliding prohibition

In addition, the proposed NSR changes would violate the anti-backsliding provisions of the Clean Air Act. Section 193 of the Act provides that no control requirement in affect in any nonattainment area before November 15, 1990 may be altered unless the revision insures equivalent or greater emissions reductions. 42 U.S.C. § 7515. The provision accordingly prohibits states from revising their SIPs "unless equivalent or more restrictive standards are adopted." *American Lung Ass'n v. Kean*, 856 F. Supp. 903, 917 (D.N.J. 1994). In the Senate floor debate, Senator Chafee stated that Section 193 "was intended to ensure that there is no backsliding on the implementation of adopted and currently feasible measures that EPA has approved as part of a [SIP] in the past, or that EPA has added to State plans on its own initiative or pursuant to a court order or settlement." 136 Cong. Rec. S17,232, S17,237 (Oct. 26, 1990). EPA has acknowledged that Section 193 prohibits backsliding unless alternative emissions reductions are secured:

> [T]he language is in fact "extraordinarily rigid" in its requirement to provide equivalent or greater emission reductions to offset relaxations to pre-1990 rules ... [S]ection 193 unambiguously requires any relaxations to control requirements or plans in effect prior to enactment of the CAA amendments of 1990 to be offset by equivalent or greater emission reductions. The clarity of the statutory language supported by the

[106] Complaint, *United States v. Westar Energy, Inc.*, Case No. 09-cv-02059 (D. Kansas filed Feb. 4, 2009).

[107] Complaint, *United States v. Alabama Power Co.,* Case No. 01-cv-00152-VEH (N.D. Al. filed Jan. 12, 2001).

> legislative history evidences intent by Congress that relaxations to pre-1990 requirements should occur only where compensating strengthening will result in no increase in emissions.

64 Fed. Reg. 70,652, 70,654 (Dec. 17, 1999) (emphasis added). Furthermore, "compensating reductions must be contemporaneous with the relaxation." *Id.* at 70,656; *see also* 42 U.S.C. § 7410(*l*) (EPA may not approve any SIP revision if the revision "would interfere with any applicable requirement concerning attainment or reasonable further progress . . . . or any other applicable requirement of [the Clean Air Act].").

The current NSR regulations constitute "control requirements" incorporated into SIPs to enable states to attain the NAAQS. *See Lead Industries Ass'n, Inc. v. EPA*, 647 F.2d 1130, 1149 n.37 (D.C. Cir. 1980) (referring to measures in SIPs that impose pollution control requirements on sources); *South Coast Air Quality Mgmt. Dist. v. EPA*, 472 F.3d 882, 900-02 (D.C. Cir. 2006), *clarified on denial of reh'g*, 489 F.3d 1245 (D.C. Cir. 2007). If the proposed rule's provisions become part of SIPs, sources in nonattainment areas could increase their emissions without triggering NSR permitting and pollution control requirements (including in states with power plants that cause pollution problems in downwind areas). Furthermore, contrary to the anti-backsliding provision, the proposed rule does not require equivalent or greater emission reductions. *Cf. City of Waukesha v. EPA*, 320 F.3d 228, 240-42 (D.C. Cir. 2003) (vacating EPA rule that violated the Safe Drinking Water Act's anti-backsliding provision where the statutory language required EPA to maintain at least the level of protection that had been achieved by the existing standard even if science demonstrates that the prior level posed less of a risk than EPA initially thought).

As conceded by EPA and further demonstrated above, the revisions to EPA's NSR regulations set out in the proposed rule would increase emissions of, at a minimum, sulfur dioxide and nitrogen oxides over the amounts that would be emitted if EPA left the current NSR regulations in place. This would occur both nationwide and in specific areas, including nonattainment areas. Promulgation of the NSR revisions set out in the proposed rule would thus interfere with the requirement to attain the NAAQS both in areas where the emissions took place and in downwind areas in violation of the anti-backsliding prohibitions of Sections 193 and 110(*l*).[108]

---

[108] The removal of NSR as a regulatory control under the proposed rule would effectively reduce upwind states' compliance with the "good neighbor" requirements under

3. The proposed NSR changes would improperly exempt projects that are not required for compliance with the proposed rule

EPA's proposed NSR changes go well beyond those necessary to accomplish EPA's own stated goal of removing obligations under the NSR program to control conventional pollutants for power plants undertaking heat rate improvement requirements that states may impose pursuant to the replacement proposal.

EPA reports the claim by some stakeholders that power plants may forego voluntary heat rate improvement projects because of the cost of NSR compliance. 83 Fed. Reg. at 44,775, 44,776-77. But EPA offers no specific examples of this occurring. As support for the proposition that NSR may inhibit efficiency improvements, EPA cites an article that finds that many power plants currently do not meet NSR permitting and emission-reduction requirements but might have to meet those requirements if they freely chose, or if an agency compelled them, to undertake heat rate improvements as a means to reducing carbon dioxide emissions. 83 Fed. Reg at 44,776 n.49 (citing Adair, S., *et al.*, New Source Review and coal plant efficiency gains: How new and forthcoming air regulations affect outcomes, 70 Energy Policy 183 (2014)).[109]

But disincentives to voluntary action are not an issue here since the idea underlying the proposed rule is that state section 111(d) plans would *require* power plants to undertake heat rate improvement projects. Given that framework, the question is simply what the compliance cost for power plants would be. For some power plants, a required heat rate improvement project would result in annual emissions increases due to increased utilization, and that could trigger NSR control obligations under current EPA regulations; for other plants, the required heat rate improvement would not result in such emissions increases and thus would not

---

42 U.S.C. § 7410(a)(2)(d)(i) by allowing greater upwind contributions to nonattainment and maintenance problems in downwind areas.

[109] EPA fails to note that the article itself criticizes the NSR changes EPA now proposes. The article states that the Clean Air Act "appears to preclude the EPA from excluding 111(d) compliance projects from NSR," and cites *New York I* for the proposition that "EPA has no statutory authority to exclude pollution control projects from NSR to the extent that such projects increase emissions." Adair, S., *et al.*, New Source Review and coal plant efficiency gains: How new and forthcoming air regulations affect outcomes, 70 Energy Policy 183, 191 (2014)). The article then suggests as a solution allowing states to develop "flexible plans that contain no unit-specific compliance requirement," *id.*, in effect endorsing the alternative that the Clean Power Plan allows and that the proposed rule seeks to eliminate.

trigger control obligations. Thus, it is only for the modifications that are expected to increase pollution that power plants would incur NSR costs. The D.C. Circuit held that EPA's previous attempt to exclude air pollution control projects from NSR requirements on similar grounds was unlawful, as there was "nothing 'absurd' about increasing the regulatory cost of projects that increase collateral emissions." *New York I*, 413 F.3d at 41. In any event, EPA provides no analysis of what percentage of heat rate improvement modifications would be expected to cause such increases.

Tacitly acknowledging that disincentives to voluntary action are not the issue here, EPA provides as the rationale for its proposed NSR changes the fact that the state section 111(d) plans under the proposed rule would *mandate* heat rate improvement projects, and thus in some cases mandate NSR compliance costs. 83 Fed. Reg. at 44,777 (the "dynamic takes on a new character" because under the proposal, power plants could not "choose to forego a project to avoid NSR permitting"). But as noted above, the proposed rule covers *all* types of power plant modifications currently subject to NSR, not just a limited subset of heat rate improvement projects potentially required under the proposal. Thus, EPA's stated *rationale for the NSR changes* under the proposal only applies to efficiency-enhancing heat rate modifications, but *the changes themselves* apply to a much broader category of modifications for which the rationale does not apply (even if that rationale had merit). That is because, as discussed above, EPA's replacement proposal would exempt modifications at power plants from NSR requirements if the modification is not expected to increase the maximum hourly emissions rate. *See*, *e.g.*, 83 Fed. Reg. at 44,780. The proposal would exclude *all* modifications meeting that criterion. *See* 83 Fed. Reg. at 44781 (requesting comment on whether the proposed changes should be limited in scope). Accordingly, even on EPA's own terms, the narrowly applicable rationale does not justify the broadly applicable NSR changes, and a decision to finalize any such broadly applicable NSR changes based on an inconsistent and mismatched rationale would be arbitrary and capricious. *See*, *e.g.*, *State Farm*, 463 U.S. at 43 (agency must articulate a "rational connection between the facts found and the choice made"); *Delaware Dept. of Nat'l Res. & Envt'l Control v. EPA*, 785 F.3d 1, 17-18 (D.C. Cir. 2015) (vacating a nationwide exemption when EPA failed to explain why it promulgated that broad exemption rather than a narrower one limited to areas where the problem sought to be addressed existed).

For the same reason, EPA's modeling of the air quality impacts of its changes to NSR requirements is flawed because EPA's modeling only included impacts from

heat rate improvement projects, not the universe of modifications to power plants that EPA's proposed NSR changes would exempt from regulation. And as discussed above, the evidence from EPA's own enforcement cases provides numerous examples of projects that increased the availability of a plant, thereby increasing its pollution of NOx or SO_2 by hundreds or thousands of tons.

This limitation of EPA's analysis to a subset of the qualifying emissions-increasing modifications is arbitrary and capricious for several reasons. First, it means that the analysis on which EPA bases its proposed NSR changes is not consistent with the proposed changes. The analysis therefore does not provide reliable support for any conclusions EPA seeks to draw regarding the impacts of those proposed changes (in addition to the flaws discussed above).

In addition, many if not all of the modifications not mandated by a state 111(d) plan—but nonetheless exempt from NSR requirements under the proposed rule—would be done to improve the availability of the generating unit or for other purposes unrelated to heat rate improvements and would thus not have efficiency-enhancing benefits. Accordingly, the increased utilization associated with those modifications would lead directly to increased emissions, without any offset for improved efficiency in electric and pollution generation.[110]

EPA further asserts that the proposed NSR changes would avoid "conflict" between the current NSR requirements and the section 111(d) provisions set out in the replacement proposal. 83 Fed. Reg. at 44,782. But there is no conflict. The proposed rule's section 111(d) provisions would, according to EPA, serve to reduce carbon dioxide emissions that contribute to climate change; the current NSR

[110] Because NSR controls such as flue gas desulfurization or selective catalytic reduction generally increase operating costs, they have the opposite effect on dispatch and utilization from heat-rate improvements: a heat-rate improvement would tend to lower operating costs and thus increase utilization, while operation of NSR controls would tend to increase operating costs and thus reduce utilization. Thus, for generating units on which heat-rate modifications were undertaken, EPA's proposed weakening of NSR requirements increases conventional pollution in two ways: by increasing the hourly emissions rate because sources would not install and operate controls, and by increasing the hours of operation because sources would have greater efficiency and thus lower operating costs. Similarly, for generating units on which modifications to improve availability were undertaken, EPA's proposed weakening of the NSR requirements would also increase conventional pollution in two ways: by increasing the hourly emissions rate because sources would not install and operate controls, and by increasing the hours of operation because sources would have greater availability, that is, would not be off line for repairs as frequently.

requirements serve, at a minimum, to reduce conventional pollutant emissions to address a variety of human health and environmental harms. To the extent that a source's obligations to reduce carbon dioxide emissions lead to emissions increases that trigger NSR requirements, there is no inconsistency in requiring the source to meet those NSR requirements. It is frequently the case that power plants have to address multiple pollutants through multiple control measures and programs, for example, installation of low-NOx burners to meet reasonably available control technology requirements for nitrogen oxides, installation of flue gas desulfurization technology to address sulfur dioxide emissions for interstate transport purposes, and installation of electrostatic precipitators to control local particulate matter emissions. There is no reason why, as a legal or factual matter, power plants cannot undertake heat rate improvement projects for 111(d) purposes and also install and operate any necessary controls for NSR purposes. *See*, *e.g.*, *Massachusetts v. EPA*, 549 U.S. at 532 (EPA cannot refuse to implement a statutory duty when that duty overlaps another statutory duty but does not create inconsistency between the two duties).

Finally, EPA asserts that the NSR revisions are severable and thus might be upheld or promulgated separate from the 111(d) or other components of the proposed rule. 83 Fed. Reg. at 44,783. Any such independent promulgation of the NSR revisions based on the record here would be arbitrary and capricious: EPA has not established a stand-alone rationale for the proposed changes, and has not provided a stand-alone analysis to calculate the change in emissions, health or environmental impacts resulting from the proposed NSR changes without the proposed 111(d) requirements.

4. The *UARG* decision does not support EPA's attempts to weaken the NSR program

EPA seeks comment on whether EPA "can apply the reasoning of *UARG [v. EPA*, 134 S. Ct. 2427, 2439-41 (2014)] to read the definition of 'modification' in this context to afford more flexibility to exempt sources from NSR requirements when they are compelled to make changes by an NSPS (Comment C-69)?" The answer is no. To begin with, as EPA argued in its merits brief in *West Virginia v. EPA*, UARG presented an unusual situation in which EPA's interpretation of the PSD and Title V permitting provisions as applied to stationary source emitters of greenhouse gases would have swept in thousands and millions, respectively, of smaller sources into these programs, a result unintended by Congress. *See* EPA Br. at 42-43; *see UARG*, 134 S. Ct. at 2443 (PSD program is "designed to apply to . . . a relative

handful of large sources"). By contrast, here EPA would exempt the largest sources of greenhouse gases and other major pollutants from NSR permitting and pollution control requirements. As the UARG court held, EPA cannot "rewrite clear statutory terms to suit its own sense of how the statute should operate." 134 S. Ct. at 2446.

In addition, EPA's current NSR regulations already have "flexibility" built in for modifications. The Supreme Court in *UARG* upheld the aspect of the regulations providing that the requirement to comply with BACT is only triggered for greenhouse gases when it is first triggered due to a projected significant increase in conventional pollutants, such as NOx or SO_2. *Id.* at 2448-49.[111] In light of the unambiguous statutory language that requires compliance with NSR for "any" physical or operational change that increases emissions, *see New York II*, 443 F.3d at 884-87, 890, EPA lacks the authority to exempt modifications as it has proposed here.

* * *

In sum, EPA's proposed weakening of the NSR program as a way to address the pollution increases its proposed rule is likely to cause is contrary to the Clean Air Act and relevant court precedent. Instead, the likelihood such pollution increases will occur should lead EPA to conclude that its BSER determination in the proposed rule must be re-evaluated.

VII. ECONOMIC IMPACTS OF THE PROPOSAL

This section provides comments on the evaluation of economic impacts of the proposed rule in the RIA. The RIA, like the RIA for EPA's proposed repeal of the Clean Power Plan, is undermined by several fundamental flaws, including: utilizing inappropriate discount rates and underestimating the co-benefits and the social cost of carbon. As a result, the RIA significantly understates the net benefits afforded by the Clean Power Plan relative to the proposed rule. Therefore, any policy decision based on the RIA would not properly account for public health and welfare, contrary to the basic aim of the Clean Air Act.

Despite these flaws and their implications, the RIA for the proposed rule, like the RIA for the proposed repeal, does provide further evidence that the Clean Power

[111] Under EPA's regulations, NSR cannot be triggered based on an increase solely in greenhouse gas emissions. Instead, an existing source will trigger NSR under the modification provision if the physical or operational change would significantly increase emissions of a conventional pollutant (such as NOx or SO_2) and also cause an increase in more than 75,000 tons per year of greenhouse gases. *See* 40 C.F.R. 52.21(b)(49)(i).

Plan—compared to any replacement or repeal being considered by EPA—would substantially benefit public health by preventing additional avoidable deaths and illnesses. In fact, despite the various flaws discussed below in the RIA that underestimate the foregone benefits of the Clean Power Plan, the RIA nonetheless shows that the Clean Power Plan delivers net benefits substantially greater than any of the various iterations of the proposed rule. This additional evidence emphasizes the significance of what is at stake and acknowledges the "life or death" impacts of the regulation of power plant pollution on individuals—a perspective that can be lost when distilling a complicated issue down to an aggregate cost-benefit analysis.

A. The RIA Underestimates the Foregone Benefits of Reducing Carbon Pollution

1. EPA erroneously failed to consider international costs of climate change in calculating the social cost of carbon

The RIA for the proposed rule underestimates the social cost of carbon by only considering impacts "within U.S. borders."[112] EPA fails to explain its rejection of the social cost of carbon developed by the Interagency Working Group, which, using the best available methodologies and data, included impacts outside of the U.S. that impact our country.[113] The Seventh Circuit Court of Appeals upheld this metric against a similar domestic-only argument, 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. Department of Energy*, 832 F.3d 654, 679 (7th Cir. 2016). EPA's approach is also directly at odds 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."[114] By narrowing consideration of the social cost of carbon to impacts "within U.S. borders," the RIA erroneously assumes (1) any benefits that occur

---

[112] RIA at 4-2.

[113] *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.

[114] Nat'l Academy of Sciences, Engineering, & Medicine, *Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide* (2017) ("*Valuing Climate Damages*"), at 53 (Repeal Comments JA, Att. I8).

outside of U.S. borders from the Clean Power Plan have no impact on the welfare of U.S. citizens or residents; and (2) climate change policy in other countries is made completely independently of U.S. climate change policy.

Instead of incorporating global impacts into their main analysis, the RIA considers the "forgone global climate benefits" from the proposed rule as a stand-alone sensitivity analysis.[115] However, this sensitivity analysis does nothing to repair the errors inherent in the RIA's estimate of domestic benefits. Put simply, even when accepting the notion that only domestic benefits should be considered, the RIA is flawed because it fails to consider non-domestic factors that will have significant impacts on domestic benefits. Furthermore, because the treatment of forgone global climate benefits is incorporated as a sensitivity analysis, "it is not possible to present analogous estimates of international costs resulting from the proposed action." RIA at 4-7.

EPA's assumption that any benefits that occur outside of U.S. borders have no impact on the welfare of U.S. citizens or residents within U.S. borders has many logical flaws, including:

- It ignores the fact that intended beneficiaries of U.S. policy (in general) live outside of U.S. borders (*e.g.*, U.S. citizens living abroad) and that their welfare is directly impacted by effects of climate change outside of U.S. borders.
- It implicitly assumes that U.S. citizens and residents derive no utility from the welfare of citizens of other countries.
- It fails to account for climate change effects on foreign trading partners and the resulting impacts to domestic welfare. For example, the United States and Canada have interconnected electricity grids. As such, climate change and its effect on Canadian water resources and reliant hydroelectricity generators are matters of importance to U.S. electricity consumers.[116]
- It ignores the fact that lower economic growth in other regions could reduce demand for U.S. exports, and lower productivity could increase the prices of U.S. imports.[117]

---

[115] RIA at 4-6,7; 7-7,8.

[116] *See* Vliet, Wiberg et al. "Power-generation system vulnerability and adaptation to changes in climate and water resources." Nature Climate Change. Vol 6, April 2016 (Repeal Comments JA, Att. B75).

[117] *Valuing Climate Damages* at 53.

- It implicitly assumes that U.S. residents do not travel and derive no utility from physical impacts outside of the U.S. (*e.g.*, it assumes that if rising sea levels inundate Venice, then U.S. residents would be no worse off).
- It ignores the fact that, as the Department of Defense reported in 2015, "climate change is an urgent and growing threat to our national security, contributing to increased natural disasters, refugee flows, and conflicts over basic resources such as food and water."[118]

Therefore, many benefits that deserve consideration in the determination of a domestic social cost of carbon are ignored by the RIA, which consequently underestimates the true social cost of carbon "within U.S. borders."

The EPA's implicit assumption that other countries' climate change policies are made completely independently of U.S. policy is also fundamentally flawed. This assumption ignores economic theory showing that an individual country can maximize domestic benefits—in a country's self-interest—when its climate change policy accounts for the *global* social cost of carbon.[119] Conversely, a climate change policy that considers only the domestic social cost of carbon is economically *inefficient* and foregoes domestic benefits—against a country's self-interest. Put differently, by considering the welfare of foreign countries in the social cost of carbon, an individual country gains leverage to encourage foreign countries to do the same, hence increasing globally shared benefits created from coordinated action. Therefore, ignoring non-domestic benefits in the social cost of carbon is not in a country's rational self-interest because doing so foregoes benefits gained from reductions in carbon pollution by foreign entities. For example, the United Nations Framework Convention on Climate Change featured elements that demonstrate how the members considered the interdependence of policy decisions across countries including the importance of repeated interaction between nations, complete information, the potential use of transfer payments between nations, and commitments for climate finance to developing countries.[120]

---

[118] *National Security Implications of Climate-Related Risks and a Changing Climate*, report to Congress, July 23, 2015 (Department of Defense).

[119] *See, e.g.*, Kotchen, Matthew J., "*Which Social Cost of Carbon? A Theoretical Perspective*," Journal of the Association of Environmental and Resource Economists (forthcoming), *available at*: http://www.nber.org/papers/w22246.pdf.

[120] *Id.* at 13.

The idea that the United States has an interest in the global effects of greenhouse gas emissions was not the creation of the last presidential administration. During the George W. Bush Administration, for example, EPA explained that it is basic economic theory that in considering a global problem like climate change, costs to all in society be considered:

> 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).[121]

In the end, both the idea that the United States has no interest in what happens in other nations, and the idea that the United States' actions will not affect what other nations do, defy common sense and history. If the United States has no interest in what happens in the rest of the world, the Marshall Plan was irrational. It was a waste of breath for President Reagan to say "Mr. Gorbachev, tear down this wall." In the context of climate change, it is equally obvious that the United States' actions are likely to affect those of the rest of the world. If the United States—one of the world's largest carbon emitters—is not joining the effort to meaningfully reduce greenhouse gas emissions, other nations may say "what's the point?"

---

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

In *State Farm*, the Supreme Court said that one of the indications that an agency's action is arbitrary and capricious is if its explanation for the action is "so implausible that it could not be ascribed to a difference in view or the product of agency expertise." *State Farm*, 463 U.S. at 43. That the United States has no interest in the rest of the world's climate change effects, and that nobody will follow the United States' lead in deciding whether to prioritize reducing greenhouse gas emissions, is patently implausible.

2. EPA inappropriately used a 7-percent discount rate to evaluate climate change costs

The RIA for the proposed rule incorporates net present value ("NPV") calculations that utilize various discount rates. The RIA uses a 7-percent discount rate in many of its cost, benefits, and net benefits calculations, which differs from the Clean Power Plan RIA's use of discount rates in the range of 2.5 to 5 percent, ranges based on the work of the Interagency Working Group. *Compare* RIA at ES 11-19 *with* Clean Power Plan RIA, Tables ES-7 and ES-9.[122] This 7-percent discount rate overstates the opportunity cost of avoided compliance costs, overstates the uncertainty of future benefits, and erroneously biases the cost-benefit analysis toward current generations at the expense of the social welfare of future generations. Therefore, the use of a 7-percent discount significantly underestimates of the NPV of the Clean Power Plan.

A 7-percent discount rate overstates the opportunity cost of compliance in the Clean Power Plan relative to the proposed rule. The costs of any section 111(d) emission guideline occur sooner than many of the expected benefits. Furthermore, all else being equal, using a higher discount rate will increase the NPV of compliance costs relative to benefits. Therefore, since the reported benefits of the Clean Power Plan are greater than those of the proposed rule, using a 7-percent discount rate will understate the net benefits of the Plan relative to the proposed

---

[122] 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 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.

rule. In addition, to the extent that the 7-percent discount rate is used as a proxy for the opportunity cost of capital, RIA at 7-5, it overstates the actual return the entities making compliance investments would expect to realize from alternative investments.

A 7-percent discount rate also overstates the uncertainty of future benefits associated with the Clean Power Plan and therefore understates the current value of future benefits. In NPV calculations, a discount rate often reflects the uncertainty of a future stream of value. The RIA overstates the actual uncertainty by using a high discount that lacks a scientific foundation. EPA argues that 7 percent is intended to "represent the average before-tax rate of return to private capital in the U.S," RIA at 4-3, but does not provide any justification for why this discount rate should be used to discount benefits from any emissions guidelines including "uncertainty in monetizing climate-related benefits." *Id.* at ES-21. Unlike with respect to how individual businesses may plan investments, where decisions not to invest can be revisited on an ongoing basis and reversed as needed, EPA must provide certainty to the regulated community and the environmental impacts are often not reversible.

A 7-percent discount rate also biases the consideration of benefits toward the current population at the expense of the welfare of future generations. Economists generally accept the notion that individuals value benefits now more than the same benefits in the future, so that it makes sense for an individual's NPV calculation to incorporate some form of discounting. In the context of climate change, however, a high discount rate significantly underestimates the real costs our states and residents will suffer, in particular future generations. *See* Comments of Fourteen State Agencies on EPA's Proposed Repeal of the Clean Power Plan at 12. Specifically, a 7-percent rate discounts impacts 30 years out by around 90 percent, which is the equivalent of EPA absurdly saying that it is appropriate to care only 10 percent as much about what happens in our children's lifetimes as our own. And notwithstanding the fact that economic experts have questioned applying such a high discount rate to intergenerational effects and the Office of Management and Budget has concluded that a discount rate of 7 percent is not appropriate for effects experienced on a long time horizon, such as climate change, *see id.*,[123] EPA failed to explain its departure from the discount rates used in the Clean Power Plan RIA and its choice of a 7-percent rate in the proposed rule RIA.

---

[123] *See also* Guidelines for Preparing Economic Analysis, Section 6-15; Clean Power Plan RIA at ES-19.

In addition, EPA failed to meaningfully consider a declining discount rate and/or a discount rate of lower than 3 percent. The case for why EPA should consider lower discount rates was made by the agency itself 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. Although EPA did conduct a sensitivity analysis with a 2.5-percent discount rate, it provided little discussion of applying this rate, much less any lower rates in the range referred to in the quoted language above. By contrast, a recent survey of experts showed that 62 percent believed that the appropriate discount rate should be lower than 2.5 percent.[124]

EPA also arbitrarily failed to consider using a declining discount rate.[125] "[A]n increasingly prevalent view among economists supports the use of declining interest

---

[124] 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 on EPA Docket No. EPA-HQ-OAR-2017-0355), Maximilian Auffhammer, October 24, 2018, at 12.

[125] EPA acknowledges that "some experts have argued [for] a declining discount rate," but dismisses the idea with the comment that "additional research is needed to develop a methodology." RIA at 7-6. EPA does not acknowledge that Great Britain, for example - as noted below - has actually adopted a methodology. Moreover, the argument that "additional research is needed to develop a methodology" could be used to dispute the entire idea of assigning a cost to carbon. EPA acknowledges (RIA 7-2) that "[t]here are

rates because of uncertainties about future economic growth." Daniel A. Farber, *The Case for Declining Discount Rates*, The Regulatory Review (April 7, 2014).[126] One of the reasons for using a discount rate is the assumption that society will get richer; therefore, a dollar today is worth more than a dollar in twenty years. But the assumption that economies will continue to grow at rates seen in the recent past becomes weaker the farther into the future you project. Human history, after all, is not a history of consistent economic growth.[127] Moreover, climate change itself poses a grave risk to future economic growth. A 2015 survey of experts found that "[m]ore than three-quarters of respondents believe that climate change will have a long-term, negative impact on the growth rate of the global economy," and under a scenario of global mean temperature increases of 3 degrees Celsius, "[e]xperts believe that there is greater than a 20% likelihood that this … would lead to a "catastrophic" economic impact (defined as a global GDP loss of 25% or more)."[128]

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 defies common sense. 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.

---

various sources of uncertainty in the SC-CO2 estimates used in this RIA," but goes on to say "[i]t is important to note that even in the presence of uncertainty, scientific and economic analysis can provide valuable information to the public and decision makers." Thus, despite acknowledged uncertainty, EPA is comfortable with assigning a reduced cost to carbon, using high discount rates, but refuses to seriously consider the idea of a declining discount rate, citing the need for "additional research."

[126] The British government uses a declining discount rate – 3 percent for 0 to 30 years, 2.57 percent for 31 to 75 years, 2.14 percent for 76 to 125 years, 1.71 percent from 16-200 years, 1.29 percent for 200-300 years, and 0.86 percent for 301+ years. *Intergenerational wealth transfers and social discounting: Supplementary Green Book guidance,* Joseph Lowe (for Her Majesty's Treasury) (July 2008), at 5.

[127] For example: "Following the collapse of per capita incomes in Italy in the mid-fifteenth century, it took more than 400 years to regain [previous] levels of GDP per capita. Portugal suffered a dramatic collapse of roughly 40 percent of per capita GDP in the first half of the sixteenth century, associated with poor weather conditions (Reis et al. 2013) – though it recovered partially in the subsequent two decades. The Spanish economy also declined from the end of the sixteenth century …" *Seven centuries of European economic growth and decline* Roger Fouquet and Stephen Broadberry, Centre for Climate Change Economics and Policy Working Paper No. 232 (Sept. 2015), at 6.

[128] *Expert Consensus on the Economics of Climate Change*, Peter Howard and Derek Sylvan, Institute for Policy Integrity (Dec. 2015), at 1-2.

To use an analogy, suppose scientists were aware of a threat, such as an asteroid, that they predict would kill 1 billion people when it collides with the Earth in 500 years. Using a 3-percent discount rate, 1 billion lives in 2518 are only worth 381.41 lives today. EPA currently values each life at $10.5 million. RIA at 4-23. That means that the present value of 1 billion lives in 2518 is slightly over $4 billion. If one were to solely base a decision now about whether to take action to avoid that catastrophe based on that discount rate, it would be irrational to make a $5 billion investment today in order to avoid a catastrophe causing a billion deaths in 2518. That is the logic EPA is adopting here in refusing to consider lower discount rates in the climate change context.

3. EPA failed to meaningfully consider the non-monetized costs of climate change that are not incorporated in the social cost of carbon models, as required by OMB Circular A-4 and Supreme Court precedent

EPA also failed to adequately analyze the non-monetized benefits of reducing carbon pollution. OMB Circular A-4 specifically requires that "[w]hen there are important non-monetary values at stake, you should also identify them in your analysis,"[129] 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."[130] In addition, OMB warned that "the most efficient alternative will not necessarily be the one with the largest quantified and monetized cost-benefit estimate."[131]

In the RIA for the proposed rule, EPA admitted that there were "important impacts" that it could not monetize. EPA stated that "[d]ue to current data and modeling limitations, [its] estimates of the benefits from reducing CO_2 emissions do not include important impacts like ocean acidification or potential tipping points in natural or managed ecosystems." RIA at 6-1. Yet, the agency failed to follow the instructions in OMB Circular A-4 that it include a summary table that lists all the unquantified benefits and costs, and use the agency's professional judgment to highlight those that are most important.

---

[129] OMB Circular A-4 at 3.

[130] *Id.* at 27.

[131] *Id.* at 2.

The paper *Omitted Damages: What's Missing From the Social Cost of Carbon*[132] details some of the numerous costs of climate change that are not included in the social cost of carbon models:

> These omissions include 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).[133]

The paper subsequently elaborates, pointing out, *inter alia*, that damages which "for all real purposes, are excluded" include damage to "fisheries, energy supply, transportation, communication, and recreation and tourism."[134] The fact that the social cost of carbon models omit these important factors is a major reason why a majority of climate economists surveyed believe that the model-based cost of carbon estimated by the Obama Administration was too low.[135]

As detailed in Appendix A hereto, damages caused by ocean acidification and wildfires are not just theoretical: they are among the damages of climate change that states are already experiencing. Just to mention a few examples, wildfire smoke has threatened human health in California, North Carolina, Oregon, and Washington; and ocean acidification is threatening shellfish populations in California, Maine, Oregon, Rhode Island, and Washington. Meanwhile, states such as Maryland and North Carolina describe the threat that climate change poses to tourism.

In addition, the National Academy of Sciences, in its 2017 report, "Valuing Climate Damages," identified another category of damages that is largely ignored by the social cost of carbon models: "loss of cultural heritage, historical monuments,

---

[132] Peter Howard, for EDF, NRDC and the Institute for Policy Integrity (2014).

[133] *Id.* at 5.

[134] *Id.* at 17.

[135] *See* "*Expert Consensus on the Economics of Climate Change,"* Peter Howard and Derek Sylvan (Institute for Policy Integrity, 2015) at 19, describing a survey of 365 climate economists: "More than half of respondents believed that $37 is too low of a value for the SCC, and more than two-thirds believed that actual SCC was equal or greater than $37. Twice as many experts had no opinion (16%) as believed that the SCC is too low (8%)."

and favored landscapes."[136] It should be self-evident that this is an "important aspect of the problem" of climate change. To give a few examples:

- By 2100, Massachusetts is projected to experience between 4.0 and 7.6 feet of sea level rise (relative to the mean 2000 level), with up to 10.2 feet of sea-level rise under a high-emissions scenario.[137] Related impacts threaten loss of and damage to nationally important cultural and historical resources in the City of Boston and other coastal areas.

- A 2016 report by UNESCO (the United Nations Educational, Scientific and Cultural Organization), UNEP (United Nations Environment Programs) and the Union of Concerned Scientists explained that the Statue of Liberty is at grave risk from climate change, and Yellowstone National Park could be unrecognizable.[138] It noted that "[a] 2015 vulnerability analysis carried out by the National Park Service on its coastal properties concluded that 100 percent of the assets at Liberty National Monument are at 'high exposure' risk from sea-level rise due to the extremely low elevation of the island and its vulnerability to storms."[139]

EPA's neglect of these omitted damages, and its disregard of OMB Circular A-4, is arbitrary and capricious. EPA has "entirely failed to consider an important aspect of the problem," *State Farm*, 463 U.S. at 43, and it has ignored Justice Scalia's observation in *Michigan v. EPA* that "any disadvantage could be termed a cost." *Michigan v. EPA*, 135 S. Ct. 2699, 2707 (2015).

---

[136] *Valuing Climate Damages – Updating Estimation of the Social Cost of Carbon Dioxide*, National Academy of Sciences (2017), at 152.

[137] *See* Massachusetts Climate Change Projections (2018), https://nescaumdataservices-assets.s3.amazonaws.com/resources/production/MA%20Statewide%20and%20MajorBasins%20Climate%20Projections_Guidebook%20Supplement_March2018.pdf.

[138] *World Heritage and Tourism in a Changing Climate*, UNESCO, UNEP, and the Union of Concerned Scientists, at 52-59 (2016).

[139] *Id.* at 58.

B. The RIA for the Proposed Rule Underestimates the Foregone Co-Benefits of the Clean Power Plan

In addition to the issues regarding discount rates mentioned above, the RIA for the proposed rule changes the methodology used in the Clean Power Plan RIA resulting in a relative underestimation of the public health benefits of the Clean Power Plan. In particular, the RIA's incorporation of compliance thresholds from the NAAQS eliminates all foregone benefits associated with exposure to air pollution below those standards, and thus significantly underestimates the actual benefits of the Clean Power Plan. There is no scientific or legal basis for the agency to ignore these benefits in absolute or relative terms in the RIA.

The NAAQS were set as reasonable benchmarks for limiting "unacceptable risks to public health." EPA's use of the NAAQS as thresholds in its RIA fundamentally ignores the public health costs resulting from exposures below those limits. Furthermore, EPA's approach contradicts its own findings that some risk is expected at and below the levels of the NAAQS and considers these to be legitimate components of the total benefits estimate. Put differently, EPA's use of the NAAQS thresholds assumes that these standards represent limits below which there are no discernible benefits. This assumption is wrong, contrary to findings in current policy research, and contrary to EPA's own findings establishing the NAAQS for non-threshold pollutants, such as particulate matter and ozone. *See* Repeal Comments at 41, n.39-42.

C. EPA's Air Quality Analysis is Flawed Because It Assumes that Important Regulations the Agency Is in the Process of Rescinding or Weakening Will be in Effect in the Future

In the Appendix to the RIA entitled "Air Quality Modeling," EPA explains that it used existing air quality modeling for 2011 and 2023 to estimate particulate matter and ozone concentrations in 2025, 2030, and 2035 for its modeling scenarios for the proposed rule. RIA at 8-1. The emission inventory for 2023 for power plants and for non-stationary sources assumes that current regulations requiring emissions reductions will continue to remain in place. For power plants, that includes the Mercury and Air Toxics (MATS) rule announced on December 21, 2011. *Id.* at 8-4. For mobile sources, the agency considered emission reductions expected under "the 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards (LD GHG)." *Id.* at 8-5.

EPA's modeling fails to account for the fact that the agency has proposed (or soon will be proposing) to rescind or weaken the MATS and LD GHG regulations.

See 83 Fed. Reg. 42,986 (Aug. 24, 2018) (proposed weakening of LD GHG regulations); *see* Office of Info. & Regulatory Affairs, *Mercury & Air Toxics Standards for Power Plants Residual Risk & Tech. Review & Cost Review* (Fall 2018 Unified Regulatory Agenda information page on EPA's revision of MATS rule; proposed rule expected November 2018).[140] The agency must account for these regulatory proposals and explain what the impacts of those rollbacks would be in the context of the proposed replacement rule. *See State Farm*, 463 U.S. at 43 (agency cannot "fail[] to consider an important aspect of the problem" or "offer[] an explanation for its decision that runs counter to the evidence before the agency"); *see Flyers Rights Educ. Fund, Inc. v. FAA*, 864 F.3d 738, 744 (D.C. Cir. 2017) (agency's reliance on studies that did not address critical passenger safety variables and were outdated was arbitrary and capricious); *see also City of Kansas City Dep't of Housing and 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).

D. Requiring State Agencies to Analyze Heat Rate Improvements for Each of the Candidate Technologies at Each Power Plant Will Burden Agency Resources While Providing, Little, if Any, Benefit in Terms of Pollution Reductions

Under the proposed rule, state permitting agencies preparing their state plans will be required to evaluate heat rate improvement projects for each of EPA's seven chosen "candidate technologies" at each power plant in the state covered by the rule. *See* 83 Fed. Reg. at 44,808-09 (proposed 40 C.F.R. 60.5740a(a)(1)). EPA acknowledges that this "will entail many hours of staff time to develop and coordinate programs for compliance with the proposed rule." *Id.* at 44,796. This may especially be the case for states that have significant numbers of power plants, such as Illinois, North Carolina, Pennsylvania, and Virginia. And because EPA is not proposing a presumptive emission limit, this analysis of whether a particular power plant can implement one or more of the candidate technologies and what heat rate improvement (and emission rate) can be expected following such a project may be difficult for permitting agencies to perform depending on their level of power plant engineering expertise and may lead to costly and time-consuming facility-by-facility

---

[140] *Available at*: https://reginfo.gov/public/do/eAgendaViewRule?pubId=201810&RIN=2060-AT99; *see also* Coral Davenport, *Trump Administration Prepares a Major Weakening of Mercury Emissions Rules*, N.Y. Times (Sept. 30, 2018), *available at*: https://www.nytimes.com/2018/09/30/climate/epa-trump-mercury-rule.html.

disputes or litigation with power plant owners and operators regarding feasibility and emission rates.

Moreover, the potentially significant investment of resources and expertise will, as explained in the sections above, likely yield little—if any—benefits in terms of reducing carbon pollution and may even result in worsening air quality, depending on the state. This waste of state resources is yet another reason that EPA should abandon its misguided proposal.

CONCLUSION

For all the reasons set forth above, EPA should not finalize the proposed rule, and instead should implement and then strengthen the Clean Power Plan.

Respectfully Submitted,

FOR THE STATE OF NEW YORK

BARBARA D. UNDERWOOD
Attorney General

/s/ Michael J. Myers

MICHAEL J. MYERS
Senior Counsel
MORGAN A. COSTELLO
Section Chief, Affirmative Litigation
ANDREW G. FRANK
BRIAN M. LUSIGNAN
CLAIBORNE WALTHALL
Assistant Attorneys General
ALAN BELENSZ
Chief Scientist
PETER MALASPINA
Chief Economist
ANDREA CATALFAMO
Legal Assistant
Environmental Protection Bureau
The Capitol
Albany, NY 12224
(518) 776-2400

FOR THE STATE OF CALIFORNIA

XAVIER BECERRA
ATTORNEY GENERAL
Robert W. Byrne
Sally Magnani
Senior Assistant Attorneys General
David A. Zonana
Supervising Deputy Attorney General
M. Elaine Meckenstock
Elizabeth B. Rumsey
Timothy E. Sullivan
Jonathan Wiener
Deputy Attorneys General
1515 Clay Street
Oakland, CA 94612
(510) 879-1300

FOR THE STATE OF CONNECTICUT

GEORGE JEPSEN
ATTORNEY GENERAL
Matthew I. Levine
Scott N. Koschwitz
Assistant Attorneys General
Office of the Attorney General
P.O. Box 120, 55 Elm Street
Hartford, CT 06141-0120
(860) 808-5250

FOR THE STATE OF DELAWARE

MATTHEW P. DENN
ATTORNEY GENERAL
Valerie S. Edge
Deputy Attorney General
Delaware Department of Justice
102 West Water Street, 3d Floor
Dover, DE 19904
(302) 739-4636

FOR THE STATE OF ILLINOIS

LISA MADIGAN
ATTORNEY GENERAL
Matthew J. Dunn
Gerald T. Karr
Daniel I. Rottenberg
Assistant Attorneys General
Jason James
Special Asst. Attorney General
69 W. Washington St., 18th Floor
Chicago, IL 60602
(312) 814-3816

FOR THE STATE OF IOWA

THOMAS J. MILLER
ATTORNEY GENERAL
Jacob Larson
Assistant Attorney General
Office of Iowa Attorney General
Hoover State Office Building
1305 E. Walnut Street, 2nd Floor
Des Moines, IA 50319
(515) 281-5341

FOR THE STATE OF MAINE

JANET T. MILLS
ATTORNEY GENERAL
Gerald D. Reid
Natural Resources Division Chief
6 State House Station
Augusta, ME 04333
(207) 626-8800

FOR THE COMMONWEALTH OF MASSACHUSETTS

MAURA HEALEY
ATTORNEY GENERAL
Melissa A. Hoffer
Christophe Courchesne
Assistant Attorneys General
Megan M. Herzog
Special Assistant Attorney General
Environmental Protection Division
One Ashburton Place, 18th Floor
Boston, MA 02108
(617) 963-2423

FOR THE STATE OF NEW MEXICO

HECTOR BALDERAS
ATTORNEY GENERAL
Anne Minard
Assistant Attorney General
Office of the Attorney General
408 Galisteo Street
Villagra Building
Santa Fe, NM 87501
(505) 490-4045

FOR THE STATE OF MARYLAND

BRIAN E. FROSH
ATTORNEY GENERAL
Joshua M. Segal
Assistant Attorney General
200 St. Paul Place, 20th Floor
Baltimore, MD 21202
(410) 576-6962

FOR THE STATE OF MINNESOTA, BY AND THROUGH ITS MINNESOTA POLLUTION CONTROL AGENCY

OFFICE OF THE ATTORNEY GENERAL
STATE OF MINNESOTA
Karen D. Olson
Deputy Attorney General
Max Kieley
Assistant Attorney General
445 Minnesota Street, Suite 900
St. Paul, MN 55101-2127
(651) 757-1244

FOR THE STATE OF NORTH CAROLINA

JOSHUA H. STEIN
ATTORNEY GENERAL
Daniel Hirschman
Senior Deputy Attorney General
Taylor Crabtree
Asher Spiller
Assistant Attorneys General
Environmental Division
North Carolina Department of Justice
P.O. Box 629
Raleigh, NC 27602-0629
(919) 716-6000

FOR THE STATE OF OREGON

ELLEN F. ROSENBLUM
ATTORNEY GENERAL
Paul Garrahan
Attorney-in-Charge
Steve Novick
Special Assistant Attorney General
Natural Resources Section
Oregon Department of Justice
1162 Court Street NE
Salem, OR 97301-4096
(503) 947-4593

FOR THE COMMONWEALTH OF PENNSYLVANIA

JOSH SHAPIRO
ATTORNEY GENERAL
Michael J. Fischer
Chief Deputy Attorney General
Aimee Thomson
Deputy Attorney General
Office of the Attorney General
Strawberry Square
Harrisburg, PA 17120
(215) 560-2171

FOR THE STATE OF RHODE ISLAND

PETER F. KILMARTIN
ATTORNEY GENERAL
Gregory S. Schultz
Special Assistant Attorney General
Rhode Island Department of Attorney General
150 South Main Street
Providence, RI 02903
(401) 274-4400

FOR THE STATE OF VERMONT

THOMAS J. DONOVAN, JR.
ATTORNEY GENERAL
Nicholas F. Persampieri
Assistant Attorney General
Office of the Attorney General
109 State Street
Montpelier, VT 05609-1001
(802) 828-3186

FOR THE COMMONWEALTH OF VIRGINIA

MARK HERRING
ATTORNEY GENERAL
Stephen A. Cobb
Deputy Attorney General
Donald D. Anderson
Sr. Asst. Attorney General and Chief
Matthew L. Gooch
Assistant Attorney General
Environmental Section
900 East Main Street
Richmond, VA 23219
(804) 225-3193

FOR THE STATE OF WASHINGTON

ROBERT W. FERGUSON
ATTORNEY GENERAL
Katharine G. Shirey
Assistant Attorney General
Office of the Attorney General
P.O. Box 40117
Olympia, WA 98504-0117
(360) 586-6769

FOR THE DISTRICT OF COLUMBIA

KARL A. RACINE
ATTORNEY GENERAL
Robyn R. Bender
Deputy Attorney General
David S. Hoffman
Assistant Attorney General
Office of the Attorney General
441 Fourth Street, NW
Suite 650 North
Washington, DC 20001
(202) 442-9889

FOR BROWARD COUNTY, FLORIDA

ANDREW J. MEYERS
COUNTY ATTORNEY
Mark A. Journey
Assistant County Attorney
Broward County Attorney's Office
115 S. Andrews Avenue, Room 423
Fort Lauderdale, FL 33301
(954) 357-7600

FOR THE CITY OF CHICAGO

EDWARD N. SISKEL
CORPORATION COUNSEL
BENNA RUTH SOLOMON
Deputy Corporation Counsel
30 N. LaSalle Street, Suite 800
Chicago, IL 60602
(312) 744-7764

FOR THE CITY OF NEW YORK

ZACHARY W. CARTER
CORPORATION COUNSEL
Susan E. Amron
Chief, Environmental Law Division
Kathleen C. Schmid
Senior Counsel
New York City Law Department
100 Church Street
New York, NY 10007
(212) 356-2319

FOR THE CITY OF BOULDER

TOM CARR
CITY ATTORNEY
Debra S. Kalish
City Attorney's Office
1777 Broadway, Second Floor
Boulder, CO 80302
(303) 441-3020

FOR THE CITY OF PHILADELPHIA

MARCEL S. PRATT
CITY SOLICITOR
Scott J. Schwarz
Patrick K. O'Neill
Divisional Deputy City Solicitors
The City of Philadelphia
Law Department
One Parkway Building
1515 Arch Street, 16th Floor
Philadelphia, PA 19102-1595
(215) 685-6135

FOR THE CITY OF SOUTH MIAMI

THOMAS F. PEPE
CITY ATTORNEY
City of South Miami
1450 Madruga Avenue, Suite 202
Coral Gables, Florida 33146
(305) 667-2564

FOR THE CITY OF LOS ANGELES

MICHAEL N. FEUER
CITY ATTORNEY
Michael J. Bostrom
Assistant City Attorney
Los Angeles City Attorney's Office
200 N. Spring Street, 14th Floor
Los Angeles, CA 90012
(213) 978-1882

Appendix A: Climate Change Impacts

(updated October 31, 2018)

Our States and Cities have already begun to experience adverse impacts from climate change. Based on the overwhelming scientific evidence, those harms are likely to increase in number and severity unless aggressive steps are taken to reduce emissions of carbon dioxide and other greenhouse gases. Summarized below are some of those most significant threats being faced by our States and Cities.

California

Climate change's adverse effects have become impossible to ignore in California. The state weathered a historic five-year drought only to face record-setting fire seasons and a variety of other unprecedented phenomena increasingly harming the health and prosperity of Californians from all walks of life and all parts of the state, as described in more detail in a recent report of the California Air Resources Board.[1]

Drought conditions beginning in 2012 left reservoirs across the state at record low levels, often no more than a quarter of their capacity. The Sierra snowpack—critical to California's water supply, tourism industry, and hydroelectric power—was the smallest in at least 500 years.[2] The resulting cutbacks threatened the livelihoods of farmers and fishermen alike. In the Central Valley, the drought cost California agriculture about $2.7 billion and more than 20,000 jobs in 2015 alone.[3] In addition, the drought led to land subsidence, due to reduced precipitation and increased groundwater pumping, and the death of 129 million trees throughout the state.[4]

Even prior to the drought, the U.S. Forest Service had found that California was at risk of losing 12 percent—over 5.7 million acres—of the total area of forests and woodlands in the state due to insects and disease thriving in a hotter climate.[5] Several pine species are projected to lose around half of their basal area.[6] And a majority of the ponderosa pine in the foothills of the central and southern Sierra Nevada Mountains has already died, killed by the western pine beetle and other bark beetles.[7] The increasing threat from these insects is driven in large part by warmer

---

[1] *See generally* California Air Resources Board, *California's 2017 Climate Change Scoping Plan Update: The Strategy for Achieving California's 2030 Greenhouse Gas Target*, (Nov. 2017), https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf.

[2] *See* NOAA, National Centers for Environmental Information: "Multi-Century Evaluation of Sierra Nevada Snowpack," https://www.ncdc.noaa.gov/news/multi-century-evaluation-sierra-nevada-snowpack.

[3] *California's 2017 Climate Change Scoping Plan Update*, *supra*, at 7.

[4] U.S Forest Service, *Record 129 Million Dead Trees in California* (2017), https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd566303.pdf.

[5] *California's 2017 Climate Change Scoping Plan Update*, *supra*, at 7.

[6] *Id*.

[7] *Id*.

summer temperatures attributable to climate change.[8] The very high levels of tree mortality led Governor Brown to issue an Emergency Proclamation on October 30, 2015, directing state agencies to identify and take action to reduce wildfire risk through the removal and use of the dead trees.[9]

Notwithstanding the Governor's Proclamation, the hotter, drier weather and millions of dead trees have increasingly accelerated the damage from wildfires. The 2017 season—the worst on record—killed dozens of people, destroyed thousands of homes, forced hundreds of thousands to evacuate, and burned more than half a million acres.[10] Prior to 2017, the worst year on record was 2015. In between, California faced the most expensive wildfire in U.S. history, the Soberanes fire, which burned for three months in 2016 and cost more than $250 million to put out.[11] Climate change is expected to make longer and more severe wildfire seasons "the new normal" for California.[12] Besides the immediate threats they pose to life and property, wildfires significantly impair both air quality (via smoke and ash that can hospitalize residents) and water quality (via the erosion of hillsides stripped of their vegetation).

Off the coast, rising ocean temperatures and ocean acidification have spurred toxic algal blooms, resulting in high levels of the neurotoxin domoic acid.[13] This toxin has hit California's economically valuable Dungeness crab fishery particularly hard. From 2015 to 2017, domoic acid contamination forced California to close the fishery for parts of the season in order to protect consumers from serious health risks, with the 2015-16 season declared a federal disaster.[14] Other fisheries have suffered a similar fate. The Dungeness crab fishery is expected to decline significantly in the future as acidification increases.[15] In addition, high levels of domoic

---

[8] Jeffry B. Mitton and Scott M. Ferrenberg, *Mountain Pine Beetle Develops an Unprecedented Summer Generation in Response to Climate Warming*, THE AMERICAN NATURALIST, Vol. 179, No. 5 (May 2012).

[9] "Proclamation of a State of Emergency," https://www.gov.ca.gov/wp-content/uploads/2017/09/10.30.15_Tree_Mortality_State_of_Emergency.pdf.

[10] Lauren Tierney, *The Grim Scope of 2017's California Wildfire Season Is Now Clear. The Danger's Not Over.*, WASH. POST (Jan. 4, 2018), https://www.washingtonpost.com/graphics/2017/national/california-wildfires-comparison/.

[11] Lyndsey Gilpin, *The 10 Most Expensive Wildfires in the West's History*, HIGH COUNTRY NEWS (Oct. 5, 2016), https://www.hcn.org/articles/the-10-most-expensive-wildfires-in-the-wests-history.

[12] California Department of Forestry and Fire Protection, *California's Forests and Rangelands: 2010 Assessment*, Ch. 3-7 (2010).

[13] S. Morgaine McKibben et al., *Climatic Regulation of the Neurotoxin Domoic Acid*, 114 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES 2 (2007).

[14] See Tara Duggan, *Toxin again an issue as Dungeness crab season nears*, S.F. CHRONICLE (Oct. 30, 2017), https://www.sfchronicle.com/food/article/Dungeness-crab-season-could-be-delayed-again-by-12318483.php; Mary Callahan, *California's crab fleet awaits share of $200 million in disaster relief*, SANTA ROSA PRESS-DEMOCRAT (Feb. 15, 2018), http://www.pressdemocrat.com/news/7996795-181/californias-crab-fleet-awaits-share?sba=AAS.

[15] Marshall, K.N. et al.. *Risks of Ocean Acidification in the California Current Food Web and Fisheries: Ecosystem Model Projections*, 21 GLOB. CHANGE BIOL. 4 (2017).

acid are poisoning marine mammals, and have been linked to reproductive failure (including high rates of miscarriage and premature birth) among California sea lions.[16]

California's many miles of coastline, particularly coastal bluffs, make it uniquely vulnerable to sea-level rise and more intense storms. Even if storms do not become more intense or frequent, sea-level rise itself will magnify the adverse impact of any storm surge and high waves on the California coast. Some observational studies report that the largest waves are already getting higher and winds are getting stronger.[17] California is likely to face greater than average sea-level rise, because of gravitational forces and the rotation of the Earth. Recent projections indicate that if no significant greenhouse gas mitigation efforts are taken, the San Francisco Bay Area may experience sea level rise between 1.6 to 3.4 feet, and in an extreme scenario involving the rapid loss of the Antarctic ice sheet, sea levels along California's coastline could rise up to 10 feet by 2100.[18]

In addition to damage to the physical environment, increased temperatures California will experience due to climate change will put the health of state residents at risk. Increased hospitalizations for multiple diseases, including cardiovascular disease, ischemic heart disease, ischemic stroke, respiratory disease, pneumonia, dehydration, heat stroke, diabetes, and acute renal failure are associated with increases in same-day temperature.[19] Such temperature increases have also been found to be associated with increased risk of preterm delivery[20] and stillbirths.[21] Recent California studies suggest increased mortality risk not only with extreme heat, but also with increasing ambient temperature.[22]

---

[16] T. Goldstein et al., *The Role of Domoic Acid in Abortion and Premature Parturition of California Sea Lions (Zalophus californianus) on San Miguel Island, California*, JOURNAL OF WILDLIFE DISEASES. 45(1): 91-108 (2009).

[17] National Research Council of the National Academy of Sciences, *Sea-Level Rise for the Coasts of California, Oregon and Washington: Past, Present, and Future*. National Academies Press (2012).

[18] Griggs, G, Árvai, J, Cayan, D, DeConto, R, Fox, J, Fricker, HA, Kopp, RE, Tebaldi, C, Whiteman, EA (California Ocean Protection Council Science Advisory Team Working Group). *Rising Seas in California: An Update on Sea-Level Rise Science*. California Ocean Science Trust, April 2017.

[19] Green R, Basu R, Malig B, Broadwin R, Kim J and Ostro B (2010). *The Effect of Temperature on Hospital Admissions in Nine California Counties.* INTERNATIONAL JOURNAL OF PUBLIC HEALTH 55(2): 113-121. *See also* Basu R, Pearson D, Malig B, Broadwin R and Green S (2012). *The effect of elevated ambient temperature on emergency room visits in California.* EPIDEMIOLOGY 23(6):813-20; Sherbakov T, Malig B, Guirguis K, Gershunov A, Basu R. (2018) *Ambient temperature and added heat wave effects on hospitalizations in California from 1999 to 2009*. ENVIRON RES. 160:83-90.

[20] Basu R, Malig B and Ostro B (2010). *High ambient temperature and the risk of preterm delivery*. AM J EPIDEMIOLOGY 172(10): 1108-1117.

[21] Basu R, Sarovar V, Malig BJ (2018) *Association Between High Ambient Temperature and Risk of Stillbirth in California*. AM J EPIDEMIOL. 183(10):894-901.

[22] Basu R and Ostro BD (2008a). *A multicounty analysis identifying the populations vulnerable to mortality associated with high ambient temperature in California*. AM J EPIDEMIOL. 168(6): 632-637; Basu R, Feng W and Ostro B (2008b). *Characterizing temperature and mortality in nine California counties, 1999-2003*. EPIDEMIOLOGY 19(1): 138 -145; Basu R and Malig B (2011). *High ambient*

California 2018 Supplement

In 2018, the State of California produced two substantial reports on the impacts of climate change in California, which incorporate the latest scientific research on the impacts of climate change in California.

The first report, published May 2018 titled "***Indicators of Climate Change in California***" examines thirty-six separate indicators and reflects the contributions of dozens of scientists from California's universities, and state agencies, as well as the U.S. National Oceanic and Atmospheric Administration and the U.S. Department of Energy's Lawrence Berkeley National Laboratory.[23] A copy of the full "Indicators" report is included in the attachments to the States' comments.

The second report, published August 2018 titled "***California's Fourth Climate Assessment***" includes thirty-three papers from State-funded research, and eleven papers from externally funded researchers, as well as regional summaries and a statewide summary of climate vulnerabilities, and a key findings paper.[24] A copy of selected research papers and the regional and statewide summaries and key findings reports are included in the attachments to the States' comments.

Key findings from those reports and other sources include the following:

Temperature Changes and Air Quality Impacts

> "Since 1895, annual average air temperatures have increased throughout the state, with temperatures rising at a faster rate beginning in the 1980s. The last four years were notably warm, with 2014 being the warmest on record, followed by 2015, 2017, and 2016. Temperatures at night have increased more than during the day: minimum temperatures (which generally occur at night) increased at a rate of 2.3 degrees Fahrenheit (°F) per century, compared to 1.3°F per century for maximum temperatures."[25]

---

temperature and mortality in California: Exploring the roles of age, disease, and mortality displacement. ENVIRONMENTAL RESEARCH 111(8): 1286-1292.

[23] *See* Office of Environmental Health Hazard Assessment, California Environmental Protection Agency (2018). *Indicators of Climate Change in California*. Available at www.oehha.ca.gov/climate-change/document/indicators-climate-change-california (last visited October 24, 2018) (hereinafter "California Climate Indicators 2018").

[24] *See* California Natural Resources Agency, *California's Fourth Climate Change Assessment* (2018), *available at* www.ClimateAssessment.ca.gov (last visited October 24, 2018) (hereinafter "California 4th Assessment").

[25] California Climate Indicators 2018 at S-4.

> "Extremely hot days and nights — that is, when temperatures are at or above the highest 2 percent of maximum and minimum daily temperatures, respectively — have become more frequent since 1950. Both extreme heat days and nights have increased at a faster rate in the past 30 years. Heat waves, defined as five or more consecutive extreme heat days or nights, are also increasing, especially at night. Nighttime heat waves, which were infrequent until the mid-1970s, have increased markedly over the past 40 years."[26]

> In addition, rising temperatures "could lead to increases in ground-level ozone and reduce the effectiveness of emission reductions taken to achieve air quality standards…."[27]

> "A recent detailed analysis suggests that adoption of low-carbon energy in California to reduce GHG emissions 80 percent below 1990 levels would lead to a 55 percent reduction in air pollution mortality rates relative to 2010 levels (Zapata et al., 2018). These public health improvements have a value of $11-20 billion/year in California (Zapata et al., 2018)."[28]

Human Health Impacts

Climate change poses direct and indirect risks to public health, as people will experience earlier death and worsening illnesses.

> "Nineteen heat-related events occurred from 1999 to 2009 that had significant impacts on human health, resulting in about 11,000 excess hospitalizations. However, the National Weather Service issued Heat Advisories for only six of the events. Heat-Health Events (HHEs), which better predict risk to populations vulnerable to heat, will worsen drastically throughout the state: by midcentury, the Central Valley is projected to experience average Heat-Health Events that are two weeks longer, and HHEs could occur four to ten times more often in the Northern Sierra region."[29]

> "The 2006 heat wave killed over 600 people, resulted in 16,000 emergency department visits, and led to nearly $5.4 billion in damages. The human cost of these events is already immense, but research suggests that mortality risk for those 65 or older could increase ten-fold by the 2090s because of climate change."[30]

---

[26] *Id.* at S-5.

[27] California's Fourth Climate Change Assessment, California's Changing Climate 2018: Statewide Summary Report at 40 (Aug. 2018), *available at* http://www.climateassessment.ca.gov/state/docs/20180827-StatewideSummary.pdf. (hereinafter "California Statewide Summary").

[28] *Id.* at 71.

[29] *Id.* at 10.

[30] *Id.*

Environmental Justice Impacts

"Multiple studies of vulnerability and climate impacts indicate that existing inequities can be exacerbated by climate change. For example, the consequences of climate-related water impacts are particularly acute for communities already dealing with a legacy of inequalities. A recent study on drought and equity in California found that low-income households, people of color, and communities already burdened with environmental pollution suffered the most severe impacts caused by water supply shortages and rising cost of water (Feinstein et al., 2017). In a report prepared as part of the Fourth Assessment, Ekstrom et al. (2018) found that while all water districts faced similar challenges during the drought, small water districts (defined as those serving less than 10,000 people or less than approximately 3,300 connections) were less likely to have the resources and capacity to overcome those challenges. These districts are most likely to serve small, rural communities in California. Furthermore, for marginalized populations in rural areas of the state, agricultural actions in response to the drought, including increases in groundwater pumping and crop choices, are increasing and reshaping their vulnerability to drought and water shortage (Greene, 2018).[31]

"Inequities not only exist in varying exposures to climate risk, but also in the availability and implementation of potential adaptation or resilience solutions. Recent research analyzed differences in tree canopy, an important tool for adapting to the effects of extreme heat, at the census block group scale in coastal Los Angeles and found disparities between canopy in high-income and low-income neighborhoods (Locke et al., 2017). This disparity can have implications for communities because of the benefits tree canopy provides in reducing the negative effects of extreme heat events. A study prepared for the Fourth Assessment provides one of the first estimates of these benefits in one location (Taha et al., 2018)."[32]

Tribal and Indigenous Communities Impacts

"Tribes and Indigenous communities in California face unique challenges under a changing climate. Tribes maintain cultural lifeways and rely on traditional resources (e.g., salmon fisheries) for both social and economic purposes. However, tribes are no longer mobile across the landscape. For many tribes in California, seasonal movement and camps were a part of living with the environment. Today these nomadic options are not available or are limited. This is the result of Euro-American and U.S. policy and actions and underpins several climate vulnerabilities. Tribes with reservations/Rancherias/allotments are vulnerable to climate change in a specific way: tribal lands are essentially locked into fixed geographic

[31] California Statewide Summary at 36-37.

[32] *Id.* at 37.

locations and land status. Only relatively few tribal members are still able to engage in their cultural traditions as livelihoods."[33]

Precipitation and Water Supply Impacts

"California has the highest variability of year-to-year precipitation in the contiguous United States."[34] By 2050, "the average water supply from snowpack is projected to decline by 2/3 from historical levels."[35]

> "Statewide precipitation has become increasingly variable from year to year. In seven of the last ten years, statewide precipitation has been below the statewide average (22.9 inches). In fact, California's driest consecutive four-year period occurred from 2012 to 2015. In recent years, the fraction of precipitation that falls as rain (rather than snow) over the watersheds that provide most of California's water supply has been increasing — another indication of warming temperatures."[36]

> "Spring snowpack, aggregated over the Sierra Nevada and other mountain catchments in central and northern California, declines substantially under modeled climate changes (Figure 6). The mean snow water equivalent (SWE) declines to less than two-thirds of its historical average by 2050, averaged over several model projections under both RCP 4.5 and 8.5 scenarios. By 2100, SWE declines to less than half the historical median under RCP 4.5, and less than one-third under RCP 8.5. Importantly, the decline in spring snowpack occurs even if the amount of precipitation remains relatively stable over the central and northern California region; the snow loss is the result of a progressively warmer climate. Furthermore, while the models indicate that strong year-to-year variation will continue to occur, the likelihood of attaining spring snowpack that reaches or exceeds historical average is projected to diminish markedly (Pierce et al., 2018) (Figure 6)."[37]

Agriculture Impacts

"Agricultural production could face climate-related water shortages of up to 16% in certain regions. Regardless of whether California receives more or less annual precipitation in the

---

[33] *Id.* at 10.

[34] *Id.* at 24.

[35] California's Fourth Climate Change Assessment, California's Changing Climate 2018: A Summary of Key Findings from California's Fourth Climate Change Assessment 6 (Aug. 2018), *available at* http://www.climateassessment.ca.gov/state/docs/20180827-SummaryBrochure.pdf. (hereinafter "California Key Findings") at 5.

[36] California Climate Indicators at S-5.

[37] California Statewide Summary at 27.

future, the state will be dryer because hotter conditions will increase the loss of soil moisture."[38]

"Winter chill has been declining in certain areas of the Central Valley. This is the period of cold temperatures above freezing but below a threshold temperature needed by fruit and nut trees to become and remain dormant, bloom, and subsequently bear fruit. When tracked using "chill hours," a metric used since the 1940s, more than half the sites studied showed declining trends; with the more recently developed "chill portions" metric, fewer sites showed declines."[39]

"[I]t is evident from recent droughts that agricultural production will be challenged by water shortages, higher temperatures, changing atmospheric conditions, and conversion of agricultural land to developed uses (Medellín-Azuara et al., 2018; Wilson et al., 2017). Agriculture is the economic foundation for many of California's communities, particularly rural communities where other employment opportunities are limited. Roughly 6.7 percent of jobs statewide are generated by farms and farm processing, and in the Central Valley the figure is much higher (22 percent) (UC Agricultural Issues Center, 2012). This means that climate change impacts to agriculture, and even nuanced impacts such as shifting cropping patterns, may create hardships in the rural communities where agriculture is foundational. Different crops have different labor demands (Medellín-Azuara et al., 2016), and shifting crop patterns may result in changes in employment throughout the agricultural sector (Greene, 2018; Villarejo, 1996). A Fourth Assessment study found that in the 2012-2016 drought, to access higher market prices and compensate for the higher cost of water, many farms switched to higher value crops, for which cultivation and harvesting could be largely automated— leaving agricultural workers with employment shortages beyond the drought (Greene, 2018). A report by the University of California found that in 2016, the drought resulted in a $603 million loss to the economy and the loss of 4,700 jobs due to the impacts on agriculture (Medellín-Azuara et al., 2016)."[40]

Forest Impacts

A new paper published on October 18, 2018, estimates that "human-caused climate change caused over half of the documented increase in fuel aridity since the 1970s and doubled the cumulative forest fire area since 1984," contributing an additional 4.2 million ha [hectares] of forest fire.[41] As the paper notes, "[i]ncreased forest fire activity across the western United States

---

[38] *Id.*

[39] California Climate Indicators at S-5.

[40] California Statewide Summary at 59.

[41] John T. Abatzoglou and A. Park Williams, Impact of Anthropogenic Climate Change on Wildfire Across the Western U.S. Forests, *Proceedings of the National Academy of Science*, vol. 113, no.

in recent decades has contributed to widespread forest mortality, carbon emissions, periods of degraded air quality and substantial fire suppression expenditures."[42]

> "A changing climate combined with anthropogenic factors has already contributed to more frequent and severe forest wildfires in the western U.S. as a whole (Abatzoglou & Williams, 2016; Mann et al., 2016; Westerling, 2016)."[43]

> "One Fourth Assessment model suggests large wildfires (greater than 25,000 acres) could become 50% more frequent by the end of century if emissions are not reduced. The model produces more years with extremely high areas burned, even compared to the historically destructive wildfires of 2017 and 2018."[44]

> "By the end of the century, California could experience wildfires that burn up to a maximum of 178% more acres per year than current averages."[45] Increased wildfire smoke will also lead to more respiratory illness.[46]

> In addition, the changes in climate make trees more vulnerable to pest infestations.

> "Moisture stress in conifer forests enhances tree vulnerability to insect infestation, particularly by bark beetles (Anderegg et al., 2015; Bentz et al., 2010; Berryman, 1976; Gaylord et al., 2013; Hart et al., 2014; Kolb et al., 2016; Raffa et al., 2008). Between 2010 and 2017, an estimated 129 million trees have died (Young et al., 2017). Bark beetle outbreaks may be promoted by warming for multiple reasons (Bentz et al., 2010). Warming may promote successful beetle overwintering (Weed et al., 2015) and may also promote earlier timing of adult emergence and flight in spring/early summer, which may enable beetles to increase the frequency at which they can mate, lay eggs, and emerge as adults (Bentz et al., 2016)."[47]

Drought and Land Subsidence Impacts

> "The recent 2012-2016 drought was exacerbated by unusual warmth (Williams, Seager, et al., 2015), and disproportionately low Sierra Nevada snowpack levels (Dettinger & Anderson, 2015). This drought has been described as a harbinger of projected dry spells in

---

42 (Oct. 18, 2018), *available at* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5081637/pdf/pnas.201607171.pdf.

[42] *Id.*

[43] California Statewide Summary at 28.

[44] California Key Findings at 6.

[45] *Id.*

[46] *Id.* at 8.

[47] California Statewide Summary at 64.

future decades, whose impacts will likely be worsened by increased heat (Mann & Gleick, 2015). A very wet winter in 2016-2017 followed this drought, a further indication of potential continued climate volatility in the future (Berg & Hall, 2015; Polade, et al., 2017; Swain et al., 2018)."[48]

"Warming air temperatures throughout the 21st century will increase moisture loss from soils, which will lead to drier seasonal conditions even if precipitation increases (Thorne et al., 2015). Warming air temperatures also amplify dryness caused by decreases in precipitation (Ault et al., 2016; Cayan et al., 2010; Diffenbaugh et al., 2015). These changes affect both seasonal dryness and drought events. Climate projections from the previous and present generation of GCMs (e.g. Pierce et al., 2014; Swain et al., 2018) show that seasonal summer dryness in California may become prolonged due to earlier spring soil drying that lasts longer into the fall and winter rainy season. The extreme warmth during the drought years of 2014 and 2015 intensified some aspects of the 2012-2016 drought (Griffin & Anchukaitis, 2014; Mao et al., 2015; Stephenson et al., 2018; Williams, Seager, et al., 2015) and may be analogous for future drought events (Diffenbaugh et al., 2015; Mann & Gleick, 2015; Williams, Seager, et al., 2015)."[49]

In addition, a "secondary, but large, effect of droughts is the increased extraction of groundwater from aquifers in the Central Valley, primarily for agricultural uses. The pumping can lead to subsidence of ground levels, which around the San Joaquin-Sacramento Delta has been measured at over three-quarters of an inch per year."[50]

"This subsidence compounds the risk that sea-level rise and storms could cause overtopping or failure of the levees, exposing natural gas pipelines and other infrastructure to damage or structural failure. At this rate of subsidence, the levees may fail to meet the federal levee height standard (1.5 ft. freeboard above 100-year flood level) between 2050-2080, depending on the rate of sea-level rise."[51]

Sea-Level Rise, Coastal Erosion and Infrastructure Impacts

"Along the California coast, sea levels have generally risen. Since 1900, mean sea level has increased by about 180 millimeters (7 inches) at San Francisco and by about 150 millimeters (6 inches) since 1924 at La Jolla. In contrast, sea level at Crescent City has declined by about 70 millimeters (3 inches) since 1933 due to an uplift of the land surface from the movement

[48] *Id.* at 13.

[49] *Id.* at 26.

[50] *Id.* at 14.

[51] California Statewide Summary at 12.

of the Earth's plates. Sea level rise threatens existing or planned infrastructure, development, and ecosystems along California's coast."[52]

"If emissions continue at current rates, Fourth Assessment model results indicate that total sea-level rise by 2100 is expected to be 54 inches, almost twice the rise that would occur if greenhouse gas emissions are lowered to reduce risk."[53]

"31 to 67% of Southern California beaches may completely erode by 2100 without large-scale human interventions."[54]

"Flooding from sea-level rise and coastal wave events leads to bluff, cliff, and beach erosion, which could affect large geographic areas (hundreds of kilometers). In research conducted for the Fourth Assessment, Erikson et al. (2018) found that if a 100-year storm occurs under a future with 2m (6.6 feet) of SLR, resultant flooding in Southern California could affect 250,000 people and lead to damages of $50 billion worth of property and $39 billion worth of buildings."[55]

In addition, airports in major urban areas will be susceptible to major flooding from sea-level rise and storm surge by 2040-2080, and 370 miles of coastal highway will be susceptible to coastal flooding by 2100.[56]

Ocean Acidity and Health Impacts

"Increasing evidence shows that climate change is degrading California's coastal and marine environment. In recent years, several unusual events have occurred along the California coast and ocean, including a historic marine heat wave, record harmful algal bloom, fishery closures, and a significant loss of northern kelp forests."[57]

In addition:

"[o]cean acidification … is predicted to occur especially rapidly along the West Coast (e.g., Gruber et al., 2012). Ocean acidification presents a clear threat to coastal communities through its significant impacts on commercial fisheries and farmed shellfish (Ekstrom et al., 2015) as well as to ocean ecosystems on a broader scale. Ocean acidification affects many shell-forming species, including oysters, mussels, abalone, crabs, and the microscopic

[52] California Climate Indicators at S-7.

[53] California Key Findings, at 6.

[54] *Id.* at 15.

[55] California Statewide Summary at 31.

[56] *Id.* at 54-55.

[57] *Id.* at 12.

plankton that form the base of the oceanic food chain (Kroeker et al., 2013; Kroeker et al., 2010). Significant changes in behavior and physiology of fish and invertebrates due to rising CO2 and increased acidity have already been documented (e.g., Hamilton et al., 2017; Jellison et al., 2017; Kroeker et al., 2013; Munday et al., 2009). Species vulnerable to ocean acidification account for approximately half of total fisheries revenue on the West Coast (Marshall et al., 2017)." [58]

Connecticut

In April 2010, the Governor's Steering Committee on Climate Change produced a report that predicted the impact of climate change on Connecticut's agriculture, infrastructure, natural resources and public health.[59] In general the report concluded that the impact of climate change on these four areas would be largely negative; Connecticut crops such as maple syrup, apple and pear production, and shellfish will suffer; infrastructure to control coastal flooding and storm water could be substantially damaged; rare habitats and critical species face elimination; and Connecticut's public health, particularly of the most vulnerable communities, is threatened by a decrease in air quality, extreme heat and the favorable conditions for increased disease.

The Connecticut Institute for Resilience and Climate Adaptation or CIRCA, an institute housed at the University of Connecticut, has projected a rise in sea level of approximately twenty inches by 2050. In response to this latest analysis, Governor Malloy signed Public Act 18-82, *An Act Concerning Climate Change Planning and Resiliency*, into law which requires state and federally funded projects to plan for a scenario of 50 centimeters of sea level rise by 2050, ensuring the success of future projects undertaken in the state, the prudence of state investments, and the safety of those residing on or near the shoreline. In addition to preparations for the imminent rise in sea level, Public Act 18-82 sets an interim target of a 45% reduction in greenhouse gas emissions from a 2001 baseline by 2030, ensuring Connecticut remains on a path to achieve an 80% reduction in emissions by 2050 as mandated under the state's Global Warming Solutions Act.

Observed Change

Connecticut has already begun to experience the severe consequences of climate change induced by unchecked, increasing GHG emissions. Between 1895 and 2011, temperatures in the Connecticut increased by almost 2℉ (0.16℉ per decade), and precipitation increased by

[58] *Id.* at 66-67.

[59] Adaptation Subcommittee to the Governor's Steering Committee on Climate Change, *The Impacts of Climate Change on Connecticut Agriculture, Infrastructure, Natural Resources and Public Health* (2010), *available at* http://www.ct.gov/deep/lib/deep/climatechange/impactsofclimatechange.pdf.

approximately five inches, or more than 10% (0.4 inches per decade).[60] Between 1980 and 2018, average annual temperature in Connecticut has risen by over 2° F. Over the same period, winter temperatures have warmed by 3° F.

The Northeast has experienced a greater recent increase in extreme precipitation than any other region in the United States; between 1958 and 2010, Connecticut saw more than a 70% increase in the amount of precipitation falling in very heavy events. In 2011 Hurricane Irene caused power outages affecting 754,000 customers and over $1 billion in damage, and in 2012 Hurricane Sandy caused power outages affecting more than 600,000 customers and over $360 million in damage. The latter forced thousands of Connecticut residents evacuate, saw thousands apply for FEMA assistance, damaged roads and infrastructure, and took nine days for utilities to restore power.[61] Many of Connecticut's coastal communities and assets remain at risk to more frequent future storm events exacerbated by climate change.

Projections

Connecticut is highly vulnerable to changes in mean and extreme climate due to regional characteristics like a dense population and aging infrastructure. In conservative estimates, climate projections for Connecticut robustly indicate that annual mean temperature will rise by 5-10°F by the end of the 21st Century.

Mean annual precipitation is also likely to increase, particularly in winter and spring seasons, contributing to increased flooding risk through the region. Additionally, weather and climate extremes are projected to be more frequent and intense which will impact both natural and socioeconomic sectors. As temperatures increase along the coast, humidity will also rise, resulting in amplified heat stress during summer months. For inland areas, drought events will become more severe and longer-lived, causing increased competition for limited water resources, agricultural crop damage, ecosystem stress, and risk of wildfire. Communities in Connecticut should expect that coastal flooding intensity and frequency to increase in coming decades due to accelerating trends in coastal erosion, extreme precipitation, and storms.

Sea Level

Direct and remotely sensed measurements of sea level have shown that the annual mean level of the ocean surface is rising. In the Northeast, coastal flooding has increased due to approximate one foot rise in sea level since 1900. This rate of sea level rise exceeds the global average of approximately eight inches, due primarily to land subsidence and thermal expansion

---

[60] Horton, R., Yohe, G., Easterling, W., Kates, R., Matthias, R., Sussman, E., Whelchel, A., Wolfe, D., and Lipschultz, F. (2014). Ch. 16: Northeast. *Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 16-1-nn.

[61] Burgeson, John, *Rising Above the Tide: 5 Years Since Sandy*, CTPost, (Oct. 28, 2017), https://www.ctpost.com/local/article/Rising-above-the-tide-5-years-since-Sandy-12313727.php

(of ocean water) along the Northeastern coast. In moderately conservative estimates, sea level rise along the Connecticut coast is projected to be ~0.76 ft (0.23 meters) higher than 2000 levels by 2050.[62] And according to a report released in late March 2018 by the Connecticut Institute for Climate and Resilience (CIRA), sea level rise is anticipated to rise by 2 feet by 2050 and over 3 feet by 2100.[63] This will strongly impact the many coastal communities and businesses in Connecticut.

Delaware

As a low-lying state with 381 miles of coastline, Delaware is vulnerable to coastal storms, sea level rise, and flooding exacerbated by climate change. Sea levels around Delaware have already risen 13 inches this century.[64] This means that storm surges come further inland and coastal towns flood more frequently, jeopardizing infrastructure, and leading to costly repairs. Towns like Slaughter Beach are partnering with the state to build climate adaption plans, recognizing that these events will only get worse and more expensive. As climate change exacerbates sea level rise, over 17,000 homes and almost 500 miles of roadway in Delaware are at risk of permanent inundation from sea level rise by the end of the century.[65]

In addition, rising temperatures and extreme heat events as a result of climate change threaten public health and especially Delaware's most vulnerable citizens – young children, the elderly, outdoor workers, and individuals with underlying health conditions. Extreme heat days and extended heat waves can exacerbate poor air quality and unhealthy outdoor conditions, especially in urban areas like Wilmington. Extreme heat, saltwater intrusion from sea level rise, and changes in precipitation also threaten Delaware's $8 billion agricultural industry, which is strongly ingrained in both the state's economy and culture.

Hawaii

Hawaiians have experienced numerous climate change-related harms over the past

---

[62] O`Donnell, J., *Sea Level Rise in Connecticut*. Draft Report, Connecticut Institute for Resilience and Climate Adaptation (March 27, 2018), *available at* https://circa.uconn.edu/wp-content/uploads/sites/1618/2017/10/SeaLevelRiseConnecticutFinalDraft-Posted-3_27_18.pdf.

[63] See https://circa.uconn.edu/2018/03/27/sea-level-rise-projections-for-the-state-of-connecticut-webinar-recording-available/.

[64] Callahan, John A., Benjamin P. Horton, Daria L. Nikitina, Christopher K. Sommerfield, Thomas E. McKenna, and Danielle Swallow, *Recommendation of Sea-Level Rise Planning Scenarios for Delaware: Technical Report*, prepared for Delaware Department of Natural Resources and Environmental Control (DNREC) Delaware Coastal Programs (2017), *available at* http://www.dgs.udel.edu/sites/default/files/projects-docs/de%20slr%202017%20technical%20report%20final.pdf

[65] DNREC, *Preparing for Tomorrow's High Tide: Sea-Level Rise Vulnerability Assessment for the State of Delaware. Technical Report*, Prepared for the Delaware Sea Level Rise Advisory Committee by the Delaware Department of Environmental Control (2012), *available at* http://www.dnrec.delaware.gov/coastal/Documents/SeaLevelRise/AssesmentForWeb.pdf.

decade. For example, during one July weekend in 2017, large surf from Tropical Cyclone Fernanda swept across Hawaii's eastern shores. At the same time, Hawaii also saw, for the third time in just a few months, another round of record-level high tides. These "king tides" over the summer sent water washing over seawalls, coming dangerously close to homes and making some roads virtually impassable. The king tides and climate change's effects on Hawaii's beaches are well-documented.[66]

The State of Hawaii has conducted studies on the effects of Climate Change, and the conclusions of these reports show that Hawaii will be severely impacted.[67] Over the next 50 to 100 years, Hawaii could see tides that could make Hawaii's main roads, like Ala Moana Boulevard, un-drivable; many areas, including world famous Waikiki Beach, will become inundated from the rise of the ocean level, oceans so warm that coral, which serves as a habitat for marine life, die off in vast stretches; and an alarming rise in frequency and intensity of destructive tropical cyclones.

More specifically, scientific research has determined that:

- Sea level has been rising in Hawaii for the past century or more. Rates of rise vary amongst the islands due to differing rates of subsidence based on distance from actively-growing Hawaii Island. Rates of sea-level rise in Hawaii ranged from 0.6 inches (1.5 cm) on Oahu and Kauai, to 1.3 inches (3.3 cm) on Hawaii Island per decade over the last century.[68]
- Over the past century, 70% of the beaches in Hawaii have eroded and over 13 miles of beach have been completely lost to erosion.[69]
- This dominant trend of beach erosion could be driven by local sea-level rise.[70]

---

[66] *See, e.g.*, *Climate Change Will Ruin Hawaii, New Study Suggests*, Huffpost, (Aug.8, 2015; updated Dec. 6, 2017), *available at* https://www.huffingtonpost.com/2014/08/28/climate-change-study-hawaii_n_5731956.html (last visited Oct. 24, 2018); Lafrance, Adreienne, *The Ghost of Climate-Change Future*, The Atlantic (May 30, 2017), *available at* https://www.theatlantic.com/science/archive/2017/05/the-ghost-of-climate-change-future/528471/

[67] Ocean Resources Management Plan Working Group, *A Framework for Climate Change Adaptation in Hawaii* (Nov. 2009), *available at* http://files.hawaii.gov/dbedt/op/czm/ormp/reports/climate_change_adaptation_framework_final.pdf.

[68] NOAA Center for Operational Oceanographic Products and Services (CO-OPS)), *Mean Sea Level Trends for Global Network Stations*, fig. 9 (Nov. 22, 2013), *available at* http://tidesandcurrents.noaa.gov/sltrends/sltrends_global.shtml.

[69] Fletcher, C.H., et al. 2012. National Assessment of Shoreline Change: Historical Shoreline Change in the Hawaiian Islands. U.S. Geological Survey Open-File Report 2011–1051, 55 p. Also available at: http://pubs.usgs.gov/of/2011/1051

[70] Romine, B.M., C.H. Fletcher, M.M. Barbee, T.R. Anderson, and L.N. Frazer,. *Are beach erosion rates and sea-level rise related in Hawaii?* Global and Planetary Change 108:149-157 (2013).

- Shoreline retreat, averaging 1 ft per year (0.3 m/yr) statewide, wetland migration and cliff collapse due to erosion are occurring now on many of Hawaii's coastlines.[71]

- Elevated groundwater tables, due in part to sea-level rise, are contributing to flooding in low coastal areas during higher tides and heavy rainfall events.[72]

- Antarctic and Greenland ice sheets are melting faster than previously predicted, which is contributing to the acceleration of global sea-level rise.[73]

- More tropical cyclones have developed from storms in the Pacific between 1991 and 2010 than previously recorded from the last century.[74]

- Hawaii and the central western Pacific Ocean has been modeled to experience about 1 ft-2.5 ft (0.3 m-0.8 m) higher than global average sea-level rise by the year 2100.[75]

Because of the urgent need to take action to address these threats to Hawaii's health and natural resources, Hawaii has taken steps to regulate and reduce the local emission of greenhouse gas emissions. For example, Act 234 of the 2007 Legislature established the foundation for Hawaii to regulate greenhouse gas emissions throughout the state to combat the threat of climate change and sea level rise. Act 234 declared a policy to reduce greenhouse gas emissions statewide to 1990 levels by 2020. To implement Act 234, Hawaii's Clean Air Rules were amended to incorporate greenhouse gas rules regulating major sources of greenhouse gases in Hawaii. These rules utilize the Air Pollution Control Permit process to regulate these sources.

Illinois

Climate change is affecting Illinois in a number of ways—both by fundamentally altering the state's environment in ways never seen before and by intensifying well-recognized weather hazards. The fundamental changes can be seen in Illinois' farming industry and in the state's greatest environmental asset, Lake Michigan.

---

[71] University of Hawaii (UH) Coastal Geology Group. Hawaii Coastal Erosion website. http://www.soest.hawaii.edu/asp/coasts/maui/indez.asp.; Fletcher, C.H., Hawaii's Changing Climate, Briefing Sheet, Honolulu: Center for Island Climate Adaptation and Policy. University of Hawaii Sea Grant College Program (2010).

[72] Guidry, M.W. and F.T Mackenzie, *Climate Change, Water Resources, and Sustainability in the Pacific Basin: Emphasis on Oahu, Hawaii and Majuro Atoll, Republic of the Marshall Islands*; Honolulu, HI: University of Hawaii Sea Grant College Program. 100 p. (2006); Fletcher, 2010; Rotzoll, K. and C.H. Fletcher, *Assessment of groundwater inundation as a consequence of sea-level rise*, Nature Climate Change 3:477-481.(2013).

[73] Fletcher, C.H., *Sea level by the end of the 21st century: A review*, Shore and Beach 77(4):1-9 (2009).

[74] Webster, P.J, G.J. Holland, J.A. Curry, and H.-R. Chang. *Changes in Tropical Cyclone Number, Duration, and Intensity in a Warming Environment*. Science 309:1844-1846 (2005).

[75] Spada, G., J.L. Bamber, R.T.W.L. Hurkmans, The gravitationally consistent sea-level fingerprint of future terrestrial ice loss. *Geophysical Research Letters* 40(3):482-486 (2013).

The farming sector is particularly vulnerable to extreme precipitation caused by climate change. 2012 was Illinois' third driest summer on record. The very next year, heavy rainfall caused flooding in parts of the state that, together with the wettest January-to-June period ever recorded in Illinois, forced farmers to delay planting and lose revenue.[76] Heat waves during the crop pollination season may reduce future yield: hotter weather and altered rain patterns could cause 15% loss in the next 5 to 25 years and up to a 73% average loss by the end of the next century.[77] Milder winters will lead to more weeds, insects, and diseases surviving throughout winter, also hurting yield and quality.[78]

Climate disruption also contributes to whipsawing water levels on Lake Michigan. In January 2013, the lake fell to an all-time low water level. In 2015, it climbed to its highest level since 1998, the second-largest recorded gain over a 24-month span.[79] Rapidly swinging water levels hurt the commercial shipping industry, recreational boaters, wildlife, and beach-goers. For example, for every inch the lake loses, a freighter must forgo 270 tons of cargo. High water erodes beaches and damages property.[80]

Climate change has already turned up the volume on well-recognized catastrophic extreme weather events, causing stronger storms, increased precipitation, and higher average temperatures. In recent years, the state has been struck by deadly tornadoes in November 2013 and the 2014 polar vortex.[81]

Illinois also suffers from frequent flooding, and climate change has and will cause the frequency and strength of these floods to increase. For instance, flooding caused by increased precipitation causes dramatic damage to the lives and property of Illinois residents; this toll will increase as climate change intensifies. For example, in 2009, a freight train carrying ethanol derailed in Cherry Valley, Illinois due to washout of train tracks following heavy rains.[82] Fourteen of the tanker cars carrying ethanol caught fire, killing a woman in her car waiting for

---

[76] University of Illinois–Institute of Government & Public Affairs, *Preparing for Climate Change in Illinois: An Overview of Anticipated Impacts*, https://igpa.uillinois.edu/sites/igpa.uillinois.edu/files/reports/Preparing-for-Climate-Change-in-Illinois.pdf (last visited Oct. 11, 2018).

[77] *Id*.

[78] *Id.*

[79] Tony Briscoe, *Lake Michigan Water Levels Rising at Near Record Rate*, CHICAGO TRIBUNE (July 12, 2015), *available at* http://www.chicagotribune.com/news/local/breaking/ct-lake-michigan-water-levels-met-20150710-story.html.

[80] *Id.*

[81] National Weather Service, *Historic Tornado Outbreak of November 17, 2013*, https://www.weather.gov/ilx/17nov13 (last visited Oct. 11, 2018); National Weather Service, *The Bitterly Cold Air of January 27-28, 2014*, https://www.weather.gov/lot/2014jan28 (last visited Oct. 11, 2018).

[82] National Transportation Safety Board, *Derailment of CN Freight Train U70691-18 with Subsequent Hazardous Materials Release and Fire*, https://www.ntsb.gov/investigations/AccidentReports/Pages/RAR1201.aspx (last visited Oct. 11, 2018).

the train to pass. Seven other people were injured and about 600 nearby homes were evacuated.[83] A few days later, a 54-mile-long fish kill occurred on the Rock River when ethanol that was not consumed by the fire flowed downstream, killing over 70,000 fish.[84]

CHERRY VALLEY TRAIN DERAILMENT

Image from Rockford Register Star

In another instance, a major flood struck Jo Daviess County in northwestern Illinois in 2011 after 15 inches of rain fell during a 12-hour time period. The flood waters caused extensive damage to roads and train tracks and at least one fatality.[85] Illinois has also struggled with urban flooding caused by heavy rains falling on impervious surfaces.[86]

---

[83] CBC.ca, *CN Blamed for Fatal Train Derailment in Illinois*, https://www.cbc.ca/news/canada/cn-blamed-for-fatal-train-derailment-in-illinois-1.1139430 (last visited Oct. 12, 2018).

[84] Illinois Attorney General, *Attorney General Madigan Reaches Settlement to Recover Costs of Rockford Train Derailment, Ethanol Leak*, http://www.illinoisattorneygeneral.gov/pressroom/2015_03/20150305.html (last visited Oct. 12, 2018).

[85] *Crews Find Body of Woman Swept Away by Flood in Galena*, ROCKFORD REGISTER STAR (July 30, 2011), *available at* www.rrstar.com/x555032097/Crews-find-body-of-woman-swept-away-by-flood-in-Galena

[86] NOAA National Centers for Environmental Information, *State Climate Summaries: Illinois*, https://statesummaries.ncics.org/il (last visited Oct. 11, 2018).

2011 JO DAVIESS COUNTY FLOOD

Images from Rockford Register Star

Furthermore, rising average temperatures injures Illinois residents. Hotter weather will inevitably harm public health and lead to heat-related deaths. For instance, over 700 Illinois residents died due to the historically intense heat wave in July 1995.[87] Intensified drought conditions strengthen these impacts—the inverse of heavy precipitation.

Though catastrophes such as these have occurred from time to time throughout Illinois' history, climate change will cause them to happen more frequently and with more ferocity than ever before, at the cost of the lives and health of Illinois residents.

Iowa

Climate change increases Iowa's propensity for flooding and droughts, creates challenges for the state's agricultural economy, and poses risks to public health. While already experiencing some of climate change's adverse effects, Iowa will likely only become more susceptible to climate change-related harms as average temperatures continue to increase.

Climate change influences the frequency and duration of precipitation events, and Iowa is feeling the effects.[88] Over the past half century, Iowa has seen an increase in annual precipitation

---

[87] Jan C. Semenza, *et al*., *Heat Related Deaths During the 1995 Heat Wave in Chicago*, THE NEW ENGLAND JOURNAL OF MEDICINE (July 11, 1996), *available at* https://www.nejm.org/doi/full/10.1056/NEJM199607113350203.

[88] *Iowa Climate Statement 2017*, CTR. FOR GLOBAL & REGIONAL ENVTL. RES., 1 (2017), https://cgrer.uiowa.edu/sites/cgrer.uiowa.edu/files/wysiwyg_uploads/Iowa%20Climate%20Statement%202017_It's%20not%20just%20the%20heat,%20it's%20the%20humidity!_FINAL_August_10_2017.pdf.

and a greater frequency of extreme rain events.[89] The latest science suggests that the increase in precipitation will continue, while Iowa will also continue experiencing more significant drought in some areas.[90] The increased rain events are due to higher surface evaporation from a warmer world, while dry spells are due to reduced evaporation stemming from a lack of moisture.[91] In other words, changes in Iowa's climate will likely continue to make wet seasons wetter and dry seasons dryer.

Extreme rain events have caused significant flooding throughout Iowa, and with Iowa's over 70 interior rivers,[92] the flooding has adversely affected much of Iowa's population. Since 1990, Iowa has had over 30 presidentially declared flood-related disaster declarations.[93] The flooding has caused an estimated 13.5 billion dollars worth of property-related damage.[94] In 2016, a presidential declaration identified 19 counties affected by severe flooding, many of which were also hit hard by flooding in 2008.[95] In 2018 alone, 30 counties have already been identified in presidential disaster declarations due to severe storms and flooding.[96]

Heavy rainfall and melting snow have also led to significant flooding in Iowa's bordering Mississippi and Missouri Rivers. In 2011, the high level of the Mississippi River forced navigation closures and caused billions of dollars in damage downstream.[97] That same year, flooding along the Missouri River led to hundreds of millions of dollars in damages[98] and also

---

[89] Iman Mallakpour & Gabriele Villarini, *The Changing Nature of Flooding Across the Central United States*, 5 NATURE CLIMATE CHANGE, 250, 250–54 (2015).

[90] *What Climate Change Means for Iowa*, EPA 1 (Aug. 2016), https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-ia.pdf.

[91] Chia Chou et al., *Increase in the Range Between Wet and Dry Season Precipitation*, 6 NATURE GEOSCIENCE, 263, 263–67 (2013).

[92] *Interior Rivers*, IOWA DEP'T OF NAT. RESOURCES, http://www.iowadnr.gov/Fishing/Where-to-Fish/Interior-Rivers (last visited Oct. 2, 2018).

[93] *Iowa Disaster History*, IOWA HOMELAND SECURITY & EMERGENCY MGMT., https://www.homelandsecurity.iowa.gov/disasters/iowa_disaster_history.html (last visited Oct. 2, 2018).

[94] *Iowa Flood Center: For Legislators*, U. IOWA, https://iowafloodcenter.org/resources/for-legislators/ (last visited Oct. 2, 2018).

[95] *Iowa Disaster History*, IOWA HOMELAND SECURITY & EMERGENCY MGMT., *supra*.

[96] *Id.*

[97] HENRY DEHAAN ET AL., USACE, MISS. VALLEY DIV., MISSISSIPPI RIVER AND TRIBUTARIES SYSTEM 2011 POST-FLOOD REPORT V-12 (2012).

[98] DEP'T OF HOMELAND SEC., MISSOURI RIVER FLOOD COORDINATION TASK FORCE REPORT, 12, 39 (2011).

closed the river to navigation.[99] Iowa's Sioux City and Council Bluffs were two of the cities affected most by the flood, experiencing extensive property damage and crop loss.[100]

Iowa also has felt the impacts of climate change in its dry seasons. As recently as 2017, drought conditions throughout the state left locations with rainfall at less than 50 percent of normal precipitation.[101] In 2012, a prolonged drought cost the region more than $250 million when the scarcity of water led to narrowed navigation channels, forced lock closures, and dozens of barges running aground on the Mississippi River.[102]

Iowa has warmed between one-half to one degree in the last century, and a continued increase in temperature may lead to more challenges for Iowa's agricultural economy.[103] Iowa leads the nation in egg production, harvested acreage of principal crops, corn export value, corn for grain production, and hog and pig inventory.[104] Climate change may put additional heat stress on farmers' crops and livestock, posing a greater risk of substantial decreases in crop yields and livestock productivity.[105] Under some estimates, absent significant adaptation by Iowa farmers, the state could face declines in its corn crop of 18-77 percent—a significant blow to a corn industry currently worth nearly $10 billion.[106] Crop production can be inhibited by changing rain patterns such as wetter springs—which delay planting and increase flood risk—and less rain

---

[99] David Bailey & David Hendee, *The Mighty Missouri River: The Flooding and the Damage Done*, (Sep. 3, 2011, 8:45 AM), http://www.reuters.com/article/us-missouri-flooding/the-mighty-missouri-river-the-flooding-and-the-damage-done-idUSTRE78213720110903.

[100] DEP'T OF HOMELAND SEC., MISSOURI RIVER FLOOD COORDINATION TASK FORCE REPORT, *supra*, at 39.

[101] Craig Cogil, *Extreme Drought Expands in Southern Iowa*, NAT'L WEATHER SERV. 1 (Sep. 18, 2017), https://www.weather.gov/media/dmx/Climate/Drought.pdf.

[102] U.S. ARMY CORPS OF ENG'RS, EVENT STUDY: 2012 LOW-WATER AND MISSISSIPPI RIVER LOCK 27 CLOSURES, 6–7, 37 (2013), http://www.lrd.usace.army.mil/Portals/73/docs/Navigation/PCXIN/Drought_2012_Report_-FINAL_2013-08-30.pdf; *See* Harry J. Hillaker, *The Drought of 2012 in Iowa*, IOWA DEP'T OF AGRIC. AND LAND STEWARDSHIP, http://www.iowaagriculture.gov/climatology/weatherSummaries/2012/DroughtIowa2012Revised.pdf (last visited Oct. 2, 2018).

[103] *What Climate Change Means for Iowa*, *supra*, at 1.

[104] *Iowa's Rank in United States Agriculture*, USDA (May 2018), https://www.nass.usda.gov/Statistics_by_State/Iowa/Publications/Rankings/IA-2018-Rankings.pdf.

[105] *What Climate Change Means for Iowa*, *supra*, at 2.; J. L. Hatfield et al., *Vulnerability of Grain Crops and Croplands in the Midwest to Climatic Variability and Adaptation Strategies*, 146 CLIMATIC CHANGE, 263, 263–64 (2018).

[106] Kate Gordon 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

during the increasingly hot summers.[107] Farmers may also face the survival and spread of more unwanted pests because of warmer winters and a longer growing season.[108]

Climate change also puts Iowans' public health at risk. The higher temperatures can increase air pollutants such as ozone and fine particulates, which increase the risk of heart and lung-related illness.[109] Allergic diseases and asthma are expected to become more widespread and more severe due to exposure to new plants and increases in pollen counts.[110] The warmer, wetter climate can even increase the risk of infectious diseases transmitted by insects that will be better able to live in a more humid and warm Iowa environment.[111] Iowans' health risks will only likely increase as average temperatures continue to increase.

Maine

Maine is experiencing significant, negative effects of climate change through rising sea levels, ocean acidification, and invasive species that are expanding their range northward as the environment warms. By way of example, The Gulf of Maine is warming faster than 99% of the world's ocean waters.[112] These warmer waters have brought with them an invasion of non-native green crabs that are devastating soft-shell clam flats throughout southern and mid-coast Maine.[113] At the same time, ocean waters globally have become approximately 30% more acidic over the last century, and features of the Gulf of Maine, including its extensive freshwater inputs, make it particularly vulnerable to acidification.[114] The increasing acidity inhibits shell formation in all shellfish, including lobsters, which just five years ago were the basis of an industry estimated to be worth $1.7 billion in Maine.[115] These symptoms of climate change threaten both the health of the State's marine ecosystem and a coastal economy that depends on it.

---

[107] *What Climate Change Means for Iowa*, *supra*, at 1.

[108] Sara C. Pryor et al., *Midwest*, in CLIMATE CHANGE IMPACTS IN THE UNITED STATES: THE THIRD NATIONAL CLIMATE ASSESSMENT 418, 435 (J. M. Melillo et al. eds., 2014).

[109] *What Climate Change Means for Iowa*, *supra*, at 2.

[110] *Climate Change*, IOWA DEP'T OF NAT. RESOURCES , http://www.iowadnr.gov/Conservation/Climate-Change (last visited Oct. 2, 2018).

[111] *Id.*

[112] Woodard, C., *Mayday: Gulf of Maine in Distress*, Portland Press Herald, October 25, 2015, http://www.pressherald.com/2015/10/25/climate-change-imperils-gulf-maine-people-plants-species-rely/

[113] *Id.*

[114] Gledhill, D.K., et al., Ocean and Coastal Acidification off New England and Nova Scotia. *Oceanography* 28(2):182–197, 2015, http://dx.doi.org/10.5670/oceanog.2015.41.https://climate.nasa.gov/evidence/; http://tos.org/oceanography/article/ocean-and-coastal-acidification-off-newengland-and-nova-scotia.

[115] *Id.*; Dahlman, L, *Climate Change, Ocean Heat Content*, National Oceanic and Atmospheric Administration, https://www.climate.gov/news-features/climate-and/climate-lobsters; Hall, J., *From Bought to Caught, Lobsters all about Economics*, Portland Press Herald, August 11, 2012, http://www.pressherald.com/2012/08/11/market-forces-make-everyone-feel-the-pinch_2012-08-12/.

Similar changes are occurring in Maine's interior. Iconic species that drive the State's tourist economy are suffering from the effects of global warming. Longer, hotter summers and more frequent droughts are shrinking brook trout habitat[116] and undermining efforts to restore sea-run salmon in Maine's downeast rivers.[117] A plague of winter ticks brought on by decreased snowpack has taken a significant toll on Maine's moose population.[118] Milder winters have also hurt the ski industry,[119] while shorter and earlier springs are interfering with maple sugaring operations.[120]

Maryland

With more than 3,000 miles of coastline, Maryland's coast is particularly vulnerable to rising sea levels and the more extreme weather events associated with climate change: shoreline erosion, coastal flooding, storm surges, inundation, and saltwater intrusion into groundwater supplies.

In 2007, the Maryland Commission on Climate Change (MCCC) was established by Executive Order 01.01.2007.07 and was charged with evaluating and recommending state goals to reduce Maryland's greenhouse gas emissions to 1990 levels by 2020 and to reduce those emissions to 80 percent of their 2006 levels by 2050. The MCCC was also tasked with developing a plan of action that addressed the causes and impacts of climate change and included firm benchmarks and timetables for policy implementation. As a result of the work of more than 100 stakeholders and subject matter experts, the MCCC produced a climate action plan. That plan was the impetus for Maryland's Greenhouse Gas Emissions Reduction Act of 2009, an enhanced version of which became law in 2016.[121]

As emphasized by the MCCC's Science and Technical Working Group, estimates show that "Maryland is projected to experience between 2.1 and 5.7 feet of sea level rise over the next

---

[116] Pennsylvania State University, *For Trout Fishermen, Climate Change Will Mean More Driving Time, Less Angling*. ScienceDaily, August 20, 2015. www.sciencedaily.com/releases/2015/08/150820123648.htm.

[117] The National Academies Press, *Atlantic Salmon in Maine*, 2004, at 50-53, https://www.nap.edu/read/10892/chapter/5.

[118] Fleming, D., *Winter Ticks Raise Concerns about the Future of Maine's Moose Herd*, Portland Press Herald, June 14, 2014, http://www.pressherald.com/2014/06/14/winter-ticks-raise-concerns-about-future-of-maines-moose-herd/.

[119] Seelye, K., *Rising Temperatures Threaten Fundamental Change for Ski Slopes*, The New York Times, December 12, 2012, http://www.nytimes.com/2012/12/13/us/climate-change-threatens-ski-industrys-livelihood.html.

[120] Taylor, C., *How Climate Change Threatens Your Breakfast*, Science Friday, March 17, 2017, https://www.sciencefriday.com/segments/how-climate-change-threatens-your-breakfast/.

[121] Maryland Commission on Climate Change, 2016 Annual Report 7, http://mde.maryland.gov/programs/Air/ClimateChange/MCCC/Documents/MCCC_2016_final.pdf ("MCCC 2016 Annual Report").

century. In fact, sea level could be as much as 2.1 feet higher in 2050 along Maryland's shorelines than it was in 2000."[122]

Sea level rise could inundate some facilities of the Port of Baltimore, placing one of the most important ports along the East Coast at risk. In 2016, for instance, the Port generated nearly $3 billion in wages and salaries, supported over 13,000 direct jobs, and moved 31.8 million tons of international cargo.[123]

The state's tourism sector is also likely to feel the impact of climate change.[124] In 2015, for instance, tourism resulted in $2.3 billion in tax revenue, which directly supported more than 140,000 jobs with a payroll of $5.7 billion.[125] Rising sea levels, flooding, and heightened storm surges will place further strain on Maryland's low-lying urban and coastal lands, making tourism less feasible and increasing the costs of maintaining bridges, roads, boardwalks, and other tourism infrastructure.[126] Beaches, moreover, "will move inland at a rate 50 to 100 times faster than the rate of sea level elevation" and "the cost of replenishing the coastline after a 20-inch rise in sea level would be between $35 million and $200 million."[127]

Further, skiing and other snow sports "are at obvious risk from rising temperatures, with lower-elevation resorts facing progressively less reliable snowfalls and shorter seasons."[128] Wisp Mountain Park, for example, is a popular skiing destination in Western Maryland, and the only ski resort in the State. Even in late December of 2015, only one of the resort's 35 trails was open because of the difficulty keeping snow on the ground in above-freezing temperatures.[129]

Climate change may also adversely impact Maryland's agricultural industry, which employs some 350,000 people. [130] In 2015, the market value of agricultural products produced in Maryland was $2.2 billion, with net farm income exceeding $500 million.[131] By 2050, absent

---

[122] Maryland Commission on Climate Change, 2015 Annual Report 13, http://mde.maryland.gov/programs/Air/ClimateChange/MCCC/Publications/MCCC2015Report.pdf ("MCCC 2015 Annual Report").

[123] Maryland Commission on Climate Change, 2017 Annual Report 12, http://www.mde.state.md.us/programs/Air/ClimateChange/MCCC/Documents/MCCC_2017_final.pdf ("MCCC 2017 Annual Report").

[124] Center for Climate and Energy Solutions, Cost of Inaction Supplement, September 2015, https://www.c2es.org/document/climate-change-the-cost-of-inaction-for-marylands-economy/.

[125] Maryland Office of Tourism Development, Fiscal Year 2016 Tourism Development Annual Report, 2016, available at: http://industry.visitmaryland.org/research/annual-reports/annual-reports-archive/.

[126] MCCC 2015 Annual Report 14, *supra*.

[127] MCCC 2017 Annual Report 16, *supra*.

[128] MCCC 2016 Annual Report 18-19, *supra*.

[129] MCCC 2017 Annual Report 15, *supra*.

[130] *Id.* at 13.

[131] *Id.* at 14.

additional action, rising summer temperatures could result in nearly $150 million in median annual losses for corn, soy, and wheat.[132] Increased flooding could adversely affect the stability, salinity, drainage, and nutrient balance of soil in low-lying areas, causing declines in crop production and making farming less viable. Rising seas could lead salt water to flow into aquifers used for irrigation. Livestock could suffer from higher temperatures, too, and would need more access to cooler areas. By causing soil erosion and nutrient runoff, moreover, increased rainfall could adversely affect water quality, including in the Chesapeake Bay.[133]

Climate change will have significant effects on forests, which contribute some $2.2 billion to the Maryland economy, as well as $24 billion in ecological services.[134] Climate change will exacerbate species' existing stressors and alter their distribution, with some species likely to leave or decline and others likely to arrive or increase. Further, the services that forests provide—such as temperature regulation and water filtration—may be affected by climate change.[135]

Climate change also threatens the Chesapeake Bay, the largest estuary in the United States. Development and pollution have made the Bay and its ecosystems more vulnerable to stressors, including those resulting from climate change. Already, the Bay has warmed by three degrees Fahrenheit. Further temperature increases could change the composition of commercial fisheries and deprive aquatic life of the oxygen needed to survive. Some species are likely to move north towards cooler waters and more suitable habitats. Other forms of aquatic life, including invasive pests and diseases, are likely to arrive or proliferate in the Bay's newly-warmed waters.[136]

In terms of health impacts, Maryland is likely to experience increasing numbers of 90-degree days, markedly exacerbating heat-related illnesses and mortality, particularly among the elderly.[137] A two-week heat wave in 2012, for instance, led to 12 deaths in Maryland.[138] By mid-century, rising temperatures could cause 27 additional deaths each summer in Baltimore alone.[139]

Massachusetts

Temperatures in Massachusetts have warmed by an average of 1.3 degrees Celsius since 1895, almost twice as much as the rest of the contiguous 48 states. According to recent research

---

[132] MCCC 2015 Annual Report 15, *supra.*

[133] *Id.*

[134] *Id.*

[135] *Id.* at 15-16.

[136] *Id.* at 16.

[137] MCCC 2017 Annual Report 9, 17, *supra*.

[138] MCCC 2016 Annual Report 18-19, *supra*.

[139] *Id.*

by the University of Massachusetts, the Northeast, including Massachusetts, will continue to see temperatures rise higher more quickly than the rest of the United States and the world.[140]

Rising temperatures will result in milder winters with more freeze-thaw cycles and less precipitation falling as snow and instead as rain and freezing rain. Hotter summers will increase the number, intensity, and duration of heat waves and lead to poorer air quality.[141] Massachusetts already has the nation's highest incidence of pediatric asthma: among Massachusetts children in kindergarten to eighth grade, more than 12 percent suffer from pediatric asthma, and 12 percent of Massachusetts's adult population suffers from asthma.[142] Warmer temperatures increase ground level ozone, which impairs lung function and can result in increased hospital admissions and emergency room visits for people suffering from asthma, particularly children. Higher temperatures and carbon dioxide levels also will cause plants to produce more pollen, which can exacerbate asthma and other respiratory illnesses. More extreme heat also presents health hazards for people, including increased cardiovascular disease, Type II diabetes, renal disease, nervous disorders, emphysema, epilepsy, cerebrovascular disease, pulmonary conditions, mental health conditions, and death—especially for our most vulnerable residents.

The Northeast has seen the country's largest increases in heavy precipitation events (more than a 70-percent increase in the heaviest 1 percent of all events since 1958).[143] Some areas in Massachusetts have shown an increasing trend in the number of days with two inches of precipitation or more from 1970-2008. For example, over the last 60 years, the Connecticut River basin has experienced more than a doubling of heavy rainfall events. Regionally, the majority of heavy precipitation events have occurred during the summer months of May through September.[144] One hundred-year flood events are now occurring every 60 years, and 50-year floods are now occurring approximately every 30 years. Flooding has increased in association with extreme precipitation events, causing costly property damage and putting fish, wildlife, and their habitats at increased risk. Since 1990, Massachusetts has been affected by numerous major weather disasters, including Superstorm Sandy and Tropical Storm Irene.[145] Superstorm Sandy, a post-tropical storm in 2012, was the most extreme and destructive event to affect the

---

[140] Horton et al., *Northeast*, in CLIMATE CHANGE IMPACTS IN THE UNITED STATES: THE THIRD NATIONAL CLIMATE ASSESSMENT, 373 (2014), at http://nca2014.globalchange.gov/report/regions/northeast; *see also* EPA, Fact Sheet: What Climate Change Means for Massachusetts (Aug. 2016), at https://ia801602.us.archive.org/9/items/climate-change-ma/climate-change-ma.pdf.

[141] Massachusetts Department of Public Health, *Capacity to Address the Health Impacts of Climate Change in Massachusetts*, 6 (April 2014), at http://www.mass.gov/eohhs/docs/dph/environmental/exposure/climate-change-report-2014.pdf.

[142] *Id*; Centers for Disease Control and Prevention, 2014 Adult Asthma Data: Prevalence Tables and Maps, *at* https://www.cdc.gov/asthma/brfss/2014/tableC1.htm; Massachusetts Department of Public Health, Pediatric Asthma, *at* https://matracking.ehs.state.ma.us/Health-Data/Asthma/pediatric.html.

[143] Horton, *supra*, at 373.

[144] Massachusetts Climate Action Partnership, *Massachusetts Wildlife Climate Action Tool – Stressors: Storms and floods* (2015), at https://climateactiontool.org/content/storms-and-floods.

[145] Runkle et al., *Massachusetts State Summary*, NOAA TECHNICAL REPORT NESDIS 149-MA, 4 (2017), at https://statesummaries.ncics.org/MA.

northeastern United States in 40 years and the second costliest in the Nation's history. Storm impacts in Massachusetts included strong winds, record storm tide heights, flooding of some coastal areas and loss of power for 385,000 residents.[146] Massachusetts suffered an estimated $375 million in property losses alone.[147] In January 2018, the storm surge from a powerful winter storm caused major coastal flooding and resulted in a high tide in Boston of 15.16 feet, the highest tide since records began in 1921, even surpassing the infamous Blizzard of 1978.[148] And two months later, a March coastal storm resulted in a 14.67 feet Boston tide (the third-highest on record[149]), damaged 2,113 homes, including 147 that were destroyed, and caused more than $24 million in flooding damage across six Massachusetts coastal counties.[150]

Beyond the damage that more intense storms can cause homes, businesses, and private and public infrastructure generally, such events also threaten the aging combined sewer and stormwater systems serving many Massachusetts cities such as Boston and Lowell. Heavy precipitation and coastal flooding can overwhelm these systems and release untreated sewage to our rivers and coastal waters, threatening public health and water quality.[151]

Massachusetts is a coastal state especially vulnerable to sea level rise caused by climate change, which is already exacerbating coastal flooding and erosion from storm events and will eventually inundate low-lying communities, including the City of Boston. Roughly 5 million Massachusetts residents—75% of the state's population—live near the coast.[152] The total output of the Massachusetts coastal economy was $249.2 billion in 2014, representing over 54% of the state's annual gross domestic product, and coastal counties accounted for 53% of the state's employment and wages.[153] According to the National Climate Assessment, in Boston alone, cumulative damage to buildings, building contents, and associated emergency costs could

---

[146] *Id.*

[147] *Id.*

[148] Martin Finucane, *It's official: Boston breaks tide record*, BOSTON GLOBE, Jan. 5, 2017, *at* https://www.bostonglobe.com/metro/2018/01/05/official-boston-breaks-tide-record/UPbwDxgF0QXNOWvB9bcQ7L/story.html.

[149] Christina Prignano, *The Noon High Tide Was Bad, but the Midnight High Tide Could Be Worse*, BOSTON GLOBE, March 2, 2018, *at* https://www.bostonglobe.com/metro/2018/03/02/the-noon-high-tide-was-bad-but-midnight-high-tide-will-worse/m4O1PR8HRIoLsmx3mp2YvO/story.html.

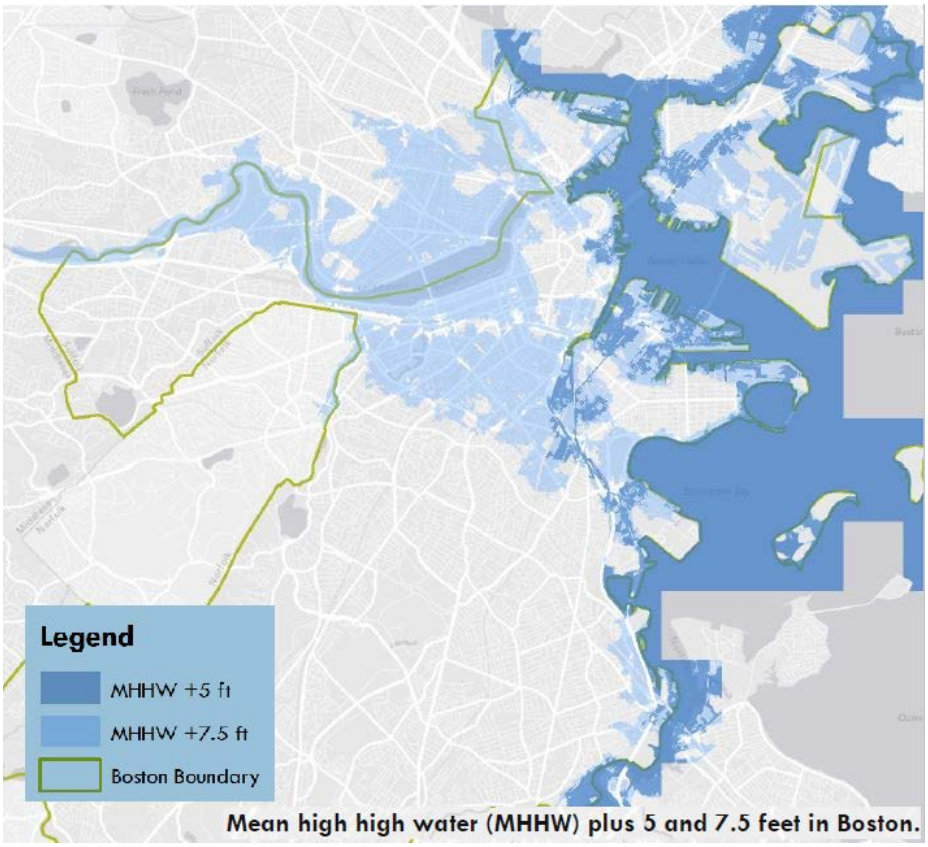
[150] Christian M. Wade, *Baker Seeks Federal Disaster Funds for Storm Damages*, LAWRENCE EAGLE-TRIBUNE, May 1, 2018, *at* https://www.eagletribune.com/news/merrimack_valley/baker-seeks-federal-disaster-funds-for-storm-damages/article_d2f0c7b4-bd75-5a8b-8a0c-4dedbe44a7b4.html.

[151] City of Boston, *Climate Ready Boston, Final Report*, 290 (December 2016), *at* https://www.boston.gov/sites/default/files/20161207_climate_ready_boston_digital2.pdf.

[152] NOAA, National Coastal Population Report, 9 (2013), *at* https://aamboceanservice.blob.core.windows.net/oceanservice-prod/facts/coastal-population-report.pdf.

[153] NAT'L OCEAN ECONOMICS PROGRAM, STATE OF THE U.S. OCEAN AND COASTAL ECONOMIES: COASTAL STATES SUMMARIES – 2016 UPDATE 29 (2016), *at* http://midatlanticocean.org/wp-content/uploads/2016/03/CoastalStatesSummaryReports_2016.pdf

potentially be as high as $94 billion between 2000 and 2100, depending on the sea level rise scenario and which adaptive actions are taken.[154]



Mean high high water (MHHW) plus 5 and 7.5 feet in Boston.

Increased sea level, combined with increased erosion rates, is also predicted to threaten Massachusetts' barrier beach and dune systems. Development on the beaches themselves, as in the case of Plum Island, will continue to face challenges associated with erosion and storm damage. Barrier beaches will be more susceptible to erosion and overwash, and in some cases breaching. Such breaching will put at risk extensive areas of developed shoreline located behind these barrier spits and islands, such as the shorelines of Plymouth, Duxbury, and Kingston. Engineered structures, such as seawalls designed to stabilize shorelines, could be overtopped. The cost of maintaining and upgrading these engineering structures and replenishing dunes and beaches damaged by erosion will increase as sea levels rise, requiring investments of millions of dollars by local governments.[155] Large areas of critical coastal and estuarine habitat, including the North Shore's Great Marsh—the largest continuous stretch of salt marsh in New England, extending from Cape Ann to New Hampshire—are at risk as they will be unable to adapt and migrate as sea level rises and local land subsides.[156]

Massachusetts already is seeing what climate change means for our natural resources. The signs of spring—including the arrival of migratory birds and the blooming of wildflowers and other plants—are arriving earlier. Warmer temperatures also are contributing to the rise in

[154] Horton, *supra*, at 379.

[155] For one example, a recent, large-scale beach replenishment project in Winthrop, Massachusetts secured $26 million in state funds for completion. See Beth Daley, *Sand Wars Come to New England*, BOSTON GLOBE, (Dec. 15, 2013), *available at* https://www.bostonglobe.com/lifestyle/health-wellness/2013/12/15/sand-wars-come-new-england-coast/F2ClK6e20wtcZeCoUQC9AM/story.html.

[156] City of Boston, *Climate Ready Boston*, *supra*, at 60.

deer populations in Massachusetts, resulting in loss of underbrush habitat for forest species and the spread of tick-borne diseases such as Lyme disease. As the Gulf of Maine is warming much faster than other water bodies, key cold-water ocean fisheries, including cod and lobster, are in decline. The timing of the migration of anadromous fish species, such as Atlantic salmon and alewives, has advanced in the last few decades, and they are migrating earlier in the season.[157]

Minnesota

Minnesota's climate is changing, and it's already affecting residents' health and the state's environment and economy. Rising temperatures may interfere with winter recreation, extend the growing season, change the composition of trees in the North Woods, and increase water pollution problems in lakes and rivers. The state will have more extremely hot days, which may harm public health in urban areas and corn harvests in rural areas.

The Minnesota Pollution Control Agency (MPCA) is a member of Minnesota's Environmental Quality Board (EQB). EQB's 2015 "Minnesota and Climate Change: Our Tomorrow Starts Today" report, outlines many changes our state is already experiencing as a result of climate change.[158] Minnesota is getting warmer and increases in temperatures means ice cover on lakes is forming later and melting sooner, which impacts traditional winter sports and tourism; the ragweed pollen season is increasing; and Minnesota is seeing a rise in tick- and mosquito-borne illnesses; among other current and expected impacts.

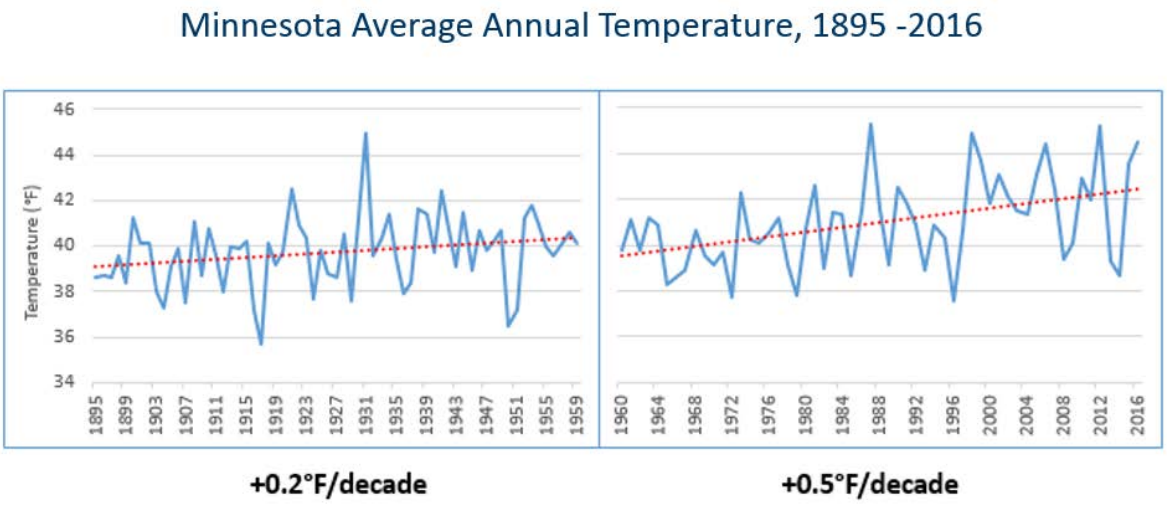
Minnesota has gotten noticeably warmer, especially over the last few decades. The temperature in the state has increased 1°F to 2°F since the 1980s.[159] Since the beginning of the data record (1895) through 1959, Minnesota's annual average temperature increased by nearly 0.2°F per decade, which is equivalent to over 2°F per century. This is shown in the graph at the left (below). This warming effect has accelerated over the last 50 plus years. Data from 1960-2016 show that the recent rate of warming for Minnesota has sped up substantially to over 0.5°F per decade, which is equivalent to 5.0°F per century. This is shown in the graph to the right (below).

---

[157] EPA, Fact Sheet: What Climate Change Means for Massachusetts, *supra*; Massachusetts Climate Action Partnership, *supra* note 99, *Ecology and Vulnerability: Alewife, at* http://climateactiontool.org/species/alewife.

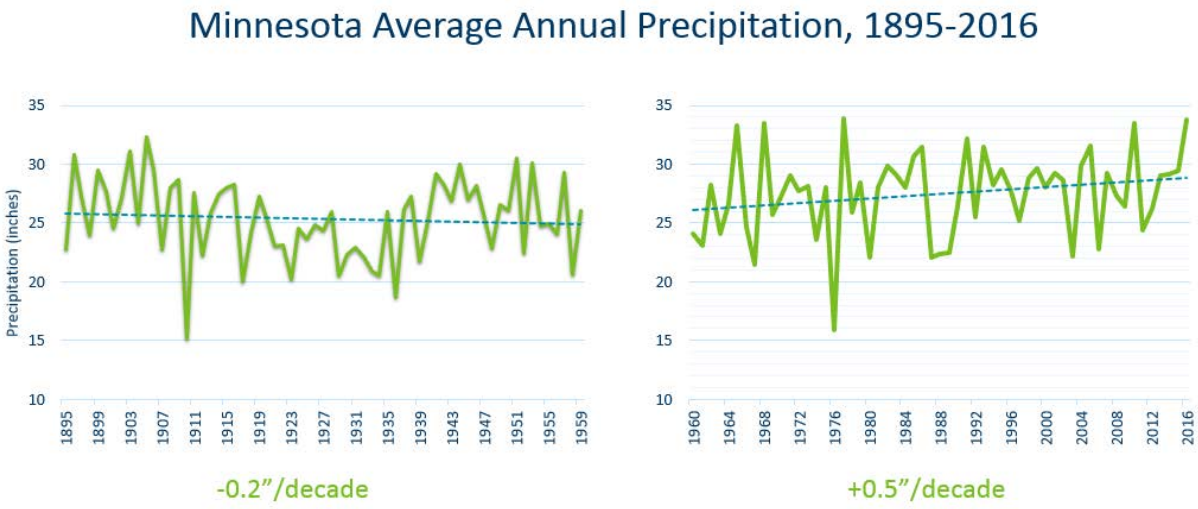
[158] Environmental Quality Board, "Minnesota and Climate Change: Our Tomorrow Starts Today"(2015), *available at* https://www.eqb.state.mn.us/content/climate-change

[159] *Minnesota and Climate Change: Our Tomorrow Starts Today*, at 6, available at: (https://www.eqb.state.mn.us/content/climate-change) (hereinafter "Minnesota and Climate Change,") citing *Climate at a Glance: Time Series* (n.d.) (retrieved July 2014, from National Climactic Data Center, available at: http://www.ncdc.noaa.gov/cag/time-series)) and Zandlo, J. (2008, March 13), *Climate Change and the Minnesota State Climatology Office: Observing the Climate* (retrieved July 2, 2014, from Minnesota Climatology Working Group, *available at* http://climate.umn.edu/climateChange/climateChangeObservedNu.htm); *see also* Pryor, S. C. et al., 2014: *Ch. 18: Midwest. Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 418-440. doi:10.7930/J0J1012N.



Source: NOAA, 2017

With a warming atmosphere, more evaporation occurs. The graph on the left (below) highlights the trend for the early part of the last century, 1895-1959, while the graph on the right (below) highlights the trend for the most recent half century, 1960-2016. For most of the first half of the 20th century, the trend in precipitation was slightly downward, at a loss of 0.2 inches per decade or the equivalent of -2 inches per century. This downward trend was influenced by the Dust Bowl years of the 1930s. However, the rate of precipitation across the state has increased by nearly 0.5 inches per decade or the equivalent of 5 inches per century over the last 50+ years.[160]



Source: NOAA, 2017

[160] *See* Minnesota Dep't of Health, *Climate Change in Minnesota*, www.health.state.mn.us/divs/climatechange/climate101.html (last visited Oct. 24, 2018) (relying on NOAA data)

Floods are becoming more frequent. According to EPA, over the last half century, average annual precipitation in most of the Midwest has increased by 5 to 10 percent, with greater inter-annual variability.[161] But rainfall during the four wettest days of the year has increased about 35 percent.[162] Yearly frequency of the largest storms – those with three inches or more of rainfall in a single day – have more than doubled in just over 50 years.[163] In the past decade, such dramatic rains have increased by more than 70 percent. Since 2004, Minnesota has experienced three 1,000-year floods and an increase in intense weather events including hailstorms, tornadoes and droughts. In 2007, we saw several counties in the state receive drought designation, while others were declared flood disasters – an occurrence that repeated itself in 2012 when 11 counties declared flood emergencies while 55 received drought designations.

Climate change impacts outside of Minnesota have affected our air quality and our health. Since 2015, thirteen of seventeen air quality alerts issued by the Minnesota Pollution Control Agency are directly attributable to wildfires or forest fires in Canada or the western United States.

Climate change has caused financial impacts to Minnesota as well. In 2013, Minnesota had some of the highest weather-related disaster claims in the nation. Since 1997, 32 severe weather natural disasters have cost Minnesota nearly $500 million in natural disaster recovery assistance to affected jurisdictions alone.[164] The impacts of climate change are expected to worsen in Minnesota, affecting our economy, our ecosystems and the health of all Minnesotans.

New Mexico

The Southwest and New Mexico are experiencing the effects of climate change at a rate much faster than the majority of U.S. states. Warming trends in the southwestern U.S. have exceeded global averages by nearly 50 percent since the 1970s, and average temperatures in New Mexico have been increasing 50 percent faster than the global average over the past century.[165] Temperatures in the Upper Rio Grande River basin are increasing at a rate of roughly 0.7° F per

---

[161] U.S. EPA, *What Climate Change Means for Minnesota* (August 2016), *available at*: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwibxob4l4zXAhXs6YMKHcl0BnUQFggoMAA&url=https%3A%2F%2Fwww.epa.gov%2Fsites%2Fproduction%2Ffiles%2F2016-09%2Fdocuments%2Fclimate-change-mn.pdf&usg=AOvVaw13tl9K6gVwgwua3_nhSUzk

[162] *Id.*

[163] Minnesota and Climate Change, *supra*, at 6; *see also* Saunders, S. et al., *Doubled Trouble: More Midwestern Extreme Storms. Rocky Mountain Climate Organization; Natural Resources Defense Council* (2012).

[164] Minnesota and Climate Change, *supra*, at 6; *see also* Office of the Legislative Auditor, State of Minnesota (2012), *Helping Communities Recover from Natural Disasters: Evaluation Report Summary*

[165] Nature Conservancy, *Implications of Recent Climate Change*, at iii; Robert Repetto, *New Mexico's Rising Economic Risks from Climate Change*, DĒMOS, at 1 (2012).

decade, contributing to an average warming of 2.7° F since 1970.[166] Mountains have shown a higher rate of temperature rise when compared to lower elevations.[167] Both minimum and maximum monthly temperatures also show rising trends. The number of very hot days and nights -- defined as temperatures above the warmest 10 percent of days on record -- has increased since 1950. Heat waves lasting longer than four days have also significantly increased since 1960.[168] These occurrences do not only affect a specific part of the state; over 95 percent of New Mexico has experienced mean temperature increases.[169]

Key findings from the Third U.S. National Climate Assessment (Assessment) for the Southwest include:

- Snowpack and streamflow amounts are projected to decline in parts of the Southwest, decreasing surface water supply reliability for cities, agriculture, and ecosystems.[170] (This is a critical issue for New Mexico because the state's social, economic and environmental systems are already water-scarce and thus vulnerable to the supply disruptions which are likely to accompany future climate changes.[171]).

- Increased warming, drought, and insect outbreaks caused by or linked to climate change have increased the frequency of catastrophic wildfires impacting people and ecosystems in the Southwest. Fire models project more wildfire and increased risks to communities across extensive areas.[172]

- The Southwest's 182 federally recognized tribes and communities share particularly high vulnerabilities to climate changes such as high temperatures, drought, forest fires, and severe storms. Tribes may face loss of traditional foods, medicines, and water supplies due to declining snowpack, increasing temperatures, increasing drought, forest fires, and subsequent flooding. Historic land settlements and high rates of poverty – more than double

---

[166] Jason Funk et al., *Confronting Climate Change in New Mexico* at 6-7, 9 (Union of Concerned Scientists, April 2016); www.ucsusa.org/NewMexicoClimateChange (last visited Oct. 18, 2018).

[167] Dagmar Llewellyn & Seshu Vaddey, *West-Wide Climate Risk Assessment: Upper Rio Grande Impact Assessment*, at 1, 37-38, 117 (U.S. Department of Interior, Bureau of Reclamation, Dec. 2013); https://www.usbr.gov/watersmart/baseline/docs/urgia/URGIAMainReport.pdf (last visited Oct. 19, 2018).

[168] Repetto, Robert, *New Mexico's Rising Economic Risks from Climate Change*, at 1, *available at* https://www.demos.org/sites/default/files/publications/UpdatedNMFullReport.pdf (last visited Oct. 24, 2018); *see also* Nature Conservancy, *Implications of Recent Climate Change*, *supra*, at 4.

[169] Nature Conservancy, *Implications of Recent Climate Change*, *supra*, at iii.

[170] U.S. Global Change Research Program, *2014 National Climate Assessment*, at 463 (2014), *available at* https://nca2014.globalchange.gov/report/regions/southwest%0D (last visited Jan. 8, 2018).

[171] 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 (last visited Oct. 18, 2018).

[172] *Id.*

that of the general United States population – constrain tribes' abilities to respond effectively to climate challenges.[173]

- The Southwest produces more than half of the nation's high-value specialty crops, which are irrigation-dependent and particularly vulnerable to extremes of moisture, cold, and heat. Reduced yields from increasing temperatures and increasing competition for scarce water supplies will displace jobs in some rural communities.[174]

- Increased frost-free season length, especially in already hot and moisture-stressed regions like the Southwest, is projected to lead to further heat stress on plants and increased water demands for crops. Higher temperatures and more frost-free days during winter can lead to early bud burst or bloom of some perennial plants, resulting in frost damage when cold conditions occur in late spring; in addition, with higher winter temperatures, some agricultural pests can persist year-round, and new pests and diseases may become established.[175]

Key findings from the Assessment for New Mexico include:

- Streamflow totals in the Rio Grande and other rivers in the Southwest were 5 percent to 37 percent lower between 2001 and 2010 than average flows during the 20th century. Projections of further reduction of late-winter and spring snowpack and subsequent reductions in runoff and soil moisture pose increased risks to water supplies needed to maintain cities, agriculture, and ecosystems.[176]

- Drought and increased temperatures due to climate change have caused extensive tree death across the Southwest. **W**inter warming due to climate change has exacerbated bark beetle outbreaks by allowing more beetles, which normally die in cold weather, to survive and reproduce.[177] Wildfire and bark beetles killed trees across one fifth of New Mexico and Arizona forests from 1984 to 2008.[178] Climate changes caused extensive piñon pine mortality in New Mexico between 1989 and 2003.[179]

---

[173] The White House, Office of the Press Secretary, *FACT SHEET: What Climate Change Means for New Mexico and the Southwest*, at 3 (2014), *available at* https://obamawhitehouse.archives.gov/sites/default/files/docs/state-reports/NEWMEXICO_NCA_2014.pdf (last visited Oct. 18, 2018); *see also Confronting Climate Change in New Mexico, supra,* at 6-7, 9.

[174] U.S. Global Change Research Program, *2014 National Climate Assessment*, *supra*, at 463.

[175] *Id.*

[176] *Id.*

[177] *Id.*

[178] *Id.* at 468.

[179] *Id.* at 484.

- Exposure to excessive heat can aggravate existing human health conditions, such as respiratory and heart disease. Increased temperatures can reduce air quality because atmospheric chemical reactions proceed faster in warmer conditions. As a result, heat waves are often accompanied by increased ground level ozone, which can cause respiratory distress. Increased temperatures and longer warm seasons will lead to shifts in the distribution of disease-transmitting mosquitoes.[180]

Additionally, a recent study led by Los Alamos National Laboratories found that greenhouse gas-driven 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.[181]

If action is not taken to reduce greenhouse gas emissions, climate models project substantial changes in New Mexico's climate over the next 50 to 100 years. Barring reduction efforts, projected climate changes by mid- to late 21st century include: air temperatures warming by 6-12 degrees Fahrenheit on average, but more so in winter, at night, and at high elevations; more episodes of extreme heat, fewer episodes of extreme cold; more intense storm events and flash floods; and winter precipitation falling more often as rain and less often as snow.[182] Severe and sustained drought will stress water sources, already over-utilized in many areas, forcing increasing water-allocation competition among farmers, energy producers, urban dwellers, and ecosystems.[183]

New York

New York has begun to experience adverse effects from climate change. In 2014, the New York Attorney General's Office released a report, *Current and Future Trends in Extreme Rainfall Across New York State*, which highlights dramatic increases in the frequency and intensity of extreme rain storms across New York.[184] As but one example, devastating rainfall from Hurricane Irene in 2011 dropped more than 11 inches of rain in just 24 hours, causing catastrophic flooding in the Hudson Valley, eastern Adirondacks, Catskills and Champlain Valley. Thirty-one counties were declared disaster areas. Over 1 million people were left without power, more than 33,000 had to seek disaster assistance, and 10 were killed. Damage estimates totaled $1.3 billion. While no individual storm can be tied to climate change, the trends in

---

[180] *What Climate Change Means for New Mexico and the Southwest, supra*, at 2-3.

[181] Chris Mooney, *Scientists say climate change could cause a 'massive' tree die-off in the U.S. Southwest*, WASH. POST, Dec. 21, 2015, *available at* https://www.washingtonpost.com/news/energy-environment/wp/2015/12/21/scientists-say-climate-change-could-cause-a-massive-tree-die-off-in-the-southwest/ (last visited Oct. 18, 2018).

[182] *Confronting Climate Change in New Mexico, supra*, at 3.

[183] *What Climate Change Means for New Mexico and the Southwest, supra*, at 1-2.

[184] *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) (based on data from the 2014 National Climate Assessment and the National Oceanographic and Atmospheric Administration's Northeast Regional Climate Center), available at: https://ag.ny.gov/pdfs/Extreme_Precipitation_Report%209%202%2014.pdf

extreme rainfall already being felt across New York State are consistent with scientists' predictions of new weather patterns attributable to climate change.

Hurricane Irene Flooding

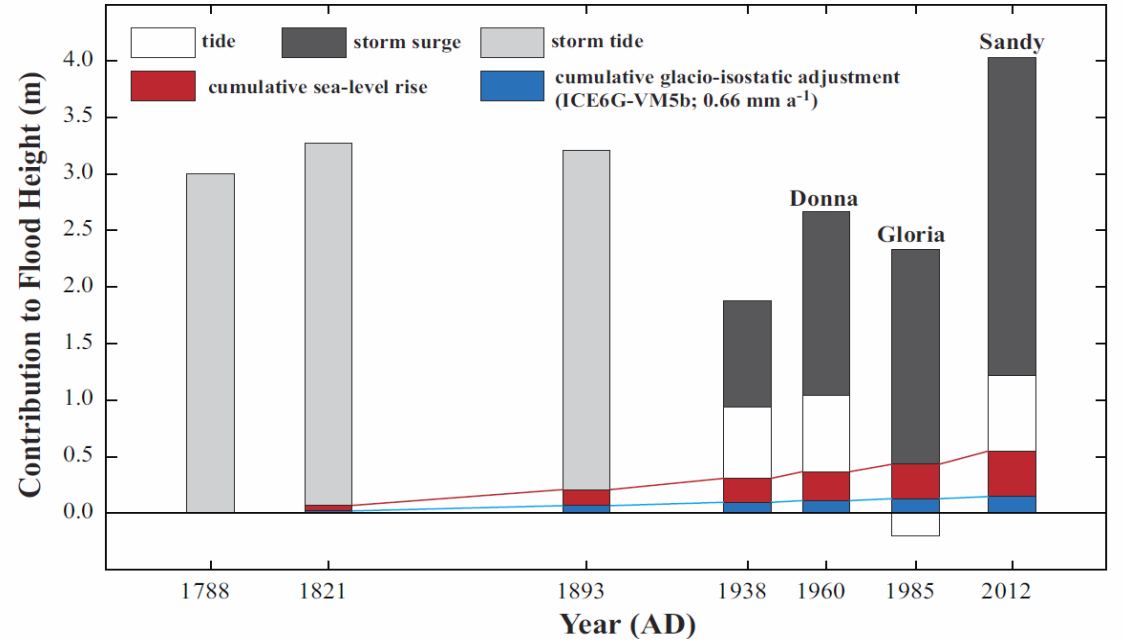
Image from ABC 7 Eyewitness News

Similarly, in August 2014, a weather front stalled over Long Island, dumping more than 13½ inches of rain—nearly an entire summer's worth—in a matter of hours and breaking the state's rainfall record. That deluge flooded out over 1,000 homes and businesses, opened massive sinkholes on area roadways, and forced hundreds to evacuate to safer ground. Initial damage estimates exceeded $30 million.

Historic Long Island Flash Flooding

Image from NYTimes (Andrew Theodorakis/Getty Images)

Also, New York's rate of sea level rise is much higher than the national average and could account for up to 6 feet of additional rise by 2100 if greenhouse gas emissions are not abated. Storm surge on top of high tide on top of sea level rise is a recipe for disaster for coastal New York. The approximately 12 inches of sea level rise New York City has experienced since 1900 may have expanded Hurricane Sandy's flood area by about 25 square miles, flooding the homes of an additional 80,000 people in the New York City area alone.[185] That flooding devastated areas of New York City, including the Brooklyn-Queens Waterfront, the East and South Shores of Staten Island, South Queens, Southern Manhattan, and Southern Brooklyn, which in some areas lost power and other critical services for extended periods of time.



Estimated Contribution to Flood Heights in New York City for Notable Historical Hurricanes[186]

Hurricane Sandy exposed critical weaknesses in the resilience of New York's utility infrastructure, the danger that this weakness poses to New Yorkers, and the collateral damage to the economy:

- Almost 2 million utility customers suffered from electricity outages;
- Tens of thousands of utility customers were left without power for weeks;
- Hospitals were shut down and patients displaced;
- Many drinking water utilities lost power, which disrupted their ability to provide safe water; and sewage treatment plants could not operate, resulting in billions of gallons of untreated or partially treated sewage flowing into local waterways.

---

[185] New York City Panel on Climate Change 2015 Report, Chapter 2: Sea Level Rise and Coastal Storms. Ann. N.Y. Acad. Sci. ISSN 0077-8923, available at: http://onlinelibrary.wiley.com/doi/10.1111/nyas.12593/full

[186] Kemp et al., Contribution of relative sea-level rise to historical hurricane flooding in New York City, *Journal of Quaternary Science 28(6), at* 537-541 (2013).

The costs of Hurricane Sandy to New York alone will likely top $40 billion, including $32.8 billion to repair and restore damaged housing, parks and infrastructure and to cover economic losses and other expenses. That figure includes $9.1 billion to help mitigate and prevent potential damages from future severe weather events.[187]

Of course, sea level rise will not stop in 2100, nor in 2200 especially if a high GHG emission scenario continues, resulting in locked-in or "committed" sea level rise over hundreds or thousands of years, drastically altering New York's coastline and disrupting our communities.[188] The figure below[189] illustrates the inundation in portions of New York City resulting from the committed sea level rise expected from 4ºC (7.2ºF) of warming.[190,] Note that in the ongoing rulemaking for the Safe Vehicles Rule, the National Highway Traffic Safety Administration has determined that taking no policy actions to reduce CO2 emissions will cause global surface temperature in 2100 to increase to 3.48ºC[191], close to the 4ºC warming represented in the figure.

[187] *See* State of New York, *Governor Cuomo Holds Meeting with New York's Congressional Delegation, Mayor Bloomberg and Regional County Executives to Review Damage Assessment for the State in the Wake of Hurricane Sandy*, available at: https://www.governor.ny.gov/news/governor-cuomo-holds-meeting-new-yorks-congressional-delegation-mayor-bloomberg-and-regional

[188] U.S. Global Change Research Program, 2014 National Climate Assessment, at 345.

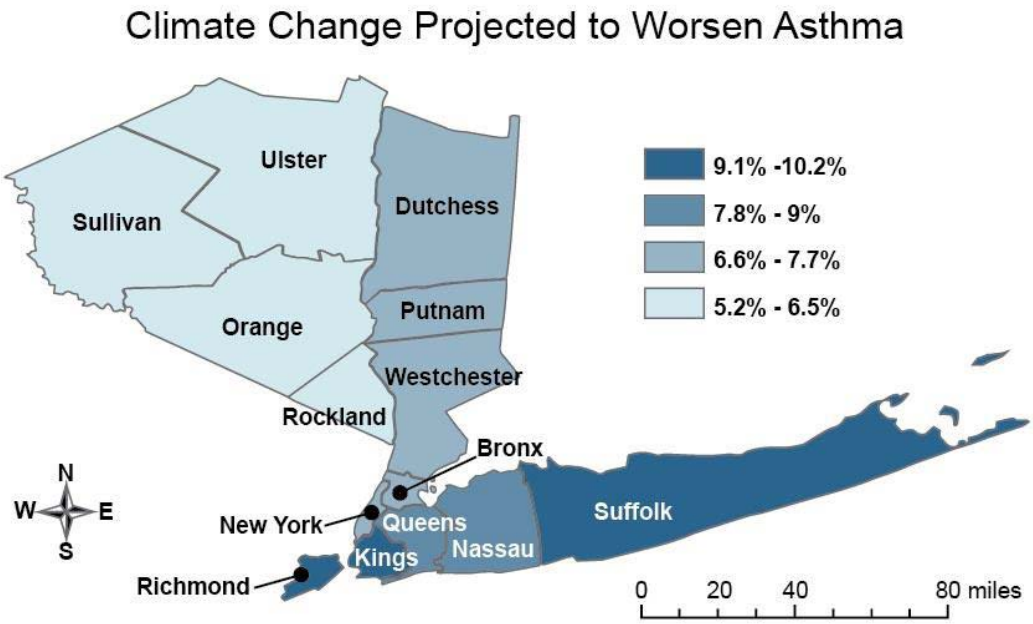
[189] Data file available at http://sealevel.climatecentral.org/maps/google-earth-video-global-cities-at-risk-from-sea-level-rise

[190] Carbon choices determine US cities committed to futures below sea level. Strauss,B.H., S. Kulp, and A. Levermann. PNAS November 3, 2015 112 (44) 13508-13513, *available at* https://doi.org/10.1073/pnas.1511186112

[191] Draft Environmental Impact Statement for the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Year 2021–2026 Passenger Cars and Light Trucks. NHTSA. July 2018. Docket No. NHTSA-2017-0069. 500 pp.

Although New York has taken a number of actions to reduce pollutants such as nitrogen oxides and volatile organic compounds that contribute to ground level ozone (smog) formation, ozone pollution remains a persistent problem. Much of New York City and Long Island have not attained the 2008 ozone standards, much less the more protective 2015 standards. A significant amount of the pollutants that contribute to smog is generated in upwind states and carried by prevailing winds into New York and other northeastern states. As the climate warms, increased temperatures create more favorable conditions for the formation of smog. According to the Third National Assessment on Climate Change, for example, under a scenario in which greenhouse gases continue to increase, this would lead to higher ozone concentrations in the New York metropolitan region, driving up the number of ozone-related emergency room visits for asthma in the area by 7.3 percent--more than 50 additional ozone-related emergency room visits per year in the 2020s, compared to the 1990s.[192] The figure below, included in that report, shows that projected worsening in asthma cases in the New York City area.

[192] U.S. Global Change Research Program, *2014 Third National Assessment on Climate Change*, at 222 (citing Sheffield, P. E., J. L. Carr, P. L. Kinney, and K. Knowlton, Modeling of regional climate change effects on ground level ozone and childhood asthma. American Journal of Preventive Medicine, 41, 251-257 (2011), *available at* http://download.journals.elsevierhealth.com/pdfs/journals/0749-3797/PIIS0749379711003461.pdf)



North Carolina

The effects of climate change have been felt and will continue to be felt from the mountains to the sea and across every sector of North Carolina's economy.

With approximately 3,375 miles of shoreline,[193] North Carolina is particularly vulnerable to the effects of sea-level rise. In its 2010 Sea Level Rise Assessment Report, the North Carolina Coastal Resource Commission's Science Panel on Coastal Hazards concluded that a 39-inch rise in sea levels was likely to occur on the North Carolina coast in the next century.[194] The Panel's 2015 update predicted that sea levels would rise by 1.9 to 10.6 inches at different locations along North Carolina's coast by 2045.[195]

Because of eastern North Carolina's low-lying topography, North Carolina faces extensive loss of land to inundation from sea-level rise.[196] In 2014, the North Carolina Division

[193] NOAA Office for Coastal Management, Shoreline Mileage of the United States, https://coast.noaa.gov/data/docs/states/shorelines.pdf.

[194] N.C. Coastal Resource Commission Science Panel, North Carolina Sea-Level Rise Assessment Report (March 2010), available at https://files.nc.gov/ncdeq/Coastal%20Management/documents/PDF/Coastal%20Hazards%20Storm%20Information/NC_Sea_Level_Rise_Assessment_Report_2010_CRC_Science_Panel.pdf.

[195] N.C. Coastal Resource Commission Science Panel, North Carolina Sea-Level Rise Assessment Report: 2015 Update to 2010 Report and 2012 Addendum (March 31, 2015), available at https://files.nc.gov/ncdeq/Coastal%20Management/documents/PDF/Science%20Panel/2015%20NC%20SLR%20Assessment-FINAL%20REPORT%20Jan%2028%202016.pdf.

[196] North Carolina Department of Public Safety, North Carolina Emergency Management Geospatial and Technology Management, North Carolina Sea Level Rise Impact Study: Final Study Report (June 2014).

of Emergency Management concluded that over the century, North Carolina could see the inundation of 800 square miles of North Carolina's coastal plain, representing 9% of the land area in North Carolina's 20 coastal counties.[197] Another study predicted that 13 North Carolina communities will face chronic inundation from sea level rise by 2035 and that a further 36 communities will experience chronic inundation by 2100.[198]

North Carolina sits within a frequent hurricane path, making its coastal region especially vulnerable to hurricanes and inland flooding. This year, Hurricane Florence claimed the lives of 39 people in North Carolina[199] and caused an estimated $13 billion in damage.[200] The storm shattered the previous rainfall record set by Hurricane Floyd in 1999 of 24.06 inches. During the hurricane, Elizabethtown, North Carolina saw 35.93 inches of rainfall and Swansboro, North Carolina saw more than 33 inches of rainfall.[201] A rainfall meteorologist at North Carolina State University calculated that Hurricane Florence, compared to all storms in the United States over the last 70 years, produced the second highest amount of rain in a concentrated (14,000 square mile) land area.[202] On the meteorologist's list, four of the top seven storms occurred in the last three years.[203] In 2016, Hurricane Matthew had devastating impacts on many of the same areas of eastern North Carolina, killing at least 27 people and causing some $1.5 billion in damage, from which the state is still recovering.[204]

The amount of rainfall and flooding these hurricanes have brought used to be extremely rare in North Carolina, but it is not rare anymore. Based on pre-climate change weather patterns, Hurricane Florence's rainfall was described as an event that eastern North Carolina could expect

---

[197] *Id.*

[198] Union of Concerned Scientists, When Rising Seas Hit Home: Fact Sheet: North Carolina Faces Chronic Inundation (July 2017), *available at* https://www.ucsusa.org/sites/default/files/attach/2017/07/when-rising-seas-hit-home-northcarolina-fact-sheet.pdf.

[199] North Carolina Governor's Office, As Recovery Moves Ahead, North Carolina Mourns Lives Lost, Works to Connect Storm Survivors with Housing (Oct. 2, 2018), *available at* https://governor.nc.gov/news/recovery-moves-ahead-north-carolina-mourns-lives-lost-works-connect-storm-survivors-housing.

[200] North Carolina Governor's Office, Governor Cooper Recommends Robust State Funding Package for Hurricane Florence Recovery and Resiliency (Oct. 10, 2018), *available at* https://governor.nc.gov/news/governor-cooper-recommends-robust-state-funding-package-hurricane-florence-recovery-and.

[201] WRAL-TV, Record Rainfall: Some Saw Almost 3 Feet from Florence (Sept. 17, 2018), *available at* https://www.wral.com/florence-causes-record-rainfall-/17850750/.

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

[203] *Id.*

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

to occur only once every 1000 years.[205] Hurricane Matthew, a 500-year flood event,[206] hit eastern North Carolina just two years before Florence. As Governor Cooper of North Carolina said, "We have to understand that when you have two so-called 500-year floods within 22 months of each other, [we're] not sure you're talking about [a] 500-year flood anymore. We've got something else on our hands." [207] A third 500-year flood event, caused by Hurricane Floyd, struck eastern North Carolina in 1999.[208] That makes three 500-year (or longer) flood events to hit eastern North Carolina in the past 19 years.

Climate change presents severe health risks for North Carolina's citizens, especially vulnerable populations such as the elderly and children. The North Carolina Department of Health and Human Services has evaluated health risks associated with climate change impacts such as increased drought, increased precipitation, heat waves, hurricanes, and sea-level rise.[209] The health risks associated with these impacts include:

- Waterborne disease outbreaks, increased foodborne illnesses, and compromised drinking water quality.
- Increases in mosquito populations after hurricanes and high rain events.
- Physical injuries caused by hurricanes, flooding, high winds, droughts, and heat waves.
- Respiratory illness caused by prolonged drought periods.
- Lung disease and premature death from heart or lung disease from increased ground-level ozone formed by rising temperatures.[210]

Droughts caused by climate change can make a forest more prone to wildfires,[211] creating another major risk to North Carolinians' health. Between October and November of 2016, thirty fires scorched 80,000 acres in drought-stricken western North Carolina counties. State air quality officials detected 24 instances of code orange conditions during the fires, 11 instances of code red, two in code purple and two in code maroon. Fine particulate matter from wildfires is an

---

[205] Risk Management Solutions, Hurricane Florence: Rainfall up to a 1,000-Year Return Period (Sep. 14, 2018), *available at* https://www.rms.com/blog/2018/09/14/hurricane-florence-rainfall-up-to-a-1000-year-return-period/.

[206] Office of Water Prediction, National Weather Service, Hurricane Matthew, 6-10 October 2016 Annual Exceedance Probabilities (AEPs) for the Worst Case 24-Hour Rainfall (prepared Oct. 18, 2016), *available at* http://www.nws.noaa.gov/ohd/hdsc/aep_storm_analysis/AEP_HurricaneMatthew_October2016.pdf.

[207] Perchick, M., Florence Flooding: Gov. Cooper Continues Survey of Flood Damage, Announces Housing Assistance Program, WTVD-TV (Sept. 22, 2018), *available at* https://abc11.com/florence-flooding-gov-cooper-continues-survey-of-flood-damage/4314903/.

[208] Millner, M., University of North Carolina, Remembering Hurricane Floyd (Oct. 2009), *available at* https://docsouth.unc.edu/highlights/floyd.html.

[209] N.C. Department of Health and Human Services, Division of Public Health, North Carolina Climate and Health Profile (March 2015), *available at* http://epi.publichealth.nc.gov/oee/climate/ClimateAndHealthProfile.pdf.

[210] *Id.*

[211] *Id.*

existing threat to North Carolinians' health, causing increases in respiratory and cardiovascular emergencies in downwind communities.[212]

Climate change also harms North Carolina's agriculture and agribusiness sector, which is largely based in the eastern part of the state and contributed $84 billion to North Carolina's economy in 2016.[213] Major crops include corn, cotton, tobacco, sweet potatoes, pork, turkey, and chicken. Increasingly severe droughts cause crop failures, and higher temperatures reduce livestock productivity.[214] Saltwater intrusion from sea level rise can make soils too salty for native plants to grow, impacting crop yields.[215] North Carolina's forestry industry would suffer similar impacts from saltwater intrusion, and increasingly severe and frequent hurricanes would damage North Carolina's forestlands. One study in North Carolina predicted that forest damages rise by $500 million for every increase in category level of hurricane.[216]

North Carolina's tourism industry, which generated $22.9 billion in visitor spending in 2016, is also at risk.[217] Tourism is threatened by loss of beach areas due to sea level rise and decrease in demand for coastal travel due to unpredictable weather patterns.[218]

North Carolina is already incurring significant transportation and infrastructure costs due to climate change impacts. Large numbers of North Carolina's coastal railways, ports, airports, and water and energy supply systems are at low elevations and are therefore vulnerable to the effects of sea level rise and more frequent hurricanes.[219] The North Carolina Department of

---

[212] N.C. Department of Health and Human Services, Division of Public Health, North Carolina Climate and Health Adaptation Plan Update (2016), *available at* http://epi.publichealth.nc.gov/oee/climate/ClimateAndHealthAdaptationPlan.pdf.

[213] Brian Long, Today's Topic: Economic impact of NC agriculture, agribusiness increases to $84 billion, In the Field, N.C. Dep't of Agriculture and Consumer Services (June 7, 2016), *available at* http://info.ncagr.gov/blog/2016/06/07/todays-topic-economic-impact-of-nc-agriculture-agribusiness-increases-to-84-billion/

[214] EPA, What Climate Change Means for North Carolina (August 2016), *available at* https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-nc.pdf

[215] N.C. Department of Environmental Quality, Division of Coastal Management, Sea Level Rise, https://deq.nc.gov/about/divisions/coastal-management/coastal-management-hot-topics/sea-level-rise (last visited Jan. 4, 2018)

[216] University of Maryland, Center for Integrative Environmental Research, Economic Impacts of Climate Change on North Carolina (Sept. 2008), *available at* http://cier.umd.edu/climateadaptation/North%20Carolina%20Economic%20Impacts%20of%20Climate%20Change%20Full%20Report.pdf.

[217] North Carolina Tourism Generates Record Employment and Visitor Spending in 2016, Economic Development Partnership of North Carolina (May 8, 2017), *available at* https://edpnc.com/north-carolina-tourism-generates-record-employment-visitor-spending-2016/

[218] University of Maryland, Economic Impacts of Climate Change on North Carolina, *supra*.

[219] EPA, What Climate Change Means for North Carolina, *supra*.

Transportation is raising the roadbed of U.S. Highway 64 across the Albemarle-Pamlico Peninsula by four feet, which includes 18 inches to account for sea level rise.[220]

Finally, climate change harms North Carolina's tremendous ecological resources, such as its coastal estuaries. North Carolina's coastal estuaries perform essential functions, including filtering pollutants and supporting fisheries.[221] Disruption of these important resources from storm damage and salt water intrusion negatively impacts fisheries and depletes water quality.

Oregon

Oregon is already experiencing adverse impacts of climate change and these impacts are expected to become more pronounced in the future, significantly affecting Oregon's economy and environment:

Loss of Snowpack and Drought

The seasonal flow cycles of rivers and streams are changing due to warmer winters and decreased mountain snowpack accumulation, as more precipitation falls as rain, not snow.[222] The Third Oregon Climate Assessment Report[223] explained that events in 2015 demonstrated the kind of impacts this has already had, and will have in the future:

> In 2015, Oregon was the warmest it has ever been since record keeping began in 1895 (NOAA, 2017). Precipitation during the winter of that year was near normal, but winter temperatures that were 5–6°F above average caused the precipitation that did fall to fall as rain instead of snow, reducing mountain snowpack accumulation (Mote et al., 2016). This resulted in record low snowpack across the state, earning official drought declarations for 25 of Oregon's 36 counties. Drought impacts across Oregon were widespread and diverse:
>
> Farmers in eastern Oregon's Treasure Valley received a third of their normal irrigation water because the Owyhee reservoir received inadequate supply for the third year in a row (Stevenson, 2016) …
>
> People near the Upper Klamath Lake were warned not to touch the water as algal blooms that thrived in the low flows and warm waters produced extremely high toxin levels (Marris, 2015) …

---

[220] U.S. Global Change Research Program, National Climate Assessment (2014), https://nca2014.globalchange.gov/report/regions/southeast.

[221] N.C. Department of Environmental Quality, Sea Level Rise, *supra*.

[222] P. Zion Klos et al., *Extent of the Rain-Snow Transition Zone in the Western U.S. Under Historic and Projected Climate*, 41 Geophysical Res. Letters 4560, 4560–68 (2014).

[223] *The Third Oregon Climate Assessment Report*, Oregon Climate Change Research Institute, January 2017.

> More than half of the spring spawning salmon in the Columbia River perished, likely due to a disease that thrived in the unusually warm waters (Fears, 2015) …
>
> The West Coast–wide drought developed alongside a naturally-driven large, persistent high-pressure ridge (Wise, 2016). However, anthropogenic warming exacerbated the drought, particularly in Oregon and Washington (Mote et al., 2016; Williams et al., 2015) …
>
> Oregon's temperatures, precipitation, and snowpack in 2015 are illustrative of conditions that, according to climate model projections, may be considered "normal" by mid-century.[224]

And there has been more bad news since 2015. In 2018, researcher John Abatzoglou reported that:

> Drought impacts are being felt most notably in Oregon, which endured a period of substandard snowpack followed by unusually dry and warm conditions since May. The impacts cover the gamut from fire to farms to fish …
>
> Fishing restrictions have been enacted in the Umpqua River in western Oregon due to critically warm stream temperatures for steelhead and salmon. The combination of very low flows—including recent daily record low flows—due to subpar precipitation and warm temperatures have allowed water temperatures to warm faster than usual.[225]

Sea Level Rise

Ocean sea levels will rise between four inches and four-and-a-half feet on the Oregon coast by the year 2100, and coastal residents, cities and towns along Oregon's 300 miles of coastline and 1400 miles of tidal shoreline will be threatened by increased flooding and erosion as a result. Residential development, state highways, and municipal infrastructure are all at risk to such threats.[226]

---

[224] *Id.* at 12-13, citing: P. W. Mote et al.,. *Perspectives on the causes of exceptionally low 2015 snowpack in the western United States.(*2016).; D. Fears, *As salmon vanish in the dry Pacific Northwest, so does Native heritage*, Washington Post (2015); J. Stevenson, *Documenting the Drought*, The Climate CIRCulator (2016); E..Marris, *In the Dry West, Waiting for Congress*, The Klamath Tribes Tribal News and Events (2015); A.P. Williams et al., *Contribution of anthropogenic warming to California drought during 2012-14*, Geophysical Research Letter, 2015.

[225] Abatzoglou, "Drought Returns to the Pacific Northwest," OCCRI Climate Circulator (August 2018).

[226] *See* W. Spencer Reeder et al., *Coasts: Complex Changes Affecting the Northwest's Diverse Shorelines, in Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities* 67–109 (Meghan M. Dalton et al. eds., 2013); Ben Strauss et al.,

Ocean Acidification and Hypoxia

As a result of climate change, ocean waters are now more acidified, hypoxic (low oxygen), and warmer, and such impacts are projected to increase, with a particular detrimental impact on some marine organisms like oysters and other shellfish, which will threaten marine ecosystems, fisheries and seafood businesses that play a vital role in Oregon's economy and culture.[227] As the Third Oregon Climate Assessment Report observed, "[T]he West Coast has already reached a threshold and negative impacts are already evident, such as dissolved shells in pteropod populations … and impaired oyster hatchery operations …"[228]

The Oregon Coordinating Council on Ocean Acidification and Hypoxia recently reported that "[n]ew research points to an ever-growing list of marine organisms that are now known to be vulnerable to the threats of ocean acidification and hypoxia (OAH). The list includes species such as Dungeness crabs, rockfishes and salmon that underpin livelihoods and connections to the sea for many Oregonians."[229]

In March of 2017, KVAL TV in Eugene, Oregon chronicled the experience of the Whiskey Creek Hatchery off Netarts Bay in Tillamook, Oregon. Manager Alan Barton said that "[w]e probably produce about a third of all oyster larvae on the West Coast." But in 2007 and 2008, hatchery output collapsed by 75%. Working with scientists from Oregon State University, Whiskey Creek identified ocean acidification as the problem. They developed a way to treat the water at the hatchery, which has been successful. But Barton does not believe that treatment is a long-term solution:

> "The short term prospects are pretty good. But within the next couple of decades we're going to cross a line I don't think we're going to be able to come back from," he says. "A lot of people have the luxury of being skeptics about climate change and ocean acidification. But we don't have that choice. If we don't change the chemistry of the water going into our tanks, we'll be out of business. It's that simple for us."[230]

Climate Cent., *California, Oregon, Washington and the Surging Sea: A Vulnerability Assessment with Projections for Sea Level Rise and Coastal Flood Risk* 29 (2014).

[227] *See* Francis Chan et al., Cal. Ocean Sci. Tr., *The West Coast Ocean Acidification and Hypoxia Science Panel: Major Findings, Recommendations, and Actions* (2015); Julia A. Ekstrom et al., *Vulnerability and Adaptation of U.S. Shellfisheries to Ocean Acidification*, 5 Nature Climate Change 207, 207–14 (2015).

[228] *Third Oregon Climate Assessment Report, supra*, at 36.

[229] Oregon Coordinating Council on Ocean Acidication and Hypoxia, 1st Biennial Report, at 8, September 15, 2018.

[230] KVAl-TV, *'One morning we came in and everything was dead': Climate Change and Oregon oysters*, March 1, 2017.

Forests, Pests and Fires

Oregon is largely defined by its iconic forests, which climate change threatens in a myriad ways, as the Third Oregon Climate Assessment Report detailed:

> Future warming and changes in precipitation may considerably alter the spatial distribution of suitable climate for many important tree species and vegetation types in Oregon by the end of the 21st century. Changing climatic suitability and forest disturbances from wildfires, insects, diseases, and drought will drive changes to the forest landscape in the future. Conifer forests west of the Cascade Range may shift to mixed forests and subalpine forests would likely contract. Human-caused increases in greenhouse gases are partially responsible for recent increases in wildfire activity. Mountain pine beetle, western spruce budworm, and Swiss needle cast remain major disturbance agents in Oregon's forests and are expected to expand under climate change. More frequent drought conditions projected for the future will likely increase forest susceptibility to other disturbance agents such as wildfires and insect outbreaks.
>
> Future warming and changes in precipitation may considerably alter the spatial distribution of suitable climate for many important tree species and vegetation types in Oregon by the end of the 21st century (Littell et al., 2013). Furthermore, the cumulative effects of changes due to wildfire, insect infestation, tree diseases, and the interactions between them, will likely dominate changes in forest landscapes over the coming decades (Littell et al., 2013). ..
>
> Over the last several decades, warmer and drier conditions during the summer months have contributed to an increase in fuel aridity and enabled more frequent large fires, an increase in the total area burned, and a longer fire season across the western United States, particularly in forested ecosystems (Dennison et al., 2014; Jolly et al., 2015; Westerling, 2016; Williams and Abatzoglou, 2016). The lengthening of the fire season is largely due to declining mountain snowpack and earlier spring snowmelt (Westerling, 2016). In the Pacific Northwest, the fire season length increased over each of the last four decades, from 23 days in the 1970s, to 43 days in the 1980s, 84 days in the 1990s, and 116 days in the 2000s (Westerling, 2016). Recent wildfire activity in forested ecosystems is partially attributed to human-caused climate change: during the period 1984–2015, about half of the observed increase in fuel aridity and 4.2 million hectares (or more than 16,000 square miles) of burned area in the western United States were due to human-caused climate change (Abatzoglou and Williams, 2016).[231]

---

[231] *The Third Oregon Climate Assessment Report* , citing J.T. Abatzoglou and A.P. Williams, *Impact of anthropogenic climate change on wildfire across western US forests.*, Proceedings of the National Academy of Sciences 113 (2016); P.E. Dennison et al, *Large wildfire trends in the western United States, 1984–2011*, Geophysical Research Letters 41 (2014); J.SD. Littell et al., *Forest ecosystems: Vegetation, disturbance, and economics*, Chapter 5. In: Dalton, Mot, and Snover(eds) *Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities*, Island Press, Washington, DC (2013); A. L. Westerling , *Increasing western US forest wildfire activity: sensitivity to changes in the timing of spring*. Phil. Trans. R. Soc. B 371 (2016).

Health Effects

An increase in forest fire activity is one of the various ways in which climate change threatens human health. As the Third Oregon Climate Assessment noted, "Climate change threatens the health of Oregonians. More frequent heat waves are expected to increase heat-related illnesses and death. More frequent wildfires and poor air quality are expected to increase respiratory illnesses."[232] For example:

> Climate change is expected to worsen outdoor air quality. Warmer temperatures may increase ground level ozone pollution, more wildfires may increase smoke and particulate matter, and longer, more potent pollen seasons may increase aeroallergens (Fann et al., 2016). Such poor air quality is expected to exacerbate allergy and asthma conditions and increase respiratory and cardiovascular illnesses and death (Fann et al., 2016).[233]

Oregon has already experienced a dramatic increase in "unhealthy air days" due to forest fires. The Medford metro region experienced 20 air quality alert days due to fire from 1985 through 2001, 19 of those in one year. From 2002 through 2012, Medford had 22 such days. But since 2013, Medford has had 74 such days, including 20 in 2017 and 35 in 2018.[234] Portland, meanwhile, had a total of two such days from 1985 through 2014 – but 13 such days from 2015 through 2018.[235]

During the 2017 Eagle Creek fire, the Oregon Health Authority (OHA) reported a 29% increase in emergency room visits for respiratory symptoms in the Portland metro region.[236]

In its 2014 Oregon Climate and Health Profile Report, OHA elaborated on the health effects of wildfire smoke:

> Particulate matter (PM) in smoke from wildfires is associated with cancer, cardiopulmonary disease and respiratory illness … As a result of projected increases in

---

[232] *Third Oregon Climate Assessment Report, supra,* at 74.

[233] *Id.,* citing N. Fann et al.,Ch. 3: *Air Quality Impacts. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. US Global Change Research Program,* Washington, DC (2016).

[234] In addition to the impact on human health, fires in the Medford area have punished a beloved Oregon institution, the Oregon Shakespeare Festival in Ashland. In 2018 alone, the Festival had to cancel – or move indoors, to smaller venues – 20 performances, costing the Festival money and ruining many theater-goers' plans. *Wildfire Smoke Disrupts Oregon Shakespeare Festival*, New York Times, August 24, 2018.

[235] Oregon DEQ, *Forest Fire Smoke Impact on Air Quality Health Trends in Bend, Klamath Falls, Medford, and Portland (1985 to 2018),* DEQ18-NWR-0066-TR (October 2018). It is worth noting that although air quality alerts are often limited to especially vulnerable populations – "unhealthy for sensitive groups" – Medford in 2017-18 has experienced 38 days in which the air was unhealthy for all populations, including five "very unhealthy" days and one "hazardous" day.

[236] Statewide Fire Activation Surveillance Report (090517-090617), Oregon Health Authority.

> wildfire, Spracklen et al. (2009) anticipate an increase in aerosol organic carbon of up to 40% and an increase in elemental carbon in the western U.S. of up to 20% in 2046–2055 compared to 1996–2005 … PM associated with wildfires in California has been shown to be more toxic to the lungs than normal ambient PM … PM exposure from wildfire smoke is a risk beyond the immediate area of the fire, since high winds can carry the PM long distances … Increases in smoke are associated with hospital admissions for respiratory complaints, and long-term exposure worsens existing cardiopulmonary disease … bronchitis and pneumonia.[237]

Impact on American Indian Tribes

As the Legislative Summary of the Third Oregon Climate Assessment Report observed:

> Changes in terrestrial and aquatic ecosystems will affect resources and habitats that are important for the sovereignty, culture, economy, and community health of many American Indian tribes. Tribes that depend upon these ecosystems, both on and off reservation, are among the first to experience the impacts of climate change. Of particular concern are changes in the availability and timing of traditional foods such as salmon, shellfish, and berries, and other plant and animal species important to tribes' traditional way of life.[238]

The threat that climate change poses to salmon populations is a particular source of concern for the tribes:

> A 2015 study of Columbia River Basin tribes, including the Confederated Tribes of Warm Springs (CTWS) and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), found that the primary concerns regarding climate change impacts included the quantity and quality of water resources, snowpack, water temperatures for spawning conditions, and fishing rights (Sampson, 2015). Pacific salmon have great cultural, subsistence, and commercial value to tribes in the Pacific Northwest, and are central to tribal cultural identity, longhouse religious services, sense of place, livelihood, and the transfer of traditional values to the next generation (Dittmer, 2013). During the last 150

---

[237] Oregon Climate and Health Profile Report at 39 (Oregon Health Authority, Public Health Division, 2014), citing C.A. Pope et al,. *Cardiovascular mortality and long-term exposure to particulate air pollution: Epidemiological evidence of general pathophysiological pathways of disease,* Circulation. 2004;109:71–7.; C.A. Pope and D.Q. Dockery, Dockery, *Health effects of fine particulate air pollution: lines that connect*., Journal of the Air & Waste Management Association (1995). 2006;56:709–42; World Health Organization. *Review of Evidence on Health Aspects of Air Pollution–REVIHAAP Projec*t (2013.) J.L, Mauderly and J.C. Chow , *Health effects of organic aerosols. Inhalation toxicology.* 2008;20:257–88; T.C.Wegesser and K.E. Pinkerton KE, J.A. Last, *California wildfires of 2008: coarse and fine particulate matter toxicity,* Environmental Health Perspectives. 2009;117:893–7.; M. Ginsberg et al. *Monitoring Health Effects of Wildfires Using the BioSense System--San Diego County, California*, October 2007. Morbidity and Mortality Weekly Report. 2008;57(27):741–4; R.J. Delfino et al., *The relationship of respiratory and cardiovascular hospital admissions to the southern California wildfires of 2003,* Occupational and Environmental Medicine. 2009;66:189–97.

[238] *The Third Oregon Climate Assessment Report, supra,* (Legislative Summary).

> years, culturally important salmon populations have declined (Dittmer, 2013). Continuation of past trends of earlier spring peak, more extreme high flows and more frequent low flows in the low elevation basins of northeast Oregon, home to the CTWS and CTUIR, may force earlier migration of juvenile salmon, challenge returning adults in low flow conditions, and increase scour risk for emerging young salmon (Dittmer, 2013).[239]
> Page 58:

The threat that climate change poses to forests is likewise a major concern for tribes:

> Changes in forest ecosystems and disturbances will affect resources and habitats that are important for the cultural, medicinal, economic, and community health of tribes (Lynn et al., 2013). In Oregon, 62% of tribal reservation land is forested, and the US government has a trust responsibility toward such forests (Indian Forest Management Assessment Team, 2013). American Indian and Alaska Native tribes that depend on forest ecosystems, whether on or off reservations, are among the first to experience the impacts that climate change is having on forests, such as the expansion of invasive species, insects, diseases, and wildfires (Norton-Smith et al., 2016). Invasive species that displace native species can negatively affect tribal subsistence and ceremonial practices, although there is little knowledge about on how climate change will interact with invasive species (Norton-Smith et al., 2016). Increasing wildfire, insects, and diseases have jeopardized the economic and ecological sustainability of tribally managed forests and important tribal resources (Indian Forest Management Assessment Team, 2013; Norton-Smith et al., 2016). Collaborative adaptive forest management that integrates tribal traditional ecological knowledge can support socio-ecological resilience to climate change (Armatas et al., 2016).[240]

Pennsylvania

The Commonwealth of Pennsylvania faces two fundamental threats related to climate: (1) sea level rise and its impact on communities and cities in the Delaware River Basin, including the city of Philadelphia; and (2) more frequent extreme weather events, including large

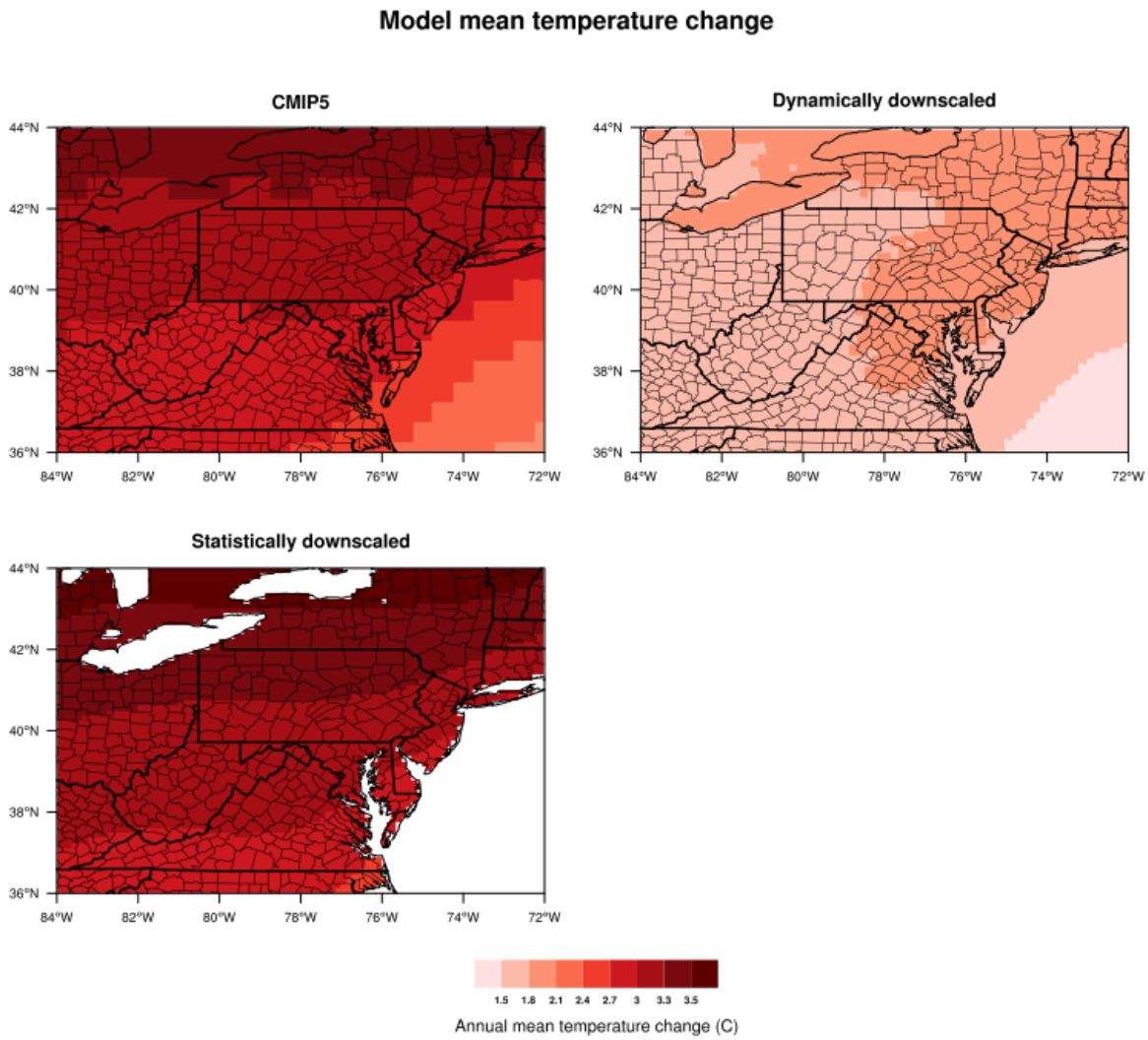
---

[239] K. Dittmer, *Changing streamflow on Columbia basin tribal lands—climate change and salmon*, Climatic Change 120(3) (2013); D. Sampson, *Columbia River Basin Tribes Climate Change Capacity Assessment*, Institute for Tribal Government, Hatfield School of Government, Portland State University: Portland, OR (2015)

[240] Citing C. Armatas et al., *Opportunities to utilize traditional phenological knowledge to support adaptive management of social-ecological systems vulnerable to changes in climate and fire regimes*, Ecology and Society 21 (2016) ; *Assessment of Indian Forests and Forest Management in the United States*, Indian Forest Management Assessment Team (2013) ; K. Lynn et al., *Northwest Tribes: Cultural Impacts and Adaptation Resources*: Chapter 8. In: M. M. Dalton et al., *Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities*, Island Press: Washington, DC (2013),; K. Norton-Smith et al., *Climate change and indigenous peoples: a synthesis of current impacts and experiences* (2016). .

storms, periods of drought, heat waves, heavier snowfalls, and an increase in overall precipitation variability. Based on studies commissioned by the Pennsylvania Department of Environmental Protection, as part of its mandate under the Pennsylvania Climate Change Act, 71 P.S. §§ 1361.1 – 1361.8, Pennsylvania has undergone a long-term warming of more than 1°C over the past 110 years.[241] The models used in the 2015 Climate Impacts Assessment Update suggest this warming is a result of anthropogenic influence, and that this trend is accelerating. Projections in the 2015 Update show that by the middle of the 21st century, Pennsylvania will be about 3°C warmer than it was at the end of the 20th century.

[241] *See* "Pennsylvania Climate Impacts Assessment Update," May 2015, available at http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-108470/2700-BK-DEP4494.pdf. *See also* "Pennsylvania Climate Impacts Assessment Update," October 2013, available at http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-97037/PA%20DEP%20Climate%20Impact%20Assessment%20Update.pdf; "Pennsylvania Climate Assessment," June 2009, available at http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-75375/7000-BK-DEP4252.pdf.



Modeling charts from the 2015 Update show that in both the CMIP5 and statistically downscaled CMIP5 datasets, mid-century temperatures in the Philadelphia region are projected to be similar to historical temperatures in the Richmond, VA area. Similarly, Pittsburgh's temperatures are projected to resemble the historically observed temperatures in the Baltimore-Washington area. The mean warming across the state simulated by these models is generally 3.0-3.5 °C (5.4-6.3°F). The CMIP5 model mean change is 3.0-3.3 °C (5.4-6.0 °F) across nearly the entire state. The statistically downscaled CMIP5 model mean change is 3.3-3.5 °C (5.9-6.3°F) in the northern half of the state and 3.0-3.3 °C (5.4-6.0°F) in the southern half. Finally, the dynamically downscaled dataset model mean change is only 1.5-1.8 °C (2.7-3.2°F) across the western half of the state and 1.8-2.1 °C (3.2-3.8 °F) across the eastern half. The reduced warming is likely at least partially because these models rely on a different emissions scenario, in which the buildup of greenhouse gases in the atmosphere occurs at a slower rate than in the than in the scenarios that the CMIP5 models use.

The 2015 Climate Impacts Assessment Update also finds that this warming trend will threaten Pennsylvania in other ways:

- Pennsylvania agriculture will have to adapt to by greater extremes in temperature and precipitation.[242] Pennsylvania dairy production is likely to be negatively affected by climate change due to losses in milk yields caused by heat stress, additional energy and capital expenditures to mitigate heat stress, and lower levels of forage quality.

- Pennsylvania's forests will be subject to multiple stressors.[243] The warming climate will cause tree species inhabiting decreasingly suitable habitat to become stressed. Mortality rates are likely to increase and regeneration success is expected to decline for these tree species, resulting in declining importance of those species in the state.

- Suitable habitat for plant and wildlife species is expected to shift to higher latitudes and elevations.[244] This will reduce the amount of suitable habitat in Pennsylvania for species that are at the southern extent of their range in Pennsylvania or that are found primarily at high latitudes; the amount of habitat in the state that is suitable for species that are at the northern extent of their range in Pennsylvania will increase. The Canada lynx, which is already rare in Pennsylvania, will likely be extirpated from the state.

- The public health of Pennsylvanians is threatened because climate change will worsen air quality relative to what it would otherwise be, causing increased respiratory and cardiac illness.[245] The linkage between climate change and air quality is most strongly established for ground-level ozone creation during summer, but there is some evidence that higher temperatures and higher precipitation will result in increased allergen (pollen and mold) levels as well.

- West Nile disease is endemic in Pennsylvania.[246] It is currently most prevalent in Southeastern and Central parts of the state, and less prevalent in the Laurel Highlands and the Allegheny Plateau. However, climate change is expected to increase the prevalence of West Nile disease in the higher-elevation areas, due to higher temperatures. In addition to its range, the duration of the transmission season for West Nile disease is sensitive to climate. Warmer temperatures result in a longer transmission season, and therefore greater infection risk.
- Climate change will have a severe, negative impact on winter recreation in Pennsylvania.[247] Downhill ski and snowboard resorts are not expected to remain economically viable past mid-century. Snow cover to support cross country skiing and

---

[242] 2015 Climate Impacts Assessment Update, *supra*, at 63.

[243] *Id*. at 114.

[244] *Id.*

[245] *Id*. at 321.

[246] *Id*. at 135.

[247] *Id*. at 141.

snowmobiling has been declining in Pennsylvania, and is expected to further decline by 20-60%, with greater percentage decreases in southeastern Pennsylvania, and smaller decreases in northern Pennsylvania.

- Climate change poses a threat to the fauna of the tidal freshwater portion of the Delaware estuary in Pennsylvania.[248] One reason is that increased water temperatures with climate change decrease the solubility of oxygen in water and will increase respiration rates, both of which will result in declines in dissolved oxygen concentration. Thus, climate change will worsen the currently substandard water quality in the tidal freshwater region of the Delaware Estuary.

- The freshwater tidal wetlands along Pennsylvania's southeastern coast are a rare, diverse, and ecologically important resource.[249] Climate change poses a threat to these wetlands because of salinity intrusion and sea-level rise. Sea-level rise, however, has the potential to drown wetlands if their accretion rates are less than rates of sea-level rise.

Rhode Island

Climate change is adversely impacting Rhode Island in many diverse ways, including warming air temperatures, warming ocean temperatures, rising sea level, increased acidity of ocean waters, increased rainfall amounts, and increased intensity of rainfall events.

Rhode Island has experienced a significant trend over the past 80 years toward a warmer and wetter climate. Trends are evident in annual temperatures, annual precipitation, and the frequency of intense rainfall events. Temperatures have been steadily climbing in the Ocean State since the early 1930s. The average annual temperature for the state is currently increasing at a rate of 1 degree Fahrenheit every 33 years. The frequency of days with high temperatures at or above 90 degrees has increased while the frequency of days with minimum temperatures at or below freezing has decreased.[250]

There has also been a pronounced increase in precipitation from 1930 to 2013. Increased precipitation has occurred as a result of large, slow moving storm systems, multiple events in the span of a few weeks (such as the 2010 spring floods), as well as an increase in the frequency of intense rain events. The average annual precipitation for Rhode Island is increasing at a rate of more than 1 inch every 10 years. The frequency of days having one inch of rainfall has nearly

---

[248] *Id*. at 152.

[249] *Id*.

[250] *Overview of a Changing Climate in Rhode Island*, David Vallee (Hydrologist-in-Charge, National Weather Service Northeast River Forecast Center, NOAA) and Lenny Giuliano (Air Quality Specialist, Rhode Island Department of Environmental Management, State Climatologist, State of Rhode Island), August 2014 at 2-3, available at http://research3.fit.edu/sealevelriselibrary/documents/doc_mgr/444/Valee%20&%20Giuliano.%202014.%20CC%20in%20Rhode%20Island%20Overview.pdf.

doubled. Intense rainfall events (heaviest 1 percent of all daily events from 1901 to 2012 in New England) have increased 71 percent since 1958. The increased amounts of precipitation since 1970 has resulted in a much wetter state in terms of soil moisture and the ground's ability to absorb rainfall.[251]

In addition, the water in Narragansett Bay is getting warmer. Over the past 50 years, the surface temperature of the Bay has increased 1.4° to 1.6° C (2.5° to 2.9° F). Winter water temperatures in the Bay have increased even more, from 1.6° to 2.0° C (2.9° to 3.6° F). Ocean temperatures are increasing world-wide, but temperature increases in the northwestern Atlantic Ocean are expected to be 2-3 times larger than the global average.[252] Warmer water temperatures in Narragansett Bay are causing many changes in ecosystem dynamics, fish, invertebrates, and plankton. Cold-water iconic fishery species (cod, winter flounder, hake, lobster) are moving north out of RI waters and warm-water southern species are becoming more prevalent (scup, butterfish, squid). Rhode Island's marine waters are also becoming more acidic due to increasing CO_2. This may cause severe impacts to shellfish, especially in their larval life stages.[253]

Sea levels have risen over 9 inches in Rhode Island since 1930 as measured at the Newport tide gauge. The historic rate of sea level rise at the Newport tide gauge from 1930 to 2015 is presently 2.72 mm/year, or more than an inch per decade.[254] At present rates, sea levels will likely increase 1 inch between every 5 or 6 years in Rhode Island. NOAA is projecting as much as 6.6 feet of sea level rise by the end of this century in Rhode Island. In the shorter-term, NOAA predicts upwards of 1 foot by 2035 and 1.9 feet by 2050. [255] This has critical implications for Rhode Island, as thousands of acres of Rhode Island's coast will be affected.

Climate change is also altering the ecology and distribution of plants and animals in Rhode Island. In southern New England, spring is arriving sooner and plants are flowering earlier (one week earlier now when compared to the 1850s). For every degree of temperature rise in the spring and winter, plants flower 3.3 days earlier. For woody plants, leaf-out is occurring 18 days earlier now than in the 1850s. Changes in the timing of leaf-out, flowering, and fruiting in plants can be very disruptive to plant pollinators and seed dispersers.[256]

Changes in the timing of annual cycles has been observed in Rhode Island birds. Based on a 45-year near-continuous record of monitoring fall migration times for passerine birds in

---

[251] *Id*. at 4.

[252] Rhode Island Executive Climate Change Coordinating Council (EC4) Science and Technical Advisory Board (STAB) Annual Report to the Full Council of the EC4 (May 2016), appendix to Rhode Island Executive Climate Change Coordinating Council Annual Report, June 2016, at 33-35, available at http://climatechange.ri.gov/documents/ar0616.pdf.

[253] *Id*.

[254] *Id*. at 28-30.

[255] *Id*.

[256] *Id*. at 38-40

Kingston, RI, Smith and Paton (2011) found a 3.0 days/decade delay in the departure time of 14 species of migratory birds.[257]

Vermont

Climate change is causing an increase in temperatures and precipitation in Vermont. Average annual temperature has increased by 1.3º F since 1960, and is projected to rise by an additional 2-3.6 º F by 2050.[258] Since 1960, average annual precipitation has increased by 5.9 inches.[259]

Heavy rainfall events are becoming more common.[260] Increasingly frequent heavy rains threaten to flood communities located in Vermont's many narrow river valleys. In 2011 Tropical Storm Irene dumped up to 11 inches of rain on Vermont, impacting 225 municipalities and causing $733 million in damage.[261] More than 1,500 residences sustained significant damage, temporarily or permanently displacing more than 1400 households.[262] More than 500 miles of state highway, 2000 municipal road segments, and 480 bridges were damaged.[263] Farms, water supply and wastewater treatment facilities were also damaged, and the channels of many streams were enlarged and/or relocated.[264]

In addition to threatening human lives and property, increasingly frequent heavy rains present challenges for state and local land use planning. Further, storm water runoff carries pollutants to the state's streams and lakes, and hinders the state's efforts to address phosphorous pollution and resulting algal blooms in Lake Champlain.

Climate change also threatens Vermont's environment and economy by affecting activities dependent on seasonal climate patterns, such as maple sugaring and winter sports.[265] Vermont is the nation's leading maple-syrup producing state[266]. Warmer temperatures are likely

---

[257] *Id.*

[258] *Vermont Climate Change Assessment*, http://vtclimate.org/vts-changing-climate/ (last visited Oct. 24, 2018).

[259] *Id.*

[260] *Id.*

[261] Pierre-Louis, Kendra, *Five Years After Hurricane Irene, Vermont Still Striving for Resilience*, Inside Climate News (Sept. 1, 2016), *available at* https://insideclimatenews.org/news/31082016/five-years-after-hurricane-irene-2011-effects-flooding-vermont-damage-resilience-climate-change.

[262] *Tropical Storm Irene by the Numbers* (Aug. 28, 2013), http://www.vermontbiz.com/news/august/tropical-storm-irene-numbers (last visited Oct. 24, 2018).

[263] *Id.*

[264] *Id.*

[265] U.S. EPA, *What Climate Change Means for Vermont* (August 2006), *available at* https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-vt.pdf.

[266]Vermont Agency of Agriculture Food & Markets, *Vermont Leads Nation in 2018 Maple Season Production* (June 13, 2018),

to shift the suitable habitat for sugar maples farther north into Canada.[267] Warmer winters may bring more rain and less snow to Vermont, harming the skiing, snowboarding, and snowmobiling industries and local economies that depend on them. *Id.* During the winter of 2016-17, Vermont recorded more than 3.9 million skier visits, second only to Colorado among the states.[268]

Climate change is also contributing to increased distribution and abundance of ticks and increased tickborne diseases, including Lyme disease and Anaplasmosis, in Vermont.[269] Vermont has the nation's highest per-capita incidence of Lyme Disease.[270]

Virginia

It's not a question of if or when; Virginia is currently experiencing the effects of climate change. Virginia's low-lying coastline is especially vulnerable to this threat. Virginia has experienced the highest rates of sea level rise along the East Coast: in Virginia Beach, the sea has risen by almost a foot since the 1960s[271] and more than 14 inches since 1930.[272] Ordinary rain events now cause flooding in the streets of Norfolk, including large connector streets going underwater.[273] Norfolk naval base, the largest navy base in the world, is currently replacing 14 piers due to sea level rise, at a cost of $35-40 million per pier.[274] According to Old Dominion University's Center for Sea Level Rise, the city of Norfolk alone will need at least $1 billion in the coming decades to replace current infrastructure and keep water out of city homes and businesses. According to a recent study by the Hampton Roads Planning District Commission,

---

http://agriculture.vermont.gov/Vermont%20Leads%20Nation%20in%202018%20Maple%20Season%20Production (last visited Oct. 24, 2018).

[267] U.S. EPA, *What Climate Change Means for Vermont, supra.*

[268] *Vermont ski industry rebounds to nearly 4 million visits*, Vermontbiz (June 15, 2017), https://vermontbiz.com/news/june/vermont-ski-industry-rebounds-nearly-4-million-visits (last vistited Oct. 24, 2018).

[269] Vermont Department of Health, *Climate Change and Tickborne Diseases*, http://www.healthvermont.gov/health-environment/climate-health/tickborne-diseases (last visited Oct. 24, 2018).

[270] DeSmet, Nicole, *Tick-borne diseases: Getting worse, CDC study finds*, Burlington Free Press (May 9, 2018), *available at* https://www.burlingtonfreepress.com/story/news/local/vermont/2018/05/09/tick-spreading-lyme-diseases-getting-worse-cdc-study-finds/589714002/.

[271] City of Virginia Beach, *Comprehensive Sea Level Rise*, https://www.vbgov.com/government/departments/public-works/comp-sea-level-rise/Pages/default.aspx (last visited Oct. 24, 2018).

[272] Chesapeake Bay Foundation, *Sea Level Rise: Finding Nature-Based Solutions to Sea Level Rise*, http://www.cbf.org/issues/climate-change/sea-level-rise.html (last visited Oct. 24, 2018).

[273] Gregory, Matt, *Rain causes Norfolk streets and neighborhoods to flood*, WAVY-TV (Sept. 21, 2016), *available at* http://wavy.com/2016/09/21/rain-causes-norfolk-streets-and-neighborhoods-to-flood/

[274] Center for Sea Level Rise, Old Dominion University, "Center For Sea Level Rise" (2017). *Hampton Roads Intergovernmental Pilot Project: Website*. 1, *available at* http://digitalcommons.odu.edu/cgi/viewcontent.cgi?article=1000&context=hripp_website.

costs from three feet of sea-level rise in the Hampton Roads region are expected to range between $12 billion and $87 billion.[275] Climate change has lengthened Virginia's allergy season and facilitated the spread of tick and mosquito borne illnesses—the ticks carrying Lyme disease are now reported in at least 72 counties, up from 12 counties in 1996.[276] These direct results of climate change generate negative impacts on Virginians, their quality of living, and their pocketbooks. Environmental impacts have direct and immediate negative economic results.

Washington

Washington is a coastal state, a mountain state, and a forest state. Reports prepared by the University of Washington Climate Impacts Group show that climate change will significantly adversely affect each of these signature features of Washington. In addition to these impacts, climate change will cause significant harm to public health.

Approximately 4 million of Washington's 6.5 million people live in the area around Puget Sound. Climate change will cause the sea level to rise and permanently inundate low-lying areas in the Puget Sound region.[277] Under a business as usual greenhouse gas scenario, sea level is predicted to rise in Seattle relative to 2000 levels by 2 feet by 2050 and 5 feet by 2100.[278] Sea level rise will also increase the frequency of coastal flood events. For example, with 2 feet of sea level rise (predicted for Seattle), a 1-in-100 year flood event will become an annual event. Sea level rise will also cause coastal bluffs (the location of many family homes in Puget Sound) to recede by as much as 75-100 feet by 2100 relative to 2000. [279] This would be a doubling, on average, of the current rate of recession. Sea level rise will also result in reduced harvest for commercial fishing and shellfish operations.[280]

Climate change is also causing ocean acidification**,** through the absorption in the ocean of excess carbon dioxide from the atmosphere. Ocean waters on the outer coast of Washington and the Puget Sound have become about 10-40 percent more acidic since 1800.[281] This increased

---

[275] *Id.*

[276] National Resources Defense Council, *Climate Change and Health in Virginia* (April 2018) *available at* https://assets.nrdc.org/sites/default/files/climate-change-health-impacts-virginia-ib.pdf

[277] U.S. Census Bureau, *Annual Estimates of the Population of Combined Statistical Areas: April 2010 to July 2011*, U.S. Census Bureau, https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_10_5YR_B01003&prodType=table (last visited Oct. 24, 2018).

[278] State of Knowledge: Climate Change in Puget Sound (November 2015), Climate Impacts Group, University of Washington, (hereinafter "State of Knowledge, Puget Sound") at 4-7; available at https://cig.uw.edu/resources/special-reports/ps-sok/

[279] *Id.*

[280] *Id.*

[281] State of Knowledge Report, Climate Change Impacts and Adaptation in Washington State: Technical Summaries for Decision Makers, (December 2013), Climate Impacts Group, University of Washington (hereinafter "State of Knowledge Report"), at 2-6; available at https://cig.uw.edu/resources/special-reports/wa-sok/

acidity is already affecting some shellfish species.[282] Washington has the largest shellfish industry on the west coast, contributing $184 million to Washington's economy in 2010 and employing 2710 workers.[283] Under a business as usual greenhouse gas scenario, ocean waters are expected to become at least 100 percent more acidic by 2100 relative to 1986-2005.[284] The predicted level of ocean acidification is expected to cause a 34 percent decline in shellfish survival by 2100.[285]

Washington depends on yearly winter mountain snow pack for drinking water, as well as water for irrigation, hydropower, and salmon. Washington's winter mountain snowpack is decreasing because climate change is causing more precipitation to fall as rain rather than snow. Snowpack decreased in Washington's Cascade Mountains by about 25 percent between the mid-20th century and 2006.[286] By the 2040s, snowpack is predicted to decrease 38-46 percent relative to 1916-2006,[287] and by the 2080s, snow pack is expected to decline 56-70 percent.[288] This loss of snowpack will cause a 50 percent increase in the number of years in which water is not available for irrigation, as well as a 20 percent decrease in summer hydropower production.[289] In addition, the decrease in summer stream flows combined with higher stream temperatures will result in stream temperatures too high to support adult salmon.[290]

Climate change is also impacting Washington's forests. Of Washington's total area (42.5 million acres), a little more than half (22 million acres) is forested.[291] Washington's forest products industry generates a gross income of about $48 billion per year, provides more than 100,000 jobs, and contributes approximately $4.9 billion in annual wages.[292] Climate change is threatening this industry in a number of ways. For example, Douglas fir accounts for almost half the timber harvested in Washington.[293] Under a moderate greenhouse gas scenario, Douglas fir

---

[282] *Id* at 2-3.

[283] Washington: A Shellfish State, Washington Shellfish Initiative, at http://www.governor.wa.gov/sites/default/files/WSI%20factsheet.pdf

[284] State of Knowledge Report at ES-2.

[285] *Id* at 8-4.

[286] *Id* at 2-5

[287] *Id* at ES-2.

[288] *Id* at 6-10.

[289] *Id* at 6-5.

[290] *Id* at ES-4, 6-6, 6-11, 6-12.

[291] Washington Forest Protection Association, Sustainable Forestry, ,http://www.wfpa.org/sustainable-forestry/ (last visited Oct. 24, 2018).

[292] Washington Department of Commerce, Forest Products Sector, at http://www.commerce.wa.gov/growing-the-economy/key-sectors/forest-products/ (last visited Oct. 24, 2018).

[293] Washington Department of Natural Resources, 2015 Washington Timber Harvest Report, (Sept. 2016), *available at* https://www.dnr.wa.gov/publications/em_obe_wa_timber_harvest_2015_final2.pdf

habitat is expected to decline 32 percent by the 2060s relative to 1961-1990.[294] In addition, the area of Washington forest where tree growth is severely limited by water availability is projected to increase (relative to 1970-1999) by about 32 percent in the 2020s, with an additional 12 percent increase in the 2040s and another 12 percent increase in the 2080s.[295] Wildland fires pose another threat to Washington's forests. Under a business as usual greenhouse gas scenario, decreases in summer precipitation, increases in summer temperatures and earlier snow melt are predicted to result in up to a 300 percent increase in the area in eastern Washington burned annually by forest fires[296] and up to a 1000 percent increase in area burned annually on the west side of the state (typically, the wet side).[297]

By far the highest costs to the state, however, are expected to come from harm to public health. More frequent heat waves and more frequent and intense flooding may harm human health directly. Warming may also exacerbate health risks from poor air quality and allergens. Climate change can indirectly affect human health through its impacts on water supplies, wildfire risks, and the ways in which diseases are spread. Risks are often greatest for the elderly, children, those with existing chronic health conditions, individuals with greater exposure to outside conditions, and those with limited access to health resources.[298]

District of Columbia

The District of Columbia is a densely populated area located at the confluence of two tidal rivers and accordingly is particularly vulnerable to the impacts of climate change including dangerous heat waves, flooding caused by rising tides and heavy rains, and increasingly severe weather.

Water levels along the Potomac and Anacostia Rivers have increased 11 inches in the past 90 years due to a combination of sea level rise and subsidence. As a result, nuisance flooding has increased by more than 300% according to the National Oceanic and Atmospheric Administration.[299] By 2080, the U.S. Corps of Engineers predicts up to 3.4 feet of additional sea level rise in the District.[300] At the same time, heavy rain events are projected to grow more frequent and intense according to local climate change projections completed by the District. As

---

[294] State of Knowledge Report, *supra*, at 7-1.

[295] *Id* at 7-3.

[296] *Id*.

[297] *Id* at 7-4.

[298] State of Knowledge, Puget Sound, *supra*, at ES-7.

[299] National Oceanic and Atmospheric Administration (2014), *Sea Level Rise and Nuisance Flood Frequency Changes around the United States*, NOAA Technical Report NOS CO-OPS 073 available at http://www.noaanews.noaa.gov/stories2014/20140728_nuisanceflooding.html.

[300] District of Columbia Department of Energy & Environment (2015), *Climate Projections & Scenario Development*, p. 46, available at https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/150828_AREA_Research_Report_Small.pdf

a result, today's 100-year rain event could become a one in 25-year event by mid-century.[301] The combined impact of rising tides and heavier rains pose significant threats to the District's infrastructure, community resources, cultural assets, government and military facilities, and residents. For example, during the second half of the century, Joint Base Anacostia-Bolling and Washington Navy Yard can expect more frequent and extensive tidal flooding, loss of currently utilized land, and substantial increases in the extent and severity of storm-driven flooding. With an intermediate rate of sea level rise, Naval Support Facility Anacostia could lose roughly 50 percent of its land area, and the Washington Navy Yard about 30 percent of its current land area, by end of century.[302]

The District is also vulnerable to rising temperatures and a corresponding increase in extreme heat events. Local climate change projections indicate that the number of heat emergency days, defined as days when the heat index exceeds 95 degrees Fahrenheit, could more than double from the current 29 days per year to 80 days per year by the 2050s under a high emission scenario.[303] As temperatures rise, and dangerously hot days grow more frequent, heat-related illnesses are also likely to increase. Hotter temperatures can also stress infrastructure like roads, rail lines, and our power grid, causing disruptions.

Boulder, CO

Like many cities and communities across the country and around the world, Boulder is adjusting to a "new normal," where the effects of climate change are becoming increasingly apparent. Global climate change will affect Boulder's ability to deliver services including fire protection and other emergency services, flood control and public works projects, and health care and social services for vulnerable populations.

According to the National Climatic Data Center, the frequency of billion-dollar extreme weather events from severe storms, flooding, droughts and wildfires has increased dramatically in recent years, trending from an average of less than three events per year in the 1980s to an average of nearly ten events per year from 2010 to 2014.[304]

The 2011 National Academies of Science assessment indicates that a one-degree Celsius rise in temperature would increase fire incidence probabilities by over 600 percent.[305] Rising

---

[301] *Id.* at 36.

[302] Union of Concerned Scientists, *On the Front Lines of Rising Seas: Joint Base Anacostia-Bolling and Washington Navy Yard* (2016), available at https://www.ucsusa.org/global-warming/global-warming-impacts/sea-level-rise-flooding-joint-base-anacostia-bolling-and-washington-navy-yard#.WlPQVrynHRY

[303] Climate Projections & Scenario Development, *supra*, at 27.

[304] National Climatic Data Center, *Extreme Weather*, https://nca2014.globalchange.gov/report/our-changing-climate/extreme-weather (last visited Oct. 24, 2018).

[305] Lukas, Jeff, et al., *Climate Change in Colorado* (Aug. 2014), *available at* https://wwa.colorado.edu/climate/co2014report/Climate_Change_CO_Report_2014_FINAL.pdf

temperatures also increase the length of drought cycles, which intensify flood, fire risks and create additional risks for Boulder's water supply. These dry conditions have in turn exacerbated insect, exotic weed, and disease threats in the flora and fauna communities.

In addition, a 2015 report by the University of Colorado Boulder and Colorado State University prepared for the Colorado Energy office states that Colorado's climate has warmed in recent decades, and climate models unanimously project this warming trend will continue into the future.[306] Although the actual pace of warming is dependent on the rate of worldwide greenhouse gas emissions, climate change has impacted and will continue to impact Colorado's resources in a variety of ways, including more rapid snowmelt, longer and more severe droughts, and longer growing seasons.

Since 1989, Boulder County has experienced four major wildland fires, the most recent of which was the Fourmile Canyon fire in 2010. The Fourmile Canyon fire destroyed over 6,000 acres of forest and 168 homes. The City's principal water treatment facility is in the region affected by the fire and was placed at risk.[307]

In September 2013, the City experienced a flood that caused damages estimated as high as $150 million. In the region, four people died, 1,202 people were airlifted from their homes, and 345 homes were destroyed. Over a period of eight days, Boulder received an unprecedented 17.15 inches of rain. To put this into context, Boulder's annual average precipitation is just 19.14 inches. In September, Boulder normally averages just 1.61 inches of rain. This disaster was so widespread and devastating that the Boulder County Board of Commissioners declared a county-wide disaster, the Governor declared the flood a state disaster, and the President declared the flood a national disaster.[308]

Boulder's complex topography and natural climate variability make it difficult, and sometimes impossible, to predict when and how often extreme events may occur. Flash flooding, for example, does not follow the boundaries of established flood maps, a lesson learned through the adversity of the 2013 floods. Flash floods may inundate neighborhoods and roads with little advance notice, impacting locations that may not have experienced flooding in the past. At the same time, increasing global temperatures exacerbate many of these hazards.[309]

But shocks are not limited to natural hazards or the effects of climate change. A globally-connected economy and the ability for pests and diseases to circle the globe with unprecedented speed, for example, mean our community's will face a host of challenges that can strike at little notice and have severe, unknowable repercussions.

---

[306] *Colorado Climate Change Vulnerability Study* (Jan. 2015), *available at* http://wwa.colorado.edu/climate/co2015vulnerability/co_vulnerability_report_2015_final.pdf

[307] Graham, Russell, et al., *Fourmile Canyon Fire Findings* (Aug. 2012), *available at* https://www.fs.fed.us/rm/pubs/rmrs_gtr289.pdf

[308] Boulder County, 2013 Flood Recovery, https://www.bouldercounty.org/disasters/flood/2013-flood/ (last visited Oct. 24, 2018).

[309] *Climate Change in Colorado, supra.*

Perhaps the most significant long-term impact of climate change to Boulder is the potential for impacts to water supply. Increased temperatures will require larger amounts of water to sustain outdoor uses such as agriculture and urban tree canopies. About 89 percent of the water consumption in Colorado is associated with agriculture so even a modest increase in agricultural water needs will have a significant impact on overall water demands in the state.[310]

Like most water users in Colorado, Boulder's water supply infrastructure depends on the accumulation of snowpack in the Rocky Mountains during winter months followed by a predictable melting and runoff into storage reservoirs throughout the rest of the year. A significant shift from snow to rain or in the timing of runoff would result in a shortfall in water supply because reservoirs are not sized to hold water supply that historically was held in the snowpack.[311]

Although virtually any aspect of Boulder's economy could be affected by changes in the climate, specific industries that rely on natural resources—agriculture, tourism and recreation, and mining and extraction—are particularly vulnerable. Reduced snowpack is an obvious concern in the ski sector, but also important are earlier melt as well as seasonal shifts in temperature, which can exacerbate wildfire potential, negatively affect plants and wildlife, and increase public exposure to vector-borne diseases.[312]

Chicago

Climate change will exacerbate existing environmental impacts on Chicago residents and lead to new, harmful impacts. Detailed, peer-reviewed federal research has exhaustively examined climate change impacts. In 2014, the US Global Change Research Program published the Third National Climate Assessment (NCA-3), developed with input from 13 federal agencies. The NCA-3 noted that climate change poses a threat to human health in many ways, including "increased extreme weather events…decreased air quality, threats to mental health, and illnesses transmitted by food, water, and disease-carriers such as mosquitoes and ticks."[313] Each of those threats is likely to exacerbate existing public health concerns affecting Chicagoans. For example, the health of the people of Chicago under current conditions already includes a substantial burden of asthma, which is worsened by decreased air quality. Mental health is also already a major concern, especially for Chicago's substantial low income population. Waterborne, foodborne, and vectorborne disease are already costly in their tolls on the health of Chicago residents and the economy.[314]

---

[310] *Id.*

[311] *Id.*

[312] *Colorado Climate Change Vulnerability Study , supra.*

[313] U.S. Global Change Research Program, NCA-3, at 221 (2014), *available at* https://nca2014.globalchange.gov/system/files_force/downloads/low/NCA3_Full_Report_09_Human_Health_LowRes.pdf?download=1

[314] *See* Physicians for Social Responsibility – Chicago Chapter, Cook County Climate Change and Public Health Action Plan at 7-11, *available at* http://www.chicagopsr.org/PDFs/climatechangepublichealthplancookcounty.pdf (discussing prevalence

Many Americans are already familiar with high-impact weather events impacting Chicago. Most tragically, Chicago has suffered from extreme weather in the form of the 1995 heat wave (which caused an estimated 741 deaths). Since 1980, Chicago's average temperature has increased approximately 2.6 degrees.[315] In the near future, Chicago will likely experience between 5 to 20 days a year with heat and humidity conditions similar to the 1995 heat wave that caused approximately 750 deaths in the city.[316] In addition, urban flooding during and after intense rain storms, leads to economic losses for families and businesses. The City of Chicago and other public agencies spend significant sums to support the readiness of public health professionals, emergency response agencies, and health care delivery systems so that they are resilient to extreme weather.[317]

In 2017, the Fourth National Climate Assessment (NCA-4), "Climate Science Special Report" (CSSR), also published by the U.S. Global Change Research Program, provided updated information about the current state of the climate and the risk of extreme heat and flooding in the U.S. While data summaries or climate projections were not available solely for Chicago, information specific to the Midwest was provided and can be used to make reasonable estimates of climate impacts in the city itself. The CSSR was "designed to be an authoritative assessment of the science of climate change, with a focus on the United States, to serve as the foundation for efforts to assess climate-related risks and inform decision-making about responses."[318] The CSSR notes that "[t]he last few years have seen record-breaking, climate-related weather extremes, and the last three years, specifically, have been the warmest years on record for the globe. These trends are expected to continue over climate timescales."[319]

Looking to the future, the CSSR predicts how climate change will exacerbate public health risks for Chicagoans, especially urban heat waves and urban flooding. "Heatwaves have become more frequent in the United States since the 1960s, while extreme cold temperatures and cold waves are less frequent. Recent record-setting hot years are projected to become common in

---

and impact of waterborne, foodborne and vectorborne disease in Cook County, in which Chicago is the largest municipality).

[315] Chicago Climate Action Plan, Climate Change and Chicago, http://www.chicagoclimateaction.org/pages/climate_change_and_chicago/5.php (last visited Oct. 24, 2018).

[316] Hettinger, Claire, *Illinois cound see effects of climate change as soon as 2020* (Sept. 1, 2016), http://cu-citizenaccess.org/2016/09/01/illinois-could-see-effects-of-climate-change-as-soon-as-2020/ (last visited Oct. 24, 2018).

[317] *See e.g.*, City of Chicago, Application Narrative for Public Comment, National Disaster Resilience Competition (March 11, 2015) (discussing City and sister agency expenditures to prepare for and react to extreme weather events), *available at* https://www.cityofchicago.org/content/dam/city/progs/env/2015_03_11_Chicago_NDRC_Consolidated-PUBLICDRAFT.pdf.

[318] USGCRP, *2017: Climate Science Special Report: Fourth National Climate Assessment* at 1, Volume I [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)], *available at* https://science2017.globalchange.gov/downloads/CSSR2017_FullReport.pdf.

[319] *Id.* at 12.

the near future for the United States, as annual average temperatures continue to rise. Annual average temperature over the contiguous United States has increased by 1.8°F (1.0°C) for the period 1901–2016; over the next few decades (2021–2050), annual average temperatures are expected to rise by about 2.5°F for the United States, relative to the recent past (average from 1976–2005), under all plausible future climate scenarios."[320] The CSSR also notes that annual precipitation has increased in Midwest, and with "high confidence" that "[h]eavy precipitation events in most parts of the United States have increased in both intensity and frequency since 1901."[321] Particularly concerning is that "[t]he frequency and intensity of heavy precipitation events are projected to continue to increase over the 21st century."[322]

The CSSR, marshalling scientific expertise from across the federal government, makes it clear that locations in the Midwest such as Chicago are expected to face increases in extreme weather events (as summarized above). Given the sound scientific basis for an expected increase in heat-related and flood-related health problems in the Chicago area, action at all levels of government is needed to prepare for those problems.

While the City of Chicago is investing in climate change adaptation and resilience measures, it is essential that the federal government does all it can to reverse the causes of the abrupt warming of the Earth: the well-documented increase in concentrations of heat-trapping gases in the atmosphere. The costs of the Clean Power Plan are likely dwarfed by the massive savings in health care expenditures for heat-related illness, flood-related illness, and other health conditions, as well as the economic damages due to flooding in cities like Chicago. Any consideration of rescinding the Clean Power Plan and replacing it with a weaker rule such as EPA's ACE proposal must include the health and economic impacts of the anticipated increase in heat waves and flooding in Chicago.

The City of Los Angeles

As EPA's August 2016 bulletin entitled "What Climate Change Means for California" recognized, California's climate is changing, and Southern California in particular has already warmed about three degrees (F) in the last century.[323] Like California as a whole, in Los Angeles, climate change will result in more common heat waves, less rainfall, increased stress on water supplies, increased risk of wildfires, and increased threats to coastal development and infrastructure.

As for heat waves, a recent UCLA study concluded that under a business as usual scenario, the annual number of days when temperatures exceed 95 degrees (F) in Los Angeles will increase from 6 days (1981-2000) to 22 days (2041-2060), and ultimately to 54 days (2081-

[320] *Id.* at 11.

[321] *Id.* at 20.

[322] *Id.* at 207.

[323] *See* EPA, *What Climate Change Means for California* (Aug. 2016), *available at* https://www.epa.gov/sites/production/files/2016-09/documents/climate-change-ca.pdf.

2100).[324] EPA's August 2016 bulletin recognizes that hot days "can be unhealthy—even dangerous." Indeed, high air temperatures, which are amplified in urban settings like Los Angeles, can cause heat stroke and dehydration and affect people's cardiovascular, respiratory, and nervous systems. Furthermore, as EPA's bulletin recognizes, warming can also increase the formation of ground-level ozone, a component of smog that can contribute to respiratory problems. Los Angeles already has the worst smog in the nation, and as the climate changes, progress toward clean air will become even more difficult and expensive. Extreme heat and poor air quality not only negatively impact Los Angeles residents and City employees, but also the City's ability to retain Los Angeles's status as a desirable business and tourist destination.

EPA's bulletin also recognized that the changing climate "is likely to increase the need for water but reduce the supply."[325] Studies cited in the Los Angeles Department of Water and Power (LADWP) 2015 Urban Water Management Plan reach the same conclusion. On the demand side, forecasted warming is projected to result in as much as a 7 percent increase in water demand.[326] Additionally, climate change would put stress on existing water supply infrastructure. The Los Angeles Aqueduct (LAA), which is one of the major imported water sources delivering a reliable water supply to the City, serves as just one example. The LAA originates approximately 340 miles away from Los Angeles, gathering snowmelt runoff in the Eastern Sierra Nevada. Projected changes in temperature (warmer winters) are anticipated to change precipitation patterns in the Eastern Sierra Nevada with less snow and more rain than historically encountered. This could strain the LAA's capacity to store runoff in surface reservoirs, as runoff would come earlier in the season than if the snowpack gradually melted in spring and summer, as has historically been the case. If climate change occurs as predicted, the City may have to expend substantial resources for operational and infrastructure changes to the LAA to ensure Los Angeles' continued reliance on this water source. [327]

EPA's bulletin also recognizes that "higher temperatures and drought are likely to increase the severity, frequency, and extent of wildfires," which already pose a substantial problem in Los Angeles. Indeed, 2017 was one of the worst wild fire seasons on record. As of December 12, 2017, it was reported that more than 405 square miles in Southern California had burned, 1160 structures had been destroyed, 90,000 people had been displaced, and more than 10,000 fire fighters from California ten other states had been employed to save lives and homes.[328] Researchers project that fires driven by Santa Ana winds, and the fires that occur

---

[324] *See The Climate Change in the Los Angeles Region Project,* http://research.atmos.ucla.edu/csrl//LA_project_summary.html (last visited Oct. 24, 2018).

[325] EPA, *What Climate Change Means for California, supra.*

[326] LADWP 2015 Urban Water Management Plan, Chapter 12, at 5 (2015), *available at* https://www.ladwp.com/ladwp/faces/ladwp/aboutus/a-water/a-w-sourcesofsupply/a-w-sos-uwmp?_adf.ctrl-state=ty6h0ptsh_29&_afrLoop=280191713614151

[327] *Id.* at 6-9.

[328] *See* Fonseca, Ryan, *The Thomas fire and Southern California's other major wildfires by the numbers*, Los Angeles Daily News (Dec. 7, 2017; updated Dec. 12, 2017), *available at* https://www.dailynews.com/2017/12/07/by-the-numbers-the-southern-california-wildfire-battles-in-la-ventura-counties/.

earlier in the year in Southern California, will burn larger areas by midcentury in part due to rising temperatures.

Finally, the City of Los Angeles has substantial public and private coastal development. Sea level rise caused by climate change may threaten both private property and public infrastructure along the Los Angeles coast, including at the Port of Los Angeles, which ranks as the #1 container port in the United States and North America.

New York City

Changing climate hazards in the New York metropolitan region are increasing the risks for the people, economy, and infrastructure of New York City in numerous and dramatic ways, as documented in the New York City Panel on Climate Change's January 2015 report, *Building the Knowledge Base for Climate Resiliency*.[329] Annual temperatures are hotter, heavy downpours are increasingly frequent, and the sea is rising. These trends are projected to continue and even worsen in the coming decades due to higher concentrations of greenhouse gases in the atmosphere.

Sea level rise in New York City has averaged 1.2 inches per decade since 1900, nearly twice the observed global rate, with a total increase of more than a foot; approximately 60 percent of that rise is driven by climate-related factors.[330] As discussed above in the New York State section, this increase in sea level exacerbated the destruction of homes and businesses from flooding during Hurricane Sandy.[331]

Climate change also risks New Yorkers' health and safety. Extreme weather events can result in injury and loss of life resulting from exposure, interrupted utility service, or lack of access to emergency services.[332] In addition, warming temperatures exacerbate or introduce a wide range of health problems, including cardiovascular and respiratory diseases, pollution and allergen-related health problems, and vector-borne diseases.[333] The health consequences of climate change disproportionately affect our most vulnerable populations – the elderly, children, and low-income communities who already experience elevated instances of cardiovascular and respiratory diseases.[334]

---

[329] New York City Panel on Climate Change, *Building the Knowledge Base for Climate Resiliency: New York City Panel on Climate Change 2015 Report*, Annals of the New York Academy of Science, Vol. 1336 (Jan. 2015), at 9, *available at* http://onlinelibrary.wiley.com/doi/10.1111/nyas.2015.1336.issue-1/issuetoc (hereinafter "*New York City Panel on Climate Change 2015 Report*").

[330] *New York City Panel on Climate Change 2015 Report*, *supra*, Chapter 2.

[331] *Id.*

[332] *Id.* at 70.

[333] *Id.* at 78-82.

[334] *See* DOHMH, *Air Pollution and the Health of New Yorkers: The Impact of Fine Particles and Ozone* at 4, at https://www1.nyc.gov/assets/doh/downloads/pdf/eode/eode-air-quality-impact.pdf; *see also* Globalchange.gov, *The Impacts of Climate Change on Human Health in the United States: A Scientific*

Long-term changes in climate mean that when extreme weather events strike, they are likely to be increasingly severe and damaging. By the 2050s, New York City will likely experience sea levels that are up to thirty inches higher than today, the number of days with rainfall at or above two inches is projected to increase by as much as 67% by the 2020s, and by the 2080s, what would today be considered a 100-year flood (*i.e.*, a flood that has a 1% chance of occurring in any given year) could have as high as a 12% chance of occurring in any given year, and this flooding could be as much as 4.8 feet higher than today's 100-year flood because of sea level rise.[335] New York City is also likely to experience more frequent heavy downpours and many more days at or above 90 degrees Fahrenheit by that timeframe.[336]

Rising sea levels will expose the homes, businesses, streets, wastewater treatment plants, and power plants that line our 520 miles of coastline to increased hazards. More extreme weather will also leave the City and its essential infrastructure susceptible to more frequent violent storms and severe flooding; at other times, the new extremes could subject the City to prolonged periods of drought.[337]

Heat waves, defined as three or more consecutive days of temperatures at or above 90 degrees, strain the City's power grid, cause deaths from heat stroke, and exacerbate chronic health conditions, particularly for vulnerable populations like the elderly.[338] Without mitigation of greenhouse gas emissions, the City can expect temperatures at or above 90°F for thirty-three days per year by the 2020s, for fifty-seven days by the 2050s, and for eighty-seven days by the 2080s.[339]

Philadelphia

Since 2010, Philadelphia has experienced a variety of extreme weather, including the snowiest winter, the two warmest summers, the wettest day, and the two wettest years on record, as well as two hurricanes and a derecho (a severe windstorm—usually associated with thunderstorms—that produces damage along a relatively straight path). Fifty-seven daily high temperature records have been set in Philadelphia since the year 2000, 28 of them since the year

---

Assessment Ch. 9, Populations of Concern (April 2016), at https://health2016.globalchange.gov/populations-concern.

[335] *New York City Panel on Climate Change 2015 Report, supra,* at 31-33, 40-42.

[336] *Id.* at 27.

[337] *See generally id.* at 23-27. For a comprehensive discussion of the likely effects of climate change on New York City's watershed and water delivery systems, *see* New York City Department of Environmental Protection Climate Change Program, *Assessment and Action Plan* (May 2008), *at* http://www.nyc.gov/html/dep/ pdf/climate/climate_complete.pdf. Details of climate change impacts on the City's wastewater treatment system are presented in DEP's *NYC Wastewater Resiliency Plan: Climate Risk Assessment and Adaptation Study* (Oct. 2013), *at* http://www.nyc.gov/html/dep/html/about_dep/ wastewater_resiliency_plan.shtml.

[338] *New York City Panel on Climate Change 2015 Report, supra,* at 26.

[339] *York City Panel on Climate Change 2015 Report* at 31.

2010. And the sea level around Philadelphia has been rising at a rate of roughly 0.11 inches per year since 1900, equivalent to an increase of nearly one foot in 100 years.[340]

Scientists expect these trends to continue in the future, at an accelerating pace and with increasing severity. The best available climate information suggests that weather in Philadelphia will become warmer and wetter during all seasons in the years and decades ahead, and that the rate of sea level rise will increase, especially toward the end of this century.[341]

Changes in climate matter to Philadelphia. Storms, heat waves, and floods already pose risks to residents and infrastructure, and the city is responsible for responding to these events by plowing the streets, managing stormwater, keeping Philadelphians safe during storms, and leading cleanup efforts when the storms clear. Philadelphia needs to build resilience to accommodate today's extremes while accounting for expected changes in the frequency of these events in the future.[342]

Expected effects of climate change in Philadelphia fall into three broad categories:

- *New Normals*

The city's buildings and infrastructure were designed to withstand past climate conditions, not those that scientists expect will occur in the future. Over time, prolonged exposure to higher temperatures and changing precipitation patterns may lead to safety hazards, service outages, and higher maintenance costs.

- *Changing Extremes*

Extreme events such as heat waves, intense rain or snowstorms, and tropical storms and hurricanes are expected to become more frequent and/or more severe as the climate changes.

- *Rising Seas*

Although Philadelphia is 90 miles inland from the mouth of the Delaware Bay, higher sea levels will raise water levels in the Delaware and Schuylkill Rivers. Higher baseline river levels would not only permanently inundate parts of Philadelphia but also increase the depth and extent of flooding in and around the city from storm surges.[343]

---

[340] Mayor's Office of Sustainability & ICF International, Growing Stronger: Toward A Climate-Ready Philadelphia, at 5 (2015), *available at*, https://beta.phila.gov/media/20160504162056/Growing-Stronger-Toward-a-Climate-Ready-Philadelphia.pdf

[341] *Id.*; *see also* ICF Incorporated, L.L.C., Useful Climate Information for Philadelphia, at 3 (2014), *available at* https://beta.phila.gov/media/20160505145605/Useful-Climate-Science-for-Philadelphia.pdf.

[342] *See* Growing Stronger: Toward A Climate-Ready Philadelphia, *supra,* at 5

[343] *Id.*

The impacts of climate change in Philadelphia will be costly. Just one severe hurricane could cause more than $2 billion in damages citywide.[344] On top of these additional disaster costs, climate change will increase the everyday cost of doing business.[345]

Extreme heat is also likely to increase risks to the health of vulnerable populations in the city. Heat events and hot days are projected to increase substantially in Philadelphia by the end of this century. Populations that are potentially vulnerable to extreme heat include the elderly, the very young, people with low socioeconomic status, and people without access to air-conditioned spaces. Nearly 27 percent of Philadelphia's population lives under the poverty level, more than 12 percent of the population is aged 65 years or older, and seven percent is under five years old.[346]

Heat can have both direct physiological impacts on health (such as heat stroke) and indirect impacts: for example, hot weather encourages the formation of ground-level ozone, which reduces air quality and poses risks to individuals with respiratory conditions such as asthma. In 2010, nearly a quarter of children in Philadelphia County had asthma, among the highest rates in the nation.[347]

Extreme heat is responsible for more deaths in Pennsylvania than all other natural disasters combined, killing an average of 50 people per year between 1997 and 2004. A 10-day heat wave that hit Philadelphia in July 1993 resulted in 118 deaths.[348]

Extreme heat can also affect city services and infrastructure. For example, interviews with city departments indicated that hotter days may require construction activities (including street paving and repairs) to shift to night hours, and pavement may require longer curing times. Extreme heat that persists for multiple days and nighttime temperatures that remain elevated magnify these impacts.[349]

Rising sea levels are expected to increase the frequency and severity of flooding in Philadelphia. Coastal storms combined with higher sea levels will cause more extensive flooding than the same storms would cause today, although tides, saturation of the ground, ground temperature, and other factors can vary the degree of flooding experienced from two storms with the same amount of rainfall.[350]

Flooding presents many risks to Philadelphia, including public health and safety hazards, interruptions in key services, and damage to buildings and infrastructure. Floods can disrupt transportation, hampering emergency services and evacuation efforts. Because fuel pumps and sump pumps require electricity to operate, a power failure during a flood could limit the

---

[344] *Id.* at 9

[345] *Id.*

[346] *Id.* at 13

[347] *Id.*

[348] *Id.*

[349] *Id.*

[350] *Id.* at 14

availability of fuel for generators and vehicles, and allow water levels to rise in buildings and other facilities.[351]

South Miami, FL

The City of South Miami is situated atop the Miami Ridge, a limestone outcropping that is cut through by a series of transverse glades that drain the Everglades basin into Biscayne Bay. The southernmost edge of the City of South Miami borders one such glade, the Snapper Creek Canal. South Miami is bisected by a second transverse glade, the Ludlam Glades Canal, which empties into the Snapper Creek Canal. In 2009, FEMA designated neighborhoods in these transverse glades as flood zone AE, requiring flood insurance.

By the late 1960s, saltwater had intruded far up the coastal drainages of Miami-Dade County. A series of saltwater exclusion dams were constructed on the canals and creeks to limit upstream flow, including on the Snapper Creek Canal downstream of South Miami. These dams freshened the drainages, but saltwater continued to advance underground because local sea level rise increased the hydrostatic pressure of intruding saltwater. As of 2011, underground saltwater had reached the southeastern corner of the City of South Miami. The South Florida Water Management District increased the height of the freshwater head on the inland side of the saltwater dams to counter the underground intrusion of saltwater. The maximum height of the freshwater buildup, however, has been limited by the low-elevation of the western suburbs, which, by law, cannot be deliberately flooded.

Local sea level rise in South Florida, including the City of South Miami, has greatly exceeded global sea level rise. Since 2010, Miami has seen an extra 5" of sea level rise. With the increase in local sea level rise in Miami, saltwater has begun overtopping the Snapper Creek Canal exclusion dam during recent "king tides" in October and November.[352]

Local sea level rise has increased the distance that storm surge can penetrate inland. Two days before landfall of Hurricane Irma on September 9, 2017, the National Hurricane Center issued its first ever storm surge warning for South Miami. For the first time ever, Miami-Dade County responded to the flood warning with a mandatory evacuation order for most of the City of South Miami.[353] Even though the storm center diverted, low areas of the City experienced floodwaters, and adjacent areas closer to the bay experienced significant damage from storm surge and flooding.

An unseen side-effect of the underwater battle being waged between freshwater and saltwater has been the rise of the local water table. In 2015, GEI Consultants, Inc. identified septic systems as the infrastructure in the City of South Miami at most immediate risk from the rising water table: "*The Snapper Creek Study Area had 11 properties (or 73% of the 15 records*

---

[351] *Id.*

[352] Dessu SB, Price RM, Troxler TG, Kominoski JS (2018). Effects of sea-level rise and freshwater management on long-term water levels and water quality in the Florida Coastal Everglades. Journal of Environmental Management, 21, 164-176, *available at* https://doi.org/10.1016/j.jenvman.2018.01.025

[353] *Miami-Dade Expands Evacuation Order*. Miami Herald (Sept. 7, 2017).

available) that were estimated to have the bottom of drainfield reached by rising groundwater within the next 25 years." When groundwater reaches the level of a house's septic drainfield, wastewater from the house (including the toilets) will backflow into the bathtub instead of the septic tank. The remedy is replacing septic systems with a municipal sewer system.[354]

The City of South Miami, on September 15, 2015, approved a resolution authorizing SRS Engineering Inc. to provide complete engineering documents consistent with a Citywide Sanitary Sewer Master Plan to replace the vulnerable septic systems with municipal sewer infrastructure. The master plan was completed on September 14, 2016 with a total estimated cost to the City and its residents of $47,639,833.26.[355]

In addition to the direct effects of sea level rise, which will compromise the City's existing sanitary waste infrastructure, the City will likely experience indirect harm based on economic factors relating to rising flood insurance costs and loss of 30-year mortgage issuance in low-lying areas. FEMA flood insurance rates have already begun to rise for the many properties in the City's AE flood zones. Based on FEMA and NOAA projections for sea level rise, indirect harm to property values will begin to manifest in the City over the next 30 years, and, as a result, the City's tax base and our ability to deliver services will become increasingly compromised.[356]

Broward County, FL

Southeast Florida is particularly vulnerable to the predicted effects of climate change due to its extensive coastline, flat landscape, porous geology, and burgeoning coastal development. In South Florida, Miami-Dade, Broward, and Palm Beach counties collectively have populations approaching 6 million residents. Millions of these residents live on or near the shoreline.[357] Their safety depends on thousands of miles of canals for drainage and flood control.

Extreme high tides have become increasingly frequent and dramatic due to rising sea levels, over-topping seawalls, pushing up through storm water systems and contributing to flooding in communities far from the waterfront and coastal canals. King tides during the last two years have been more severe and expansive than predicted, compounded by diverse meteorological conditions, and, in 2015, occurred monthly for a full six months. These conditions revealed the complexity of the challenge, as Broward County cannot simply plan for any single scenario, but most consider the array of conditions on top of sea level rise that compound coastal flood conditions (e.g., high tides, slowing gulf stream, offshore storms, and

---

[354] Cooper JA, Loomis GW, Amador JA (2016). Hell and high water: Diminished septic system performance in coastal regions due to climate change. PLoS One. 2016; 11(9): e0162104. 2016 Sep 1. doi: 10.1371/journal.pone.0162104; Ariza M (Jun 25 2017) Miami, sea level rise is coming for your poop. New Tropic. https://thenewtropic.com/climate-change-septic-tanks-miami/

[355] SRS Engineering Inc. Citywide Sanitary Sewer Master Plan, September 14, 2016.

[356] Flavelle C (19 Apr 2017) The Nightmare Scenario for Florida's Homeowners. Bloomberg News. https://www.bloomberg.com/news/features/2017-04-19/the-nightmare-scenario-for-florida-s-coastal-homeowners

[357] Coastal county definition, NOAA Office for Coastal Management, coast.noaa.gov, November 2017

super moons), independent of local rainfall. In Broward County, the condition is complicated by the expansive network of finger canals and waterways that generate more than 300 miles of shoreline and provide numerous entry points for water, creating vulnerabilities more expansive than the County's 23 miles of beach would suggest.[358]

Regionally, it has been estimated that $3 billion in property value is at risk with one foot of sea level rise. A storm surge could magnify this figure significantly. Rising sea levels threaten evacuation routes and critical energy, water, and wastewater infrastructure. Fort Lauderdale recently estimated that upgrades to the city's storm water system to combat rising sea levels would reach costs of $1 billion. In eastern Broward County, $5 billion of property is at risk with 2 feet of sea level rise, 64 percent of which is commercial.[359]

Despite its severity, coastal flooding represents just a sliver of the challenge. The broader Broward landscape is also at risk due to the influence of sea level rise on our complex drainage and flood management system, as well as the groundwater table. Already, groundwater monitoring wells reveal a one-foot increase in groundwater elevations in coastal areas of the County, a condition that degrades the function of drainage wells and water management systems designed in accordance of hydrologic conditions that no longer exist. Hydrologic modeling performed in partnership with the U.S. Geological Survey (USGS) reveals a predicted one-to-one relationship between sea level rise and change in groundwater table in coastal areas of the county with 2.5 feet of sea level rise. The influence on the groundwater table is expected to reach more than 6 miles inland with a 50% response to each foot of sea level rise. This loss of groundwater storage is already compounding flooding, and will contribute to flood stages and flood risk for a growing portion of the community.[360]

For western communities, flood protection relies upon the ability of canals to drain stormwater runoff via discharge to the coast, discharge which is made feasible by gravity. Control gates separate tidal and freshwater reaches of these canals, but as rain falls and water stages increase, the gates are opened for flood relief, allowing inland stormwater to flow down gradient and discharge to tide. As sea level has risen, the downstream gradient has diminished, and discharges are slowed. During extreme high tide, some gates must remain closed, as coastal water levels rise above canal stages preventing release of stormwater and aggravating flood risk. Pumps to replace these gravity water control structures are estimated to cost $50 million each.[361] Existing pump systems are also inadequate. Provisional modeling performed by the USGS

---

[358] Broward County, Geographic Information Systems, staff analysis

[359] Analysis of the vulnerability of Southeast Florida to Sea Level Rise. August 2012. Southeast Florida Regional Climate Change Compact Inundation Mapping and Vulnerability Assessment Work Group, August 2012

[360] Groundwater monitoring well data is available via https://nwis.waterdata.usgs.gov/nwis/gwlevels. Hydrologic modeling performed by the USGS and site-specific engineering calculations reveal recent and predicted loss of storage and compounded flood risk. Model results are not yet published.

[361] This is a minimum cost estimate based on FEMA reimbursement for retrofit of an equivalent structure in Miami-Dade County.

indicates that, by 2060, increases in groundwater level in response to rising seas will require an existing pump to run 24 hours a day to maintain flood control elevations.[362]

Rising seas impact water supplies as well, driving saltwater contamination into wellfields. USGS modeling in collaboration with the County reveals the predicted loss of 35 million gallons per day (MGD) in water supply capacity by 2060 (40 percent of Broward's coastal wellfield capacity), due fully to the additional influence of sea level rise. Sea level rise has doubled the rate of local saltwater intrusion into coastal wellfield (as compared to the influences of regional water management) and water supply operations. While the impacts will be realized county-wide, the affected wellfields pertain to Broward County and the Cities of Deerfield Beach, Pompano Beach, Hollywood, Dania Beach, and Hallandale Beach. The County is currently collaborating in a multi-jurisdictional alternative water supply project to help mitigate for these losses with construction of a 35 MGD surface water reservoir. The Phase 1 project cost is $161 Million.

In response to these overarching risks, Broward County, partner counties in the Southeast Florida Regional Climate Change Compact (Compact), and more than half of Broward municipalities have adopted a regional sea level rise projection for planning purposes, with an estimated 11 to 23 inches of additional sea level rise predicted by 2060.[363] This projection was developed via the activities of the 4-County Compact, formed in early 2010 as a voluntary collaboration among Palm Beach, Broward, Miami-Dade and Monroe Counties to jointly address shared climate mitigation and adaptation challenges. The County partnered with the U.S. Army Corps of Engineers under the Planning Assistance for States Program to undertake a hydrodynamic study to evaluate the combined influence of sea level rise, high tides, and high frequency storm events on flood conditions. The results of this study substantiate proposed establishment of a regional seawall and top-of-bank standard for tidally-influenced waterways, to improve community resilience to sea level rise and coastal flooding. A third-party risk-based economic analysis associated with this study revealed a 20.5-fold increase in economic exposure with just 1 foot of sea level rise for a storm surge event with a 1% annual probability.

To address these exposures, the County has modernized regulatory standards for surface water management systems to include wet season groundwater elevations under future sea level conditions, and is undertaking remap of the 100-year flood condition with an additional two feet of sea level rise to support new standards for finished floor elevations. The implications for planning and infrastructure design will be significant, but necessary given the risk and financial exposure of inaction.[364]

---

[362] Results not yet published.

[363] Unified Sea Level Rise Projection for Southeast Florida, Southeast Florida Regional Climate Change Compact. 2015

[364] National Hazard Mitigation Saves: an Independent Study to Assess the Future savings from Mitigation Activities. Vol. 1 – Findings, Conclusions and Recommendations. Vol. 2-Study Documentation. Appendices. MMC (Multihazard Mitigation Council). National Institute of Building Sciences, Washington, D.C. 2005

Appendix B: Clean Energy Resources in States and Cities

(updated October 31, 2018)

States' and Cities' Efforts to Address Power Plant Carbon Pollution

Even as our States and Cities have been on the frontlines of the impacts of climate change caused by manmade emissions of greenhouse gases, we have been on the forefront of crafting solutions to reduce emissions from the largest stationary sources of those emissions within our borders. We have shown that generation shifting and energy efficiency/demand response programs are cost-effective tools to substantially reduce carbon pollution from the power sector while maintaining reliability and incentivizing economic growth.

Regional Efforts: The Regional Greenhouse Gas Initiative

EPA cited in the Clean Power Plan rulemaking the success of the Regional Greenhouse Gas Initiative (RGGI). Under RGGI, ten northeastern states (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey,[1] New York, Rhode Island, and Vermont) have shown that substantial carbon pollution cuts from existing fossil fuel-fired power plants are achievable by encouraging shifts to less carbon-intensive generation, increasing use of renewable energy, and reducing demand through energy efficiency.

RGGI has been an unqualified success. The participating states created a regional cap-and-invest system pursuant to which they limit carbon pollution from power plants and use the proceeds from auctioning emission allowances to invest in programs that reduce energy demand and keep down electricity prices. Since RGGI launched in 2008, the participating states have succeeded in reducing CO_2 emissions from the power sector by more than 40 percent.[2] A 2015 report from the Nicholas Institute at Duke University found that RGGI was responsible for more reductions through 2014 than fuel switching to natural gas or the global economic downturn.[3]

The emissions cap is set at 82.2 million short tons in 2018, and declines 2.5 percent each year until 2020 to about 78.2 million tons. In 2017, the RGGI states announced plans to secure further CO_2 reductions to achieve a cap of 55.7 million tons by 2030. This represents a 65-percent drop from regional CO_2 levels in 2009.[4]

---

[1] New Jersey was a member of RGGI during the first three-month compliance period (2009-11), before withdrawing in 2012. New Jersey Governor Phil Murphy has announced that the state will be rejoining RGGI this year.

[2] Acadia Center, Outpacing the Nation: RGGI's environmental and economic success (Sept. 2017) ("Acadia Ctr. 2017 Report"), at 3, available at http://acadiacenter.org/wp-content/uploads/2017/09/Acadia-Center_RGGI-Report_Outpacing-the-Nation.pdf

[3] Brian Murray and Peter Maniloff, *Why Have Greenhouse Emissions in RGGI States Declined? An Econometric Attribution to Economic, Energy Market, and Policy Factors*, Duke Nicholas Institute (Aug. 2015), publication available at: https://nicholasinstitute.duke.edu/environment/publications/why-have-greenhouse-emissions-rggi-states-declined-econometric-attribution-economic

[4] Alex Guillen, *RGGI States Plan Further 30 Percent Emissions Cut by 2030*, Politico (Aug. 23, 2017), *at* http://www.politico.com/states/new-york/albany/whiteboard/2017/08/23/rggi-states-proposed-further-30-percent-emissions-cuts-by-2030-8613376

The decline in carbon pollution has been accompanied by reductions in other harmful pollutants, such as sulfur dioxide, nitrogen oxides, and mercury. In a recent report, Abt Associates found that RGGI was directly responsible for a substantial share of the reduction in criteria air pollutants from 2009-14, avoiding hundreds of premature deaths and tens of thousands of lost work days.[5]

The RGGI states have used the proceeds from allowance auctions to fund investments in energy efficiency, further reducing demand and generating large net economic benefits. This has helped member states achieve greater economic growth and lower electricity prices compared to other regions of the country. Specifically, average electricity prices across the region have decreased by 6.4 percent since RGGI took effect, while electricity prices in non-RGGI states have increased by an average of 6.2 percent. And since RGGI began, member states have reduced emissions by 15 percent more than other states and experienced 4.3 percent greater economic growth.[6]

The facts demonstrate that RGGI is a clear economy-booster and job-creator. Between 2015 and 2017 alone, RGGI added $1.4 billion in economic value, and created over 14,500 job-years, in the region.[7] That is on top of the $2.9 billion in economic value and 30,000 jobs RGGI created in its first six years.[8] In sum, RGGI has improved public health, reduced climate risks and stimulated economic growth—a win, win, win.

State-Specific Efforts

California

California has also succeeded in reducing its greenhouses emissions while continuing to grow its economy.[9] California's efforts to reduce greenhouse gas emissions to 40 percent below

---

[5] Michele Manion, et al., *Analysis of the Public Health Impacts of the Regional Greenhouse Gas Initiative, 2009-2014* (Jan. 2017), Abt Associates, at 1-2, available at: http://www.abtassociates.com/AbtAssociates/files/7e/7e38e795-aba2-4756-ab72-ba7ae7f53f16.pdf

[6] Acadia Center 2017 Report at 3

[7] Analysis Group, *The Economic Impacts of the Regional Greenhouse Gas Initiative on Nine Northeast and Mid-Atlantic States*, at 4, 9 (Apr. 17, 2018) available at: http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/analysis_group_rggi_report_april_2018.pdf.

[8] Analysis Group, *The Economic Impacts of the Regional Greenhouse Gas Initiative on Ten Northeast and Mid-Atlantic States* (Nov. 15, 2011) at 2, available at: www.analysisgroup.com/uploadedfiles/publishing/articles/economic_impact_rggi_report.pdf; Analysis Group, *The Economic Impacts of the Regional Greenhouse Gas Initiative on Nine Northeast and Mid-Atlantic States* (July 14, 2015) at 5, 10, available at: http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/analysis_group_rggi_report_july_2015.pdf

[9] California Air Resources Board, *California's 2017 Scoping Plan*: *The strategy for achieving California's 2030 greenhouse gas target* (Nov. 2017), p. ES3, https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf.

1990 levels by 2030 have already led to significant benefits for the state, and the State is now committed to achieving 100 percent renewable energy and carbon neutrality by 2045, with an interim goal of 60 percent renewable energy by 2030[10]. Clean energy is one of the fastest growing sectors of California's economy, employing more than a half a million people overall.[11] Energy efficiency improvements for buildings and appliances have also led to rapid employment growth, with tens of thousands of full-time jobs in the sector. In 2015 alone, California added more than 20,000 jobs in the solar industry.[12] Solar, wind and geothermal energy projects built to comply with California's Renewable Portfolio Standards have generated many thousands of well-paying skilled jobs with health benefits and pensions.[13] The workers benefiting from these job opportunities are mostly residents of low-income, rural areas, such as Kern and Imperial Counties.[14]

These efforts have also led to lower and more stable electric bills. Thanks in large part to California's energy efficiency policies, per-capita residential electricity use and monthly power bills are among the lowest in the country.[15]

Connecticut

Connecticut is a founding member of RGGI. Through RGGI, Connecticut auctions nearly all of its emission allowances. The proceeds from the annual auctions cover the administrative costs of implementing the program and further Connecticut's climate change programs under Conn. Gen. Stat. § 22a-200c. The administrative costs to administer the program consume only 7.5 percent of the proceeds. The remaining 92.5 percent of the proceeds are invested in energy efficiency and renewable energy, through programs administered by the Connecticut Green Bank and Connecticut utility companies. Investments in these programs are spurring innovation and attracting private investment in the clean energy economy, and creating green jobs in Connecticut and the other RGGI states.[16] Between 2001 and 2013, Connecticut reduced gross carbon dioxide emissions from in-state power plants by 34 percent, and economy-wide per capita

---

[10] Senate Bill (SB) 100, De León, Stats. 2018; Governor's Exec. Order No. B-55-18 (Sept. 10, 2018).

[11] AEE Institute, *Advanced Energy Jobs in California: Results of the 2016 California Advanced Energy Employment Survey* (2016), at 1, https://info.aee.net/hubfs/PDF/california-jobs-report-2016.pdf.

[12] *Supra* note 9, p. 13.

[13] Center for Labor Research and Education, University of California, Berkeley, *The Link Between Good Jobs and a Low Carbon Future: Evidence from California's Renewables Portfolio Standard, 2002—2015* (July 2016), at 4-5, http://laborcenter.berkeley.edu/pdf/2016/Link-Between-Good-Jobs-and-a-Low-Carbon-Future.pdf.

[14] *Id*. at 7

[15] U.S. Energy Information Administration, *2016 Average Monthly Bill – Residential*, https://www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf.

[16] The Investment of RGGI Proceeds in 2015. (October 2017). https://www.rggi.org/docs/ProceedsReport/RGGI_Proceeds_Report_2015.pdf

emissions by 18 percent.[17] Concurrently between 2001 and 2013, Connecticut's emissions of harmful criteria pollutants from in-state power plants dropped precipitously; overall emissions of nitrogen oxides (NOx) and sulfur oxides (SOx) decreased by 89 percent and 97 percent, respectively.[18]

Delaware

The State of Delaware is also a founding member of RGGI. Delaware directs 65% of RGGI allowance auction proceeds to the Sustainable Energy Utility, which provides energy savings programs for Delaware citizens, businesses, schools and non-profit organizations. The Department of Natural Resources and Environmental Control (DNREC), Division of Energy and Climate receives 10% of auction proceeds for implementation of the Weatherization Assistance Program (WAP), 10% for investments into innovative strategies to reduce greenhouse gas emissions and 10% for administration of the program. The Delaware Department of Health and Social Services' (DHSS) Low-Income Home Energy Assistance Program (LIHEAP) receives 5% of auction proceeds to provide fuel assistance for low income Delawareans.[19]

The Delaware Sustainable Energy Utility (DESEU) is a unique non-profit organization offering a one-stop resource through its Energize Delaware initiative to help residents and businesses save money through clean energy and efficiency. The DESEU was created in 2007 by the state of Delaware to foster a sustainable energy future for the state. The DESEU model is the first of its kind to be established in the United States, and is being replicated in several other communities around the world. In 2016, RGGI funds deployed through the Sustainable Energy Utility funded projects for 2,254 homes, 4 businesses, 26 non-profits and 13 local and state agencies resulting in energy savings of nearly $1M/year.[20]

DNREC directs 10% of RGGI proceeds to projects that benefit residents and that result in quantifiable and verifiable reductions in greenhouse gas emissions in Delaware. This funding allows the state to develop and implement programs that drive down emissions and improve air quality. These programs provide financial incentives for clean vehicles and the infrastructure to support these new technologies. Deployment of zero and low emission vehicles reduces greenhouse gas emissions into the atmosphere, reduces ground level ozone, improves public health and saves consumers and businesses money. Funding has also been directed to projects that reduce greenhouse gas emissions from the waste and energy sectors.

Municipal and county governments play a large role in preparing for climate change and reducing greenhouse gas emissions. Under Executive Order 41, state agencies are charged with

---

[17] 2013 Connecticut Greenhouse Gas Emissions Inventory. (2016). http://www.ct.gov/deep/lib/deep/climatechange/2012_ghg_inventory_2015/ct_2013_ghg_inventory.pdf

[18] 2009-2017 is from CAMD with selection of RGGI units only and 2001 data is unit by unit data from EMIT with verification from COATS data on applicable units.

[19] 7 DE Code Ch 60 - http://delcode.delaware.gov/title7/c060/sc02a/index.shtml

[20] Delaware Sustainable Energy Utility – 2016 Annual Report. https://www.energizedelaware.org/Sustainable-Energy/2016-annual-report

working with local governments to promote greenhouse gas reductions and to promote sustainable communities. The "Climate Framework for Delaware" calls for aiding local governments by providing technical assistance to help them become more sustainable. The feedback received during climate workshops is loud and clear – local governments are more than willing to promote greenhouse gas reductions and sustainability within their communities.[21]

Hawaii

Hawaii has taken action to transition away from its reliance on fossil fuels for electricity generation, transportation, and other sectors of our economy. In 2015, the Hawaii Legislature passed Act 97, the purpose of which is to reduce and to ultimately completely eliminate Hawaii's dependence on, and use of, fossil fuels for electrical generation and ground transportation by 2045.

In 2016, Hawaii ranked third in the country on solar capacity per capita, and generated more solar electricity per capita from distributed facilities than any other state. Solar energy from both utility-scale and distributed resources generated 38% of Hawaii's net generation from renewable resources. Hawaii is one of seven states with utility-scale generation from geothermal energy. In 2016, 19% of Hawaii's renewable net electricity generation came from geothermal energy. In 2016, Hawaii had approximately 202 megawatts of land based wind-energy, and is currently exploring off-shore wind energy from floating wind turbines to fulfill its renewable energy needs as well.

Illinois

According to a September 2017 report by the Clean Energy Trust, Illinois has over 119,000 clean energy jobs (the highest out of 12 Midwestern states) and posted a 4.8% percent clean energy job growth from 2015-16. Almost four out of five clean energy jobs in Illinois are in energy efficiency, which includes lighting, building materials, and heating and air conditioning. Clean energy is one of the fastest growing industries in Illinois, growing more than six times faster than overall jobs in the state.

Legislation enacted at the end of 2016 could bring over $12 billion in private investment to Illinois, and the state could see as much as 3,000 megawatts of new solar development, 1,300 megawatts of new wind power, and an over 20 percent persistent reduction in energy use in the state's largest utility's service area (ComEd). The new development of renewable energy will add to the 4,000 megawatts of already installed wind capacity in Illinois, which currently ranks sixth in the nation in that category. Expanded energy efficiency programs will add to efforts that have already saved ComEd customers 21.5 million megawatt hours of energy—enough to power more than 2.3 million homes for a year—and created customer savings of $2.3 billion on electric bills. This period of tremendous clean energy growth in Illinois has coincided with stable or declining electricity rates for consumers and record levels of grid reliability year after year. All

[21] Climate Framework for Delaware. 2014. http://www.dnrec.delaware.gov/energy/Documents/The%20Climate%20Framework%20for%20Delaware%20PDF.pdf

of this as Illinois builds toward its policy goals of 25% renewable energy by 2025 and a 21.5% reduction in energy use in the ComEd service territory by 2030.

Iowa

Based on statistics compiled by the American Wind Energy Association (AWEA), wind energy has significantly impacted Iowa: (1) wind supports around 8,000-9,000 jobs in Iowa, (2) over $13 billion has been invested in Iowa wind, (3) there are 11 wind-related manufacturing facilities in Iowa, and (4) annual land lease payments total more than $20 million.[22] Additionally, the construction of major facilities by Google, Facebook, and others in Iowa has been partly attributed to wind energy as they seek abundant sources of clean energy to meet internal sustainability goals.[23] Iowa's wind energy production was second only to Texas in 2016 and continues to grow. Some key figures include: 1) 6,952 megawatts of installed capacity; 2) nearly 4,000 installed turbines; and 3) 36.59 percent of Iowa's generated electricity came from wind in 2016.[24] The use of wind energy has a profound impact on the environment: coal and natural gas plants with equal capacity would use about 3.5 billion gallons of water annually. Additionally, 5.9 million metric tons of carbon dioxide pollution was avoided.[25] Iowa's two main electricity providers, Alliant Energy and MidAmerican Energy, have further committed to adding 2,500 MW of wind energy capacity by the end of 2019. Alliant is currently in the "acquisition phase" of a $1 billion investment with construction to begin in 2018 that will add 500 MW of energy.[26] MidAmerican's "Wind XI Project" is a $3.6 billion investment that will add 2,000 MW. Certain areas have begun construction, with the entire project to be completed by 2019.[27]

In addition to wind energy, Iowa has significant investments in solar energy. According to the Solar Energy Industries Association (SEIA), solar energy in Iowa is responsible for about 550 jobs and $113 million in total investments through 2016.[28] Iowa currently has a solar energy generating capacity of 44.1 MW, of which 13.7 MW were installed in the past year. The Energy Information Administration (EIA) reported 41,000 megawatt hours (MWh) generated in 2015, the most recent year for which data is available.[29] The EIA reported a 17,000 MWh jump from 2014-2015.

Solar's role in Iowa's energy mix is vastly different from wind's role. Wind energy is mostly utility-owned. The majority of solar production is achieved by residential and commercial

---

[22] http://awea.files.cms-plus.com/FileDownloads/pdfs/Iowa.pdf

[23] http://www.iaenvironment.org/webres/File/Iowa%20Wind%20Energy%20Fact%20Sheet%20-%20June%202017.pdf

[24] *Id*.

[25] http://awea.files.cms-plus.com/Iowa%20Report_7.15%20%281%29.pdf

[26] http://www.iowawindenergy.org/one-year-later-wind-project-updates/

[27] https://www.midamericanenergy.com/wind-energy.aspx

[28] http://www.seia.org/sites/default/files/2017%20Q1%20IA.pdf

[29] https://www.eia.gov/electricity/annual/html/epa_03_21.html

rooftop panels. This provides a retail level benefit for Iowans who want to offset part or all of their energy costs. This has been spurred on by Iowa's Solar Energy System Tax Credit, which has seen its $5 million annual fund fully utilized each of the past few years by residential and commercial applicants.[30] Additionally, prices for the purchase and installation of solar projects have dropped 64% over the last 5 years. All this makes Iowa a regional leader in distributed solar energy.[31] Although solar generation in Iowa is done largely by individual residents and businesses, utilities and local cooperatives are starting to do so also. For example, Alliant[32] is building a 5 MW array around Dubuque, while Central Iowa Power Cooperative[33] announced a 5.5 MW project last March.

During this time when the share of renewable energy in Iowa has significantly increased, coal's share of net electricity generation has declined in the state from 76 percent in 2008 to 45 percent in 2017.[34]

Maine

Maine is one of nine states that are part of RGGI, which has reduced emissions of carbon dioxide from the electricity sector in participating states by approximately 45% from 2005 levels.[35] Since its inception in 2009, RGGI has raised nearly $3 billion for participating states to invest in energy efficiency programs and to support clean, renewable power generation.[36] RGGI investments through 2014 alone are projected to return $4.67 billion in lifetime energy bill savings to more than 4.5 million households and 21,400 businesses.[37]

Maine has invested its share of revenue from the RGGI program in a variety of energy efficiency programs that have brought real benefits to Maine industry and individual citizens alike. For example, the Efficiency Maine Program relied on RGGI funding to make a $75,000 grant to weatherize 126 homes on islands off the Maine coast, where energy costs are

---

[30] https://tax.iowa.gov/sites/files/idr/Solar%20Energy%20System%20Tax%20Credit%20Annual%20Report%202016%20Revised.pdf

[31] http://www.iaenvironment.org/webres/File/Iowa%20Solar%20Energy%20Fact%20Sheet%20-%20June%202017.pdf. Only Missouri has more distributed solar energy in the region.

[32] http://www.thegazette.com/subject/news/business/alliant-building-iowas-largest-solar-site-in-dubuque-20170606

[33] http://www.thegazette.com/subject/news/business/cipco-plans-7-million-solar-project-20160331

[34] https://www.eia.gov/state/?sid=IA

[35] Abt Associates, *Analysis of the Public Health Impacts of the Regional Greenhouse Gas Initiative, 2009-2014*, January 2017, http://abtassociates.com/AbtAssociates/files/7e/7e38e795-aba2-4756-ab72-ba7ae7f53f16.pdf

[36] *Id*.

[37] The Regional Greenhouse Gas Initiative, *The Investment of RGGI Proceeds through 2014*, September 2016, https://www.rggi.org/docs/ProceedsReport/RGGI_Proceeds_Report_2014.pdf.

particularly high.[38] The results of that effort reduced annual energy costs by approximately $120,000.[39] RGGI proceeds have also funded grants to regionally important employers like GAC Chemical in rural Waldo County, which completed a full-facility energy retrofit with RGGI's support that will lower its costs and make the business more competitive.[40] Projects like these at hundreds of homes and businesses–both large and small–throughout Maine have produced the dual benefits of saving money while reducing emissions of the pollution that causes global climate change.

Maryland

In Maryland, the Electric Utility Industry Restructuring of 1999 required a transition to a competitive market for electric generation with the stated goals of, *inter alia*, establishing customer choice, providing economic benefits for all customer classes, and ensuring compliance with federal and state environmental standards.[41] As of December 2016, well over 1,400 MW of generation capacity in Maryland came from renewable resources (including wind, solar, hydropower, and waste-to-energy).[42] Through the second quarter of 2018, Maryland's installed solar capacity has grown to nearly 1000 MW.[43] Marylanders also have access to nearly 200 MW of installed wind power capacity. During 2016, wind energy accounted for 1.5 percent of all electricity production in Maryland, powering the equivalent of 47,500 homes.[44] Maryland has also taken significant steps toward the development of its offshore wind resources: In May 2017, the Public Service Commission awarded offshore wind renewable energy credits (ORECs) to two projects, which will pave the way for the construction of 368 MW of capacity off the coast of Maryland.

Maryland is a participant in the RGGI pursuant to Maryland's Healthy Air Act, En. Art. §§ 2-1001 through 2-1005. Through Maryland's participation in RGGI, Maryland has made a commitment to the use of renewable energy and achieving the State's climate goals. Maryland also has a robust renewable portfolio standard (RPS), which was created by law in 2004. It is a two-tiered system with carve-outs for solar energy (SRECs) and offshore wind energy (ORECs), and corresponding RECs for each tier. Electric companies (utilities) and other electricity

---

[38] *Id*.

[39] *Id.*

[40] The Regional Greenhouse Gas Initiative, *The Investment of Proceeds from RGGI CO2 Allowances*, September, 2011, http://www.rggi.org/docs/Press_Release_%20RGGI_Proceeds_Report.pdf.

[41] *See* S.B. 300, 1999 Gen. Assemb., Reg. Sess. (Md. 1999)

[42] *See* Maryland Dep't of Natural Resources, *Maryland Power Plants and the Environment: A Review of the Impacts of Power Plants and Transmission Lines on Maryland's Natural Resources*, DNR Publication No. 12-12132016-638 (Dec. 2016), *available at* http://www.pprp.info/ceir18/CEIR_18_Summary%20FINAL.pdf.

[43] *See* Solar Energy Industries Association, Maryland Solar, https://www.seia.org/state-solar-policy/maryland-solar (last visited Oct. 25, 2018).

[44] *See* American Wind Energy Association, Maryland Wind Energy, *available at* http://awea.files.cms-plus.com/FileDownloads/pdfs/Maryland.pdf (last visited Oct. 25, 2018).

suppliers must submit RECs equal to a percentage specified in statute each year or else pay an alternative compliance payment (ACPs) equivalent to their shortfall. Over the past few years, the requirements have been met almost entirely through RECs, with negligible reliance on ACPs. In 2017, Maryland increased its RPS, requiring utilities to derive 25 percent of their sales from renewable resources by 2020. *See* H.B. 1106, 2016 Gen. Assemb., Reg. Sess. (Md. 2016).

In addition, Maryland is encouraging energy efficiency through the State's EmPOWER program, which was first enacted in 2008. *See* EmPOWER Maryland Energy Efficiency Act of 2008, H.B. 374, 2008 Gen. Assemb., Reg. Sess. (Md. 2008). Implementation of the EmPOWER program has led to a 15% reduction in demand based on a 2007 baseline. During the 2017 legislative session, the Maryland General Assembly extended the EmPOWER program through 2023. *See* H.B. 514, 2017 Gen. Assemb., Reg. Sess. (Md. 2017).

Finally, Maryland has started to explore energy storage using grid-connected battery systems as an important tool that will facilitate the integration of renewable energy, bolster grid reliability, and provide for flexibility in the grid. In 2017, the Maryland General Assembly adopted measures to both encourage the installation of energy storage through a dedicated tax credit[45] and study methods to promote the deployment of energy storage on all parts of the electricity grid.[46] *See* S.B. 758, 2017 Gen. Assemb., Reg. Sess. (Md. 2017) (tax credit); H.B. 773, 2017 Gen. Assemb., Reg. Sess. (Md. 2017) (methods study). The Public Service Commission is also considering how energy storage may advance the goal of transforming Maryland's distribution system. *See* Maryland Public Service Commission, *In The Matter of Transforming Maryland's Electric Distribution Systems to Ensure that Electric Service is Customer-Centered, Affordable, Reliable And Environmentally Sustainable In Maryland*, PC44, Notice of Public Conference at 3 (Sept. 26, 2016).

Massachusetts

Clean energy is a powerful and growing economic engine for Massachusetts. Massachusetts has seen consistent growth across all aspects of the clean energy sector, from energy efficiency to alternative transportation, and from early stage research and development to deployed technologies. Furthermore, Massachusetts continues to be a national leader in energy efficiency. This success has shown that states can grow their economies through investing in clean energy and reducing greenhouse gas emissions.

In 2016, Massachusetts surpassed 100,000 clean energy workers for the first time. Massachusetts now employs 109,266 workers in clean energy in 6,900 establishments, with

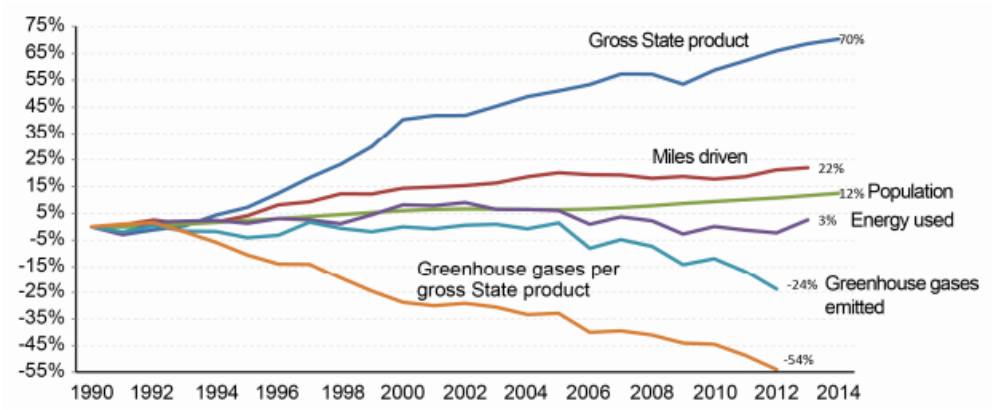
[45] Maryland's new tax credit provides for up to $5,000 for a system installed on a residential property and the lesser of $75,000 or 30% of the cost of installation of a system installed on a commercial property.

[46] HB 773 requires that the Power Plant Research Program, within the Dept. of Natural Resources, conduct a study – in collaboration with other state stakeholders – and submit a report by December 1, 2018, as to the regulatory reforms and market incentives necessary or beneficial to increase the use of energy storage devices in the state.

sector employment growing 4 percent between 2016 and 2017 and more than 80 percent between 2010 and 2017, outpacing employment growth in the Massachusetts economy as a whole.[47]

Clean energy contributes $11.4 billion to the Massachusetts economy — a 2.4-percent share of the gross state product. Almost 70 percent of the sector's full-time workers earn at least $50,000 annually. As a comparison, the median wage across all jobs in Massachusetts is roughly $45,000.

Historic MA emissions and economic indicators: cleaner air and a growing economy



Source: MassDEP (2015).

The growth of the clean energy sector and the expansion of the clean energy workforce can be attributed to the extent of projects that have been installed and conducted all over the state. This includes advanced manufacturing, legal and professional services, as well as innovation. From January through November 2017 alone, there were 10,428 solar projects installed in Massachusetts, adding 482 MW of capacity. More broadly, Massachusetts renewable and clean energy projects have added or are in the process of adding a total of approximately 26,000,000 MWh of annual electricity for Massachusetts customers (expected to be over 50 percent of Massachusetts's annual electric load) under either statutory or regulatory mandates pursuant to the Green Communities Act, St. 2008, c. 169, §§ 83, 83A, 83C, and 83D, and the Renewable Portfolio Standard, Mass. Gen. Laws ch. 25A, § 11F.[48] Massachusetts energy efficiency programs have delivered $12.5 billion in benefits since 2008 and are expected to provide another $8 billion over the next three years. And for the last seven years, Massachusetts

[47] Massachusetts Clean Energy Center, 2017 Massachusetts Clean Energy Industry Report (December 2017), *at* http://files.masscec.com/2017%20MassCEC%20CE%20Report_web%20%281%29.pdf. *See also* Massachusetts Clean Energy Center, 2016 Massachusetts Clean Energy Industry Report (December 2016), at http://files.masscec.com/2016%20MassCEC_CE_Report_Complete%20%281%29-2.pdf.

[48] These projects include onshore and offshore wind, hydropower, and solar. Some of these projects are already in operation, some are under contract and awaiting regulatory approval prior to construction, some are constructed and waiting for interconnection, and others are in the bidding stage.

has been ranked number one in the country for energy efficiency according to the American Council for an Energy Efficient Economy.[49]

Meanwhile, 1,662 MW of Massachusetts's coal generation capacity has been retired since 2008, leaving no coal-fired power plants in the state. Massachusetts is actively exploring storage technologies, and the Department of Energy Resources issued a report last fall with recommendations designed to spur investment in 600 MW of grid-scale energy storage in Massachusetts by 2025.[50]

Minnesota

Minnesota has accomplished significant reductions in greenhouse gas emissions from the electric utility sector over the past two decades through a number of strategies. In 2007, the Minnesota legislature unanimously adopted a wide-ranging state effort to address greenhouse gas emissions in Minnesota, known as the Next Generation Energy Act (NGEA) (Minn. Stat. §§ 216H.01-.13). The NGEA established state-level greenhouse gas emission reduction targets of 15% from 2005 levels by 2015, 30% from 2005 levels by 2025, and 80% from 2005 levels by 2050. The NGEA also established a biennial greenhouse gas emission reporting structure. Also in 2007, the Minnesota legislature adopted a state Renewable Energy Standard (RES) (Minn. Stat. § 216B.1691). The RES phases in from 2010 to 2025 and creates renewable energy requirements for all utilities operating in Minnesota. It will ultimately result in a weighted 27% of all retail electricity sales in Minnesota coming from renewable energy sources. According to the Minnesota Department of Commerce's 2015 Renewable Energy Update (http://mn.gov/commerce-stat/pdfs/mn-renewable-energy-update-2015-page-numbers.pdf), Minnesota now has about 3,985 megawatts (MW) of renewable energy installed, and based on Minnesota utilities' long-range resource plans, is on track to meet the statute's RES requirement by 2025.

In addition to the overall RES, in 2013, the Minnesota legislature adopted a Solar Energy Standard for the state's investor-owned utilities requiring that by the end of 2020, at least 1.5% of total retail sales are generated by solar energy (Minn. Stat. § 216B.1691, subd. 2f). According to the Minnesota Renewable Energy Tracking System, the state had 400 MW of solar power installed as of November 2017.

Minnesota has administered a demand-side management program called the Minnesota Conservation Improvement Program (CIP) since 1982. The NGEA expanded and improved the program and established a statewide energy conservation goal of 1.5% of annual retail electric and gas sales (Minn. Stat. § 216B.241). A 2013 report to the Minnesota legislature compares the cost of the CIP to the cost of electric generation by a variety of technologies

[49] *See State Energy Efficiency Scorecard*, American Council for an Energy-Efficient Economy, *at* http://aceee.org/state-policy/scorecard.

[50] Massachusetts Department of Energy Resources, *State of Charge: Massachusetts Energy Storage Initiative Study* (Sept. 16, 2016), *available at* https://www.mass.gov/files/2017-07/state-of-charge-report.pdf.

(http://archive.leg.state.mn.us/docs/2013/mandated/131112.pdf). The report demonstrates the CIP and demand-side management efforts are generally very efficient and low cost.

In 2001, the Minnesota legislature enacted an emissions reduction statute that allowed special recovery rate consideration for air pollution control projects, with the goal to reduce emissions from Minnesota's aging coal-fired utility boilers (Minn. Stat. § 216B.1692). As a result, beginning in 2007 and finishing in 2009, Xcel Energy, the state's largest electric utility, completed a project called the "Metro Emissions Reduction Project." The project repowered a 520 MW coal-fired power plant, lowering its heat rate by 5%, and retired 642 MW of coal-fired power and replaced it with 956 MW of intermediate load natural gas combined cycle generation. The repowering from coal to gas generation is not only a significant contribution to Minnesota's greenhouse gas emission reduction efforts, it also provides backup capacity to support Minnesota's wind generation.

Minnesota statute (Minn. Stat. § 216B.2422) requires that electricity generators quantify the external costs of their emissions, including of CO_2, and include these costs when making resource planning decisions. Utilities are required to consider these costs in their resource plans to determine which fuel resources should be selected to meet Minnesota's future electricity demand. In July 2017, the MPUC updated the externality cost of CO_2 emissions. The MPUC chose to use the federal government Interagency Working Group's social cost of carbon (SCC) values, with some modifications, as the best available and most appropriate values for the environmental cost of CO_2 emissions from Minnesota power plants. The MPUC's chosen range of approximately $9 to $43 per ton of CO_2 for emissions in 2020, and gradually increasing thereafter, will have real impacts on MPUC considerations regarding how future electricity is generated in Minnesota. In short, Minnesota sees the SCC as an important policy tool to value climate impacts.

Minnesota has made substantial progress towards its clean energy future. Local utilities' Integrated Resource Plans outline a continued trend towards closing coal plants and replacing that power generation with a mix of renewables backed by natural gas. The state's analyses indicate that these plans have set Minnesota on a course that will achieve the Clean Power Plan's emission reduction targets, even without that law as a backstop. Minnesota's work on clean energy shows that greenhouse gas emissions can be reduced cost-effectively while the state's economy continues to grow.

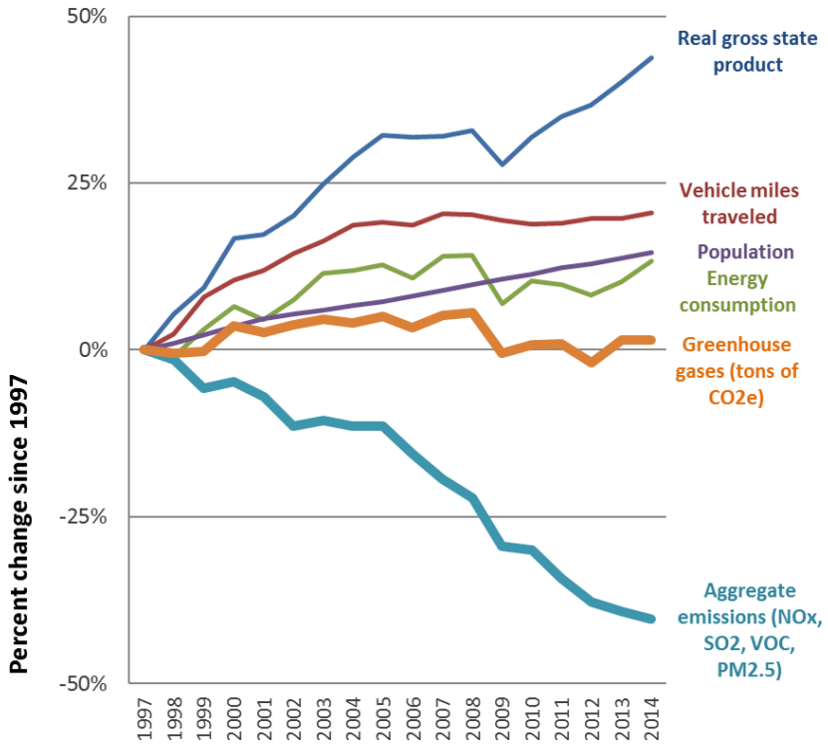
In 2008, the MPCA began to biennially track Minnesota's progress in meeting greenhouse gas emission reduction targets. The MPCA's January 2017 "Biennial Greenhouse Gas Emissions Reduction Report" (https://www.pca.state.mn.us/air/greenhouse-gas-emissions-minnesota-0) to the Minnesota legislature demonstrates that Minnesota's programs described above have resulted in significant reductions of greenhouse gas emissions from the power sector while still supporting a robust economy: Between 2005 and 2014, greenhouse gas emissions from the electric utility sector, the largest single sector source of greenhouse gas emissions in Minnesota, declined 17%.

EQB's 2016 "Climate Solutions and Economic Opportunities" report (https://www.eqb.state.mn.us/content/climate-change), which noted that, as of 2015, renewable energy accounted for 21% of the Minnesota's in-state electricity generation, up from 4% in 2000

(based on U.S. Energy Information Administration data). Wind energy alone provides over 17% of the state's electricity, while Minnesota's residential electricity rates are frequently below the national average.

For Minnesota, clean energy means family-supporting jobs and a strong economy. During this period of greenhouse gas emission reductions, the gross state product of Minnesota has increased, surpassing pre-recession (2009) levels by 2010 and continuing to grow. The following figure shows that Minnesota has successfully decoupled its economic growth from the state's greenhouse gas emissions.

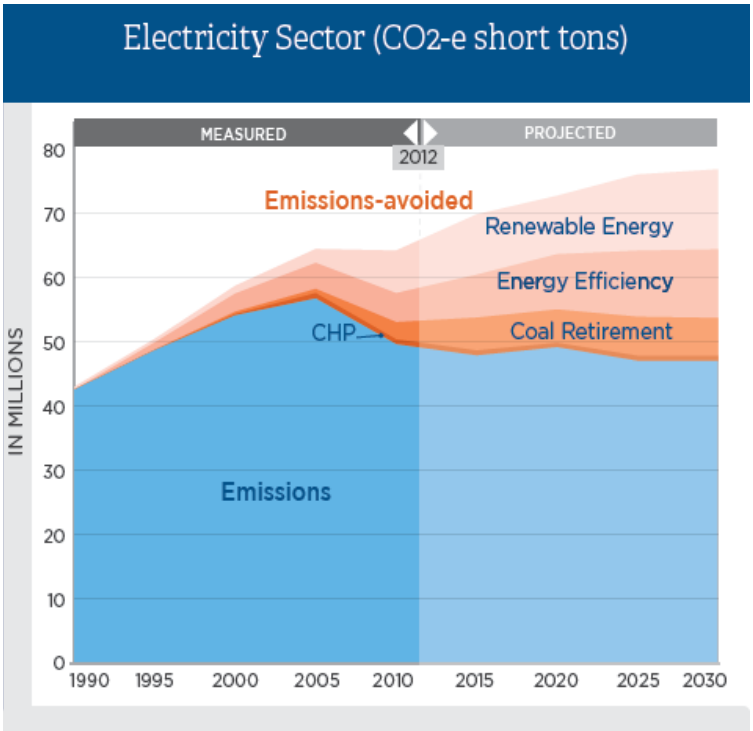
Comparison of emissions and economic indicators, 1997-2014



The Minnesota Department of Employment and Economic Development's 2014 report, "Minnesota's Clean Energy Economy Profile: How Industry Sectors are Advancing Economic Growth" (https://mn.gov/deed/data/research/clean-energy-economy/) notes that more than 15,300 Minnesotans work in the clean energy field, and these workers added more than $1 billion in direct wages to the Minnesota economy in 2013. Average annual wages in clean energy were more than $71,000 in 2013 – 42% higher than the statewide average for all jobs (about $51,000). These clean energy jobs in Minnesota grew more than 75% between 2000 and 2014, while the total Minnesota economy grew 11% during the same time period.

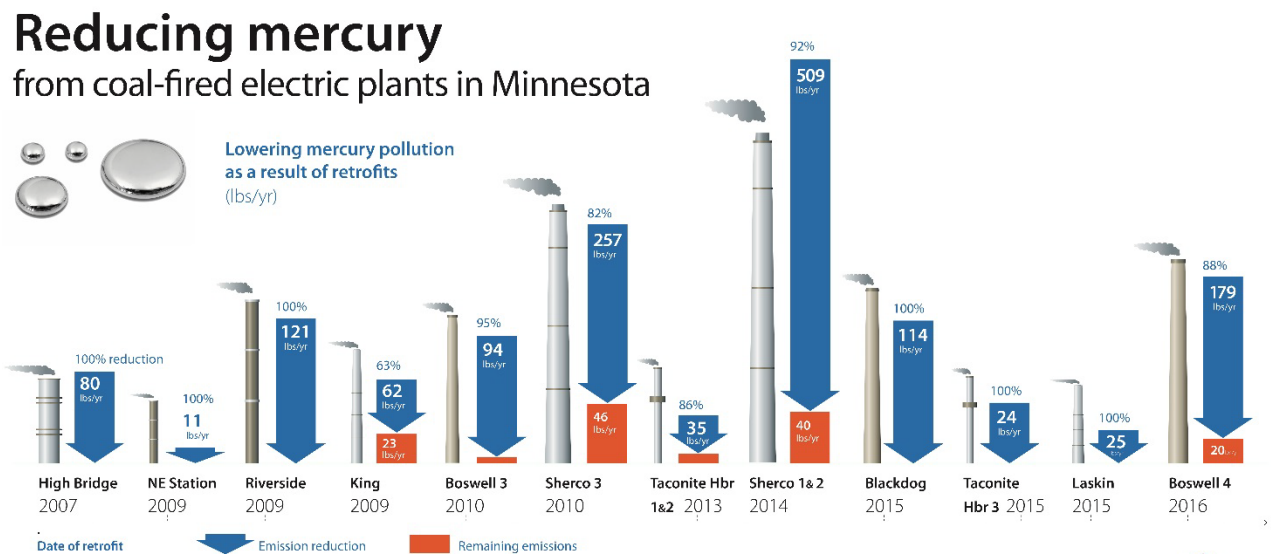
In short, Minnesota has achieved significant greenhouse gas emission reductions since 2007 while growing its economy, and has built a clean energy economy over the past decade that will support continued greenhouse gas emission reductions well into the future. These clean

energy policies continue to drive emission reductions, while bolstering Minnesota's economy. The strategies of moving toward renewable energy sources, improving energy efficiency, and reducing emissions from existing power plants have been proven to be effective both in reducing greenhouse gas emissions and in maintaining affordable electricity rates for consumers. By 2030, existing policies will drive annual reductions of about 30 million CO_2-e tons below 2005 levels. These avoided emissions result primarily from increases in renewable energy and energy efficiency. For Minnesota, clean energy means protecting the health of Minnesotans, reducing the state's contribution to global climate change, family-supporting jobs, and a strong economy.



Historic emissions (1990-2011) and projected emissions (2012-2030) are shown for the consumption of electricity in blue. These values include emissions from generation imported from other states. Estimated avoided emissions from renewable energy, energy efficiency, and coal retirement or replacement are shown in orange (Data source: MPCA, September 2013 for Climate Solutions and Economic Opportunities report)

In addition to supporting state efforts to reduce climate change-causing greenhouse gas emissions, the strategies relied upon to reduce greenhouse gas emissions have also contributed to significant reductions in "conventional" air pollutants from the same power plant sources. For example, between 2005 and 2015 emissions of nitrogen oxides (NO_X) and sulfur dioxide (SO_2) from coal-fired boilers in Minnesota decreased 76% and 80%, respectively. Power plants also saw significant reductions in air toxics. According to MPCA's 2017 "The Air We Breathe" report (https://www.pca.state.mn.us/air/air-we-breathe-2017) to the Minnesota legislature, the state has seen a 90% reduction in mercury emissions from coal-fired power plants.



Minnesota's "Life and Breath" report (https://www.pca.state.mn.us/featured/life-and-breath), a 2015 publication jointly authored by MPCA and the Minnesota Department of Health, notes that a 10% reduction in concentrations of fine particles (formed, in part, from emissions of SO_2 and NO_X) and ground-level ozone (created by chemical reactions between NO_X and volatile organic compounds) can prevent hundreds of deaths, hospitalizations, and emergency department visits due to heart and lung conditions each year.

New Mexico

As a state heavily reliant upon fossil fuels for energy generation, New Mexico's transition to a clean energy state has been slow and subject to numerous setbacks. However, New Mexico voters of both major parties support, by a large margin, expanding solar and wind generation.[51] In 2007, SB418 doubled the amount of electricity utilities had to obtain from renewable sources from 10 percent by 2011 to 20 percent by 2020.[52] Proposals are now pending which would step up renewable portfolio standards to 80 percent by 2040 and 100 percent by 2050. In 2016, New Mexico boasted 76 solar companies employing nearly 3,000 people, an

[51] Pew Research Center, *Americans Strongly Favor Expanding Solar Power to Help Address Costs and Environmental Concerns* (Oct. 5, 2016). Available at: http://www.pewresearch.org/fact-tank/2016/10/05/americans-strongly-favor-expanding-solar-power-to-help-address-costs-and-environmental-concerns/ (last visited Oct. 18, 2018).

[52] Institute for Local Self-Reliance, *Renewable Portfolio Standards – New Mexico* (Jan. 20, 2009). Available at: https://ilsr.org/rule/renewable-portfolio-standards/2569-2/ (last visited Oct. 18, 2018).

increase of 54 percent in the that year alone,[53] though growth in the sector slowed in 2017.[54] More than 1,300 MW of wind power projects are currently planned or under construction, including a 522 MW facility negotiated between the New Mexico Attorney General, Xcel Energy, the Coalition for Clean Affordable Energy, and Western Resource Advocates that will bring at least $57 million in spending to the state.[55] In referring to the project, David Hudson, president of Xcel Energy, stated that "[t]he decision to add additional wind generation is purely in the economic interest of our customers."[56] Once online, these new facilities will increase New Mexico's current wind generation output by more than 128 percent.[57] With the support of Senator Martin Heinrich, the Albuquerque City Council has unanimously approved a proposal to install $25 million worth of solar projects on City buildings with a goal of generating at least 25 percent of the City's energy use via solar by 2025, all at no cost to taxpayers.[58] The coal-fired San Juan Generating Station, located in the northwest corner of the state, shut down two of its four units at the end of 2017, and Public Service Company of New Mexico plans to shut down the remaining two units by 2022 regardless of whether EPA repeals the Clean Power Plan.[59]

New York

New York has demonstrated that it is possible to fight climate change and hold the line on electric bills, create jobs, and strengthen the economy. New York is part of RGGI, which has helped substantially reduce regional carbon dioxide emissions from the electricity sector. New York's participation in RGGI has helped enable it to cut greenhouse gas emissions from power plants by more than 40 percent from 2008 levels when the program began. New York and other

---

[53] The Solar Foundation, *National Solar Jobs Census 2016*, at 50 (March 2017), *available at* http://www.thesolarfoundation.org/wp-content/uploads/2017/02/SOLARJOBSCENSUS2016.pdf (last visited Oct. 18, 2018).

[54] The Solar Foundation, *National Solar Jobs Census 2017*, at 20, 53 (January 2018), *available at* https://www.thesolarfoundation.org/solar-jobs-census/ (last visited Oct. 18, 2018).

[55] Kevin Robinson-Avila, *Xcel Wind Farm Agreement Includes Local Spending Pledge* ALBUQUERQUE JOURNAL, Dec. 14, 2017, https://www.abqjournal.com/1106879/xcel-wind-farm-agreement-includes-local-spending-pledge.html.

[56] Press Release, Xcel Energy, New Xcel Energy wind facilities offer $2.8 billion in customer savings over 30 years (March 21, 2017), https://www.xcelenergy.com/company/media_room/news_releases/new_xcel_energy_wind_facilities_offer_$2.8_billion_in_customer_savings_over_30_years (last visited Oct. 18, 2018).

[57] Kevin Robinson-Avila, *Gust of Wind-Generated Energy Sweeping Toward New Mexico* ALBUQUERQUE JOURNAL, Dec. 27, 2016, https://www.abqjournal.com/915514/gust-of-windgenerated-energy-sweeping-toward-nm.html.

[58] Press Release, City of Albuquerque, City Announces $25M Solar Project to Increase Solar and Grow Local Jobs (June 25, 2018), https://www.cabq.gov/council/find-your-councilor/district-6/news/city-announces-25m-solar-project-to-increase-solar-and-grow-local-jobs (last visited Oct. 18, 2018).

[59] Megan Petersen, *Clean Power Plan Repeal Won't Affect San Juan Generating Station Retirement Plans*, THE FARMINGTON DAILY TIMES, Oct. 11, 2017, http://www.daily-times.com/story/news/2017/10/11/clean-power-plan-repeal-wont-affect-san-juan-generating-station-retirement-plans/752156001/

RGGI states have recently pledged to further cut carbon pollution from the power sector, by an additional 30 percent by 2030, for a total reduction of about 65 percent compared to 2008 levels.[60]

By investing the proceeds from auctioned carbon pollution allowances under the RGGI program in energy efficiency and renewable energy programs, New York has reduced the demand for electricity, preventing consumer electricity prices from increasing. Since its inception, New York's RGGI proceeds have been translated into energy bill savings of over $1 billion to over 130,000 households and 2,500 businesses.[61]

The New York Public Service Commission has adopted a Clean Energy Standard (2016) to require that 50% of New York's electricity be generated by renewable sources by 2030 as part of a strategy to reduce statewide greenhouse gas emissions by 40% by 2030.[62] To meet its clean energy goals, New York has developed roadmaps for the deployment of 1,500 megawatts of energy storage by 2025,[63] and for 2,400 megawatts of offshore wind by 2030.[64] As a result of New York's investment of RGGI proceeds and its clean energy policies, New York has grown its clean energy sector, which now employs about 151,000 workers, two-thirds of which are in the energy efficiency sector.[65] The growth in clean energy jobs in New York was 3.9 percent in 2017.

Cleantech businesses and investments in clean energy technologies are particularly important to New York City's economy. With over one million buildings, more than eight million residents, $15 billion in annual energy spending, and forward-thinking sustainability policies, New York City has a growing demand for clean energy, energy efficiency

---

[60] RGGI Inc., *RGGI States Announce Proposed Program Changes: Additional 30% Emissions Cap Decline by 2030* (Aug. 23, 2017). Available at: https://www.rggi.org/sites/default/files/Uploads/Press-Releases/2017_08_23_Announcement_Proposed_Program_Changes.pdf

[61] See http://www.dec.ny.gov/energy/rggi.html; *see also* The Analysis Group, *The Economic Impacts of the Regional Greenhouse Gas Initiative on Ten Northeast and Mid-Atlantic States* (Nov. 15, 2011), available at: http://www.dec.ny.gov/docs/administration_pdf/ag11rggi.pdf; The Analysis Group, *The Economic Impacts of the Regional Greenhouse Gas Initiative on Nine Northeast and Mid-Atlantic States* (July 15, 2015), available at: http://www.dec.ny.gov/docs/administration_pdf/ag15rggi.pdf

[62] *See* Clean Energy Standard Order available at: https://www.nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Standard

[63] *See* The New York State Energy Storage Roadmap available at: https://www.nyserda.ny.gov/All-Programs/Programs/Energy-Storage/Achieving-NY-Energy-Goals/The-New-York-State-Energy-Storage-Roadmap

[64] *See* NYS Offshore Wind Master Plan available at: https://www.nyserda.ny.gov/All-Programs/Programs/Offshore-Wind

[65] New York State Energy Research and Development Authority, *2018 New York Clean Energy Jobs Report* (October, 2018), available at: https://www.nyserda.ny.gov/About/Publications/New-York-Clean-Energy-Industry-Report

improvements, and other cleantech products and services.[66] The clean energy economy generates large numbers of skilled, high-wage jobs for New York City residents, employing approximately 61,900 in 2015, or 1.5 percent of the total workforce. Clean economy jobs generate a total payroll of $6.3 billion, constituting 1.8 percent of the total city payroll. This indicates that clean economy wages, which average about $99,500, are higher than the average city jobs. Clean economy employment also directly supports approximately 72,300 jobs in supply chain companies located in the city. These supply chain jobs generate about $10.6 billion in additional payrolls in New York City.[67] The City has also made, and is courting, investments in the clean energy sector that will cumulatively add hundreds of millions of dollars to the local economy and thousands of new jobs in the City,[68] which will advance the City's role as a national leader in green energy innovation and will strengthen and grow the City's economy.

North Carolina

In 2007, North Carolina became the first state in the Southeast to adopt a Renewable Energy and Energy Efficiency Portfolio Standard (REPS). Under the REPS program, North Carolina's investor-owned utilities are required to meet up to 12.5% of their retail electricity sales through renewable energy resources or energy efficiency measures by 2021.[69] The state has also incentivized growth of the renewable energy sector through the state's Utility Savings Initiative,[70] property tax abatements for solar energy electric systems,[71] and most recently, the passage of the Competitive Energy Solutions for NC Act.[72]

North Carolina's programs have spurred remarkable growth in the state's clean energy industry. North Carolina is now home to over 34,000 clean energy jobs[73] and is ranked second

---

[66] Green NYC 2025: Opportunities in Cleantech's Digital Evolution, New York City Economic Development Corporation (NYCEDC) 2015, available at http://www.nycedc.com/sites/default/files/filemanager/Resources/green/Green_NYC_2025_Final_Report.pdf.

[67] This paragraph includes NYCEDC analysis using data from the Quarterly Census of Employment and Wages, Bureau of Labor Statistics (2015), and based on Brookings Institution, "Sizing the Clean Economy," 2011.

[68] *See, e.g.*, "NYC Solar Summit 2013," Sustainable CUNY, June 2013; *see also* Green NYC 2025.

[69] N.C. Gen. Stat. § 62-133.8 (2017)

[70] N.C. Department of Environmental Quality, Utility Savings Initiative, https://deq.nc.gov/conservation/energy-efficiency-resources/utility-savings-initiative (last visited Jan. 4, 2018)

[71] N.C. Gen. Stat. § 105-275(45) (2017)

[72] N.C. Session Law 2017-192 (July 27, 2017)

[73] U.S. Climate Alliance, 2017 Annual Report, https://static1.squarespace.com/static/5936b0bde4fcb5371d7ebe4c/t/59bc4959bebafb2c44067922/1505511771219/USCA_Climate_Report-V2A-Online-RGB.PDF; Research Triangle Institute International, Economic Impact Analysis of Clean Energy Development in North Carolina – 2017 Update (Oct. 2017), available at https://energync.org/wp-content/uploads/2017/10/NCSEA_2017_RTI_Oct.pdf.

nationally in installed solar capacity.[74] Most recently, a 208-megawatt wind farm came online last year in North Carolina, making the state home to the largest wind farm in the Southeast.[75] With an untapped potential for offshore wind energy generation exceeding 20 GW, North Carolina is only beginning to realize the potential of its clean energy resources. [76]

The growth of the clean energy economy in North Carolina has contributed to significant reductions in CO_2 emissions. According to a recent report, between 2000 and 2014 North Carolina reduced its CO_2 emissions by 14.6% while growing its GDP by 26.3%.[77] In 2016, it is estimated that more than 3 million tons of CO2 emissions were avoided due to REPS.[78]

Between 2007 and 2016, approximately $10,024.5 million was invested in clean energy development in the state.[79] North Carolinians are benefiting from these clean energy investments in the form of lower electric bills, healthier communities, expanded local tax bases, and increased job opportunities across the state.

Oregon

Energy efficiency efforts: Since the 1980 passage of the Northwest Power and Conservation Act, Oregon has had some of the nation's most aggressive energy efficiency efforts. For the twelfth year in a row, Oregon ranks in the top 10 of the most energy efficient states in the country, according to the American Council for an Energy-Efficient Economy.[80] This is based on utility and public benefit programs and policies; transportation policies; building energy codes; combined heat and power policies; state government-led initiatives around energy efficiency; and appliance and equipment standards. Oregon was ranked number 5 in 2017 and number 7 in 2016.

---

[74] Solar Energy Industries Association, Solar Industry Data, https://www.seia.org/solar-industry-data (last visited Jan. 4, 2018).

[75] U.S. Energy Information Administration, State Profiles and Energy Estimates: North Carolina (Aug. 17, 2017), https://www.eia.gov/state/?sid=NC

[76] University of North Carolina, Coastal Wind Energy for North Carolina's Future: A Study of the Feasibility of Wind Turbines in the Pamlico and Albemarle Sounds and in Ocean Waters Off the North Carolina Coast 359 (June 2009), https://threezeros.unc.edu/files/2015/12/Coastal-Wind-Energy-for-NC2019s-Future.pdf.

[77] Devashree Saha & Mark Muro, Brookings Institute, Growth, Carbon, and Trump: State Progress and Drift on Economic Growth and Emissions Decoupling (Dec. 8, 2016), https://www.brookings.edu/research/growth-carbon-and-trump-state-progress-and-drift-on-economic-growth-and-emissions-decoupling/#fullreport.

[78] North Carolina Utilities Commission, Annual Report Regarding Renewable Energy and Energy Efficiency Portfolio Standard (Oct. 1, 2017), http://www.ncuc.commerce.state.nc.us/reports/repsreport2017.pdf

[79] Research Triangle Institute International, Economic Impact Analysis of Clean Energy Development in North Carolina – 2017 Update, supra note 5.

[80] https://database.aceee.org/state/oregon

Programs to promote renewable energy resources: Beginning in 1977 with the creation of the Residential Energy Tax Credit program, the Oregon Legislature has passed a number of bills promoting renewable energy resources, including a public purpose charge, net metering, the Renewable Portfolio Standard (RPS), wave energy development, zoning measures, and requirements for public buildings. This legislative momentum, coupled with a number of economic factors, has made Oregon one of the leading states for renewable energy development.

Oregon's RPS requires Oregon's electric utilities to meet a certain percentage of their retail electricity sales with eligible renewable energy each year. The original RPS required the largest investor-owned utilities (IOUs)in the state to provide 25 percent of retail sales from eligible renewable sources by 2025, with interim goals along the way. The state's many smaller consumer-owned utilities (COUs) were given lower targets, depending on the percent share of the state's total retail electricity load supplied by the COU.

- Oregon's RPS target was increased in 2016 by SB 1547 from 25 percent by 2025 to 50 percent by 2040. This 50 percent target applies only to the large utilities that provide three percent or more of total state retail electricity sales. COUs are required to reach 25% by 2025 but are not subject to the 50% target.[81]

- Oregon's two largest IOUs – PacifiCorp and PGE – have had compliance portfolios that included wind, solar, geothermal, biogas, and biomass resources.

Separate from the RPS, Oregon has a number of additional pathways for the generation and consumption of renewable energy that have increased supply in the state:

- Oregon's largest electric investor-owned utilities (IOUs) – Portland General Electric (PGE) and PacifiCorp – have two of the most successful voluntary green power programs in the country, as tracked and ranked annually by the National Renewable Energy Laboratory.[82] In Oregon in 2016, over 200,000 voluntary green power program participants were responsible for purchasing over 2 million MWhs of green power.[83]

- Large customers can participate in existing utility green power programs or, as large customers like Facebook are doing, they can negotiate new approaches that lead directly to new renewable energy project development. Facebook recently worked with PacifiCorp on the development of over 100 MW of solar located in Oregon.

- Through Direct Access, commercial and industrial entities who are customers of the state's largest IOUs may choose a retail provider of electricity other than their incumbent

[81] Oregon Laws 2016, Chapter 28.

[82] NREL (National Renewable Energy Laboratory). Top Ten Utility Green Pricing Programs. Golden, CO: National Renewable Energy Laboratory. Accessed 7/17/2018. https://www.nrel.gov/analysis/assets/pdfs/utility-green-power-ranking.pdf

[83] O'Shaughnessy, Eric J., Christina M. Volpi, Jenny S. Heeter, and Jeffrey J. Cook. Status and Trends in the US Voluntary Green Power Market (2016 Data). No. NREL/TP-6A20-70174. National Renewable Energy Lab. (NREL), Golden, CO (United States), 2017.

utility. This allows firms to seek out a new electricity supplier that can address their needs related to price, generation source, or reliability. As of June 2017, over 5 percent of PacifiCorp's commercial load and over 17 percent of PGE's commercial load was delivered to Direct Access participants.

Phase-out of Coal Generation: About 26 percent of Oregon's electricity resource mix comes from coal generation located outside of the state.[84]. Some of the provisions of Oregon's Clean Electricity and Coal Transition Act prohibit the state's largest investor-owned utilities from including electricity generated by coal in their rates by 2035.[85] This divestment from out-of-state coal complements the state's efforts to address in-state air pollutant emissions from Oregon's last remaining coal power plant in Boardman, Oregon, which itself provided about 6 percent of Oregonians' electricity in 2014 to 2016.

Oregon reached an agreement in 2009 to close the Boardman coal plant early in 2020 (20 years ahead of its original planned retirement) in response to strong local and state interest in reducing greenhouse gas emissions and other pollutants associated with coal plants, and to satisfy federal requirements for air quality and pollution controls to reduce haze emissions. Because of the early closing of the Boardman coal plant, between 3 and 4.5 million metric tons of carbon dioxide equivalent (CO2e) per year will be avoided. Oregon Department of Environmental Quality (DEQ) concluded that required pollution controls, when combined with the permanent closure of the plant no later than 2020, provide a significant environmental and public health benefit for Oregon:[86]

- Reduce haze forming emissions by 48 percent in the 2011 to 2019 timeframe and eliminate these pollutants completely after closure.
- Significantly improve visibility in 14 Class I wilderness areas in Oregon and Washington.
- Significantly improve visibility in the Columbia River Gorge National Scenic Area and reduce acid deposition, lessening the risk to Native American natural and cultural resources.
- Permanently eliminate approximately 4,000,000 tons per year of greenhouse gases and all of the plant's mercury emissions, which currently range from 137 to 281 pounds per year.

Other efforts to reduce GHG emissions: About 16.5 percent of Oregon's electricity mix is fueled by natural gas from sources both in- and out-of-state.[87] In 1997, the Oregon Legislature enacted a first-of-its-kind standard for CO2 emissions from baseload electric generating plants fueled by natural gas seeking site certificates/amendments from the Oregon Energy Facility Siting Council (EFSC). ORS 469.503(2). The legislation authorized EFSC to adopt CO2 emissions standards for other fossil-fueled power plants, and since 1997 they have

[84] Oregon Department of Energy (ODOE), "Electricity Mix in Oregon," 2018.

[85] Chapter 28, Oregon Laws 2016.

[86] https://www.oregon.gov/deq/Programs/Pages/PGE-Boardman.aspx

[87] ODOE, "Electricity Mix in Oregon," 2018.

adopted and updated standards for CO2 from baseload gas plants, non-baseload power plants, and non-generating energy facilities that emit CO2. Any CO2 emissions in excess of the standard must be offset, which to date has been achieved through applicants paying a third-party non-profit organization, The Climate Trust, to develop carbon offset projects or purchase carbon offset credits. This provides financial encouragement for applicants to choose more efficient technologies or configurations. The Climate Trust has indicated that total monetary payments to date have achieved close to 3 million metric tons of CO2-equivalent (mtCO2e) reductions, with another 1 million anticipated from future offset credit acquisitions.

Over the span of a decade, Oregon reduced the GHG emissions intensity of the energy used in its economy while the state population and GDP grew. In 2016, Oregon's real chained GDP was 23.5% higher than in 2006[88], while total statewide greenhouse gas emissions were ~9% lower.[89] Additionally, Oregon's carbon intensity in GHG emissions per GDP declined by roughly 26% during the same time period.[90] Regarding employment benefits, the National Association of State Energy Officials and the Energy Futures Initiative estimate that in 2018 there were 51,033 jobs in energy efficiency and renewable energy in Oregon. Other Oregon-specific quantitative analyses have not yet been conducted.

Integration of renewables into the grid: To best integrate new variable renewable energy resource into the electric grid, Oregon and its utilities have taken advantage of the ability of existing resources in the region that can quickly modify their output to better accommodate renewables—namely the region's robust hydroelectric system, and some fast responding natural gas plants. In addition, Oregon utilities are also increasingly piloting and deploying innovative new technologies (including smart grid, energy storage, and demand response) to better integrate renewables:

- Energy storage:
    - PGE was among the first utilities in the nation to deploy a utility-scale battery storage system on its electric grid with the deployment of the 5 MW (1.25 MWh) Salem Smart Power Center in 2013. The project, still in operation, was deployed as a demonstration project to evaluate the ability of battery storage to integrate renewables and provide additional grid services.
    - In addition, in 2015 the Oregon Legislature established an energy storage mandate through HB 2193, requiring PGE and PacifiCorp to procure a minimum of 5 MWh (and not to exceed battery capacity equal to 1% of the utility's peak load from 2014) of energy storage by 2020. Oregon became the second state in the nation, after California, to adopt such an energy storage mandate.
    - In August 2018, the PUC approved PGE's proposal to develop up to 39 MW of energy storage. Meanwhile, in September 2018, the PUC approved PacifiCorp's

[88] U.S. Bureau of Economic Analysis (BEA) 2018, "Regional Data: Annual Gross Domestic Product By State"

[89] Oregon Department of Environmental Quality (DEQ), "Oregon Greenhouse Gas Sector-Based Inventory Data (2018).

[90] Analysis based on data from U.S. BEA 2018 and DEQ 2018.

proposal to develop two separate energy storage projects: (1) a 2 MW / 6 MWh battery system located at a single customer site to evaluate energy storage alongside a blend of renewable and conventional generation; and (2) provide financial and technical assistance for the development of up to four energy storage projects intended to enhance community resiliency.

- Demand response:
  - Oregon utilities have operated a number of demand response programs focused on commercial and industrial customers in recent years, but are increasingly evaluating and piloting new technologies to allow for more dynamic distributed demand response solutions that can help to integrate large amounts of renewable energy.
  - PGE has been actively developing a proposal, in response to guidance given in Oregon PUC Order 17-386, to develop a demand response test bed. The test bed, as envisioned, would result in PGE deploying demand response assets at-scale downstream of three different substations across its service territory.
- Smart grid:
  - Oregon utilities submit Smart Grid reports to the PUC every two years, and each report must touch upon:
    - Smart grid strategy, goals, and objectives;
    - Status of investments in smart grid categories; and
    - Plans for investments and applications in next 5 years.
  - Many utilities across the region (including PGE, PacifiCorp, and BPA, among others) were participants in the Pacific Northwest Smart Grid Demonstration Project, a five-year, $178 million project co-funded by the U.S. Department of Energy through the American Recovery and Reinvestment Act of 2009.[91] The project concluded in 2015 and resulted in the deployment of dozens of innovative grid modernization and smart grid pilot projects, many of which incorporated demand response and load control functions.

Pennsylvania

Pennsylvania's energy efficiency law, 66 Pa.C.S.A. § 2806.2 *et seq.*, which requires the state's major electric distributing companies to meet savings targets established by the Public Utilities Commission, conserved 1,337,127 MWh/year total (equivalent to the energy it takes to power 99,229 homes for a full year) and is estimated to save Pennsylvanian ratepayers over $95 million on their electricity bills annually.[92]

[91] Pacific Northwest Smart Grid Demonstration Project. Technology Performance Report: Highlights. June 2015. https://www.pnwsmartgrid.org/docs/PNW_SGDP_AnnualReport.pdf (Accessed September 18, 2018)

[92] *See* "The Benefits of Pennsylvania's Act 129 Energy Efficiency Programs and the Potential Losses of Allowing Users to Opt Out," available at https://alliance4industrialefficiency.org/wp-content/uploads/2017/06/PA-Act-129-Report_AIE_FINAL_6.26.2017.pdf

The state's renewable energy portfolio standard, 73 P.S. §§ 1648.1- 1648.8, which requires that 18% of electric power come from clean energy sources like wind and solar by 2021, has helped to grow the clean energy industry, while providing clean energy options to Pennsylvania businesses and homeowners. More than 1,300 megawatts of wind power at over 25 wind farms and nearly 240 MW of solar – which combined is enough energy to power the equivalent of 330,000 homes – has been installed to date and has brought over $2.8 billion in capital investment into the state.[93]

"Finding Pennsylvania's Solar Future" is a 2017-2019 statewide planning project being led by the Pennsylvania Department of Environmental Protection Office of Pollution Prevention and Energy Assistance (OPPEA) to equip Pennsylvania to produce more solar energy by 2030. OPPEA has identified an initial objective of increasing to 10% the amount of in-state electricity sales that come from in-state solar energy generation.

The energy efficiency sector is the largest part of Pennsylvania's clean energy industry. 37,468 workers (65.4% of the industry total) are employed in improving the efficiency of commercial and residential facilities, developing better energy storage options, and building "smart grid" innovations in the state.[94]

Pennsylvania's renewable energy companies provide support for 13,345 workers (23.3% of the industry total). Of the 13,345 total, the largest group (5,231) works in bioenergy) which includes woody and non-woody biomass, notably wood and pellet stoves), followed by solar power (3,897), combined heat and power (1,281), and wind energy (1,207). The remaining 1,729 renewable energy workers are spread among a variety of other renewable sources and activities. Pennsylvania's clean energy industry also includes 6,517 workers (11.4% of the industry total) who work at employers focused on greenhouse gas emission accounting and management (including sequestration), alternative transportation, and other activities. A total of 19,862 Pennsylvania workers are employed in these combined sectors.[95]

Pennsylvania's clean energy industry has a diverse workforce, with tradespeople and professionals in all parts of the industry's supply chain. 22,805 workers (39.8%) are engaged in construction, while there are 19,875 workers offering professional services and research and development. Pennsylvania also supports 5,996 manufacturing and assembly workers.[96]

Rhode Island

Clean energy employment in Rhode Island in 2016 increased by 40 percent over 2015 levels and now accounts for nearly 14,000 jobs across the State. These workers and their

---

[93] *See* "Clean Jobs in Pennsylvania," available at http://cleanenergyworksforus.org/wp-content/uploads/2014/11/CleanJobsPennsylvania.pdf

[94] *Id.*

[95] *Id.*

[96] *Id.*

employers are engaged in a diverse and dynamic range of activities and technologies that include energy efficiency, renewable generation, renewable heating and cooling, and alternative transportation. This remarkable growth suggests that clean energy technologies are catalysts for new job creation, but also are transforming and providing new streams of revenue for traditional industry sectors, such as the building trades.

The State's largest clean energy segment is energy efficiency, which added 2,900 new jobs to the Rhode Island economy during 2016. With some of the nation's most robust and innovative energy efficiency policies and programs, Rhode Island is demonstrating that the benefits of these policies and programs go beyond reductions in energy consumption and costs, and include significant economic development and job growth opportunities.

Moreover, renewable energy jobs grew by 84 percent over 2015 employment levels. These employment gains were partially driven by the State's first-in-the-nation offshore wind farm, as well as an expansion of the solar industry in Rhode Island. Proposed legislation designed to expand renewable energy opportunities throughout the state's economy, such as those included in the Governor's FY17 State Budget proposal to the General Assembly, will support further clean energy employment growth in the coming years.[97]

Vermont

In 2005, the Vermont Legislature established a state goal to reduce greenhouse gas emissions from a 1990 baseline by 25% by 2012, 50% by 2028, and, if practicable using reasonable efforts, 75% by 2050. 10 V.S.A. § 578(a). In 2015, the Vermont Legislature established a Renewable Energy Standard, which requires, *inter alia*, that 55% of each retail electricity provider's annual electric sales come from renewable energy in 2017, increasing by 4% each third year, to 75% in 2032. 30 V.S.A. § 8004-8005.

Vermont depends on power from Canada and the ISO New England grid to meet the majority of its demand for electricity. A substantial portion of this is hydropower supplied by Hydro-Quebec. Vermont's in-state electricity generation comes almost entirely from renewable sources, the largest source of which is hydroelectric power. https://www.eia.gov/state/?sid=VT.

Clean energy jobs in Vermont have increased by more than 25% since 2013, from 14,788 to 18,759 as of April 2018. Clean energy jobs represent 6% of total statewide jobs. There has recently been a slight dip in clean energy jobs from a high of 19,081 as of April 2017. This is believed to be mainly attributable to policy changes regarding solar net metering rates. The median hourly wage for clean energy jobs exceeds the overall state median wage. https://publicservice.vermont.gov/sites/dps/files/documents/Renewable_Energy/CEDF/Reports/VCEIR%202018%20Report%20Final.pdf

Clean energy jobs include jobs related to energy-efficiency; renewable energy generation, including solar, wind, geothermal, bioenergy and low-impact hydroelectric; and motor vehicles, including hybrid, electric and renewable fuel technologies. *Id.*

---

[97] 2016 Rhode Island Clean Energy Jobs Report, Rhode Island Office of Energy Resources (OER) and the Executive Office of Commerce

Vermont has long been a leader in promoting energy efficiency. In 1999 it became the first state to create a statewide energy efficiency utility. Although the number of establishments working in the energy efficiency sector has also declined somewhat in 2018, it is still significantly higher than the number of businesses performing energy efficiency work in 2015. A shift is also being seen in this realm as larger clean energy employers move into Vermont to compete with smaller scale operations. *Id.*

Virginia

Virginia's economy is moving to renewable generation including solar, and doing so with minimal state incentives, such as relief from property taxes for solar equipment. In 2018, the General Assembly enacted legislation providing that 5000 MW of solar is in the public interest.[98] The legislation also provides for a $1.1 billion investment in energy efficiency programs by investor-owned utilities and cost recovery structures for projects that modernize the grid and support the integration of distributed energy resources.[99] The 2018 Virginia Energy Plan recognizes the clean energy transformation already occurring in Virginia and contains a suite of recommendations to further that growth.[100] For instance, the Plan recommends that Virginia's investor-owned utilities should issue annual Request for Proposals for the development of at least 500 megawatts of solar and wind generation each year in the Commonwealth.[101] Dominion Energy has already announced one such RFP.[102]

While Virginia does not offer state incentives such as tax credits, it still has seen significant increases in the deployment of solar power. Virginia's solar growth has increased from 17MW installed in 2014, to 188MW in 2016, to more than 320 MW installed and a total of 750 MW of solar resources permitted as of August 2018.[103] This ramp up in solar development has corresponded to an increase in clean energy jobs, which recently numbered an estimated 33,057.[104]

At least in part, as a result of these immediate environmental impacts, and associated economic impacts, the state's major investor-owned electric utility, Dominion Virginia Power, filed an amicus brief in support of EPA in the Clean Power Plan litigation, *West Virginia v. EPA*.[105] Dominion is one of numerous corporate amici on behalf of EPA. Dominion argued that

---

[98] Va. Acts ch. 296 (2018) (amending Va. Code 56-585.1(A)(6)).

[99] *Id*.

[100] 2018 Virginia Energy Plan, available at: https://www.governor.virginia.gov/media/governorvirginiagov/secretary-of-commerce-and-trade/2018-Virginia-Energy-Plan.pdf

[101] *Id*. at 12.

[102] "Solar and Onshore Wind Generation Proposals," Dominion Energy website, available at https://www.dominionenergy.com/2018solarwindrfp

[103] 2018 Virginia Energy Plan, at 14.

[104] 2016 Update to the Virginia Energy Plan, at 3, available at: http://governor.virginia.gov/media/7935/energy-in-the-new-virginia-economy-update-to-the-2014-energy-plan.pdf

[105] USCA Case #15-1363 Document #1606778

the Clean Power Plan is compatible with existing industry trends toward renewable and natural gas generation. "These trends, which are resulting in the increased use of natural gas-fired and non-hydroelectric renewable electricity generation in the power sector, have been underway for some time and are ongoing."[106]

Virginia's utilities are working cooperatively with renewable energy companies to advance bipartisan legislation to effectuate and advance even greater strides in renewable energy development. These legislative initiatives include community solar as well as additional ways to expedite the state's permitting program, and agricultural net metering incentives. Virginia's legislature, corporate leaders, administration, and economy have all turned the page to renewable generation and a low carbon future.

Washington

In 2006, Washington voters passed Initiative 937 (I-937, now codified at RCW 19.285), requiring the state's 18 largest electric utilities[107] to increase the amount of eligible new renewables in their energy mix to 15% by 2020 and requiring those same utilities to secure all possible cost-effective energy efficiency to save money for their customers.[108]

Progress reports indicate that state utilities are easily meeting I-937's efficiency requirements. Indeed, in each of the first three 2-year performance periods, energy efficiency targets were exceeded by an average of 41%.[109] Utilities are also meeting I-937's renewable energy requirements. By investing in wind, hydropower efficiency upgrades, biomass, landfill gas, and solar they easily met the 2012 renewables benchmark, and exceeded the 2016 benchmark as well.[110] Many have already acquired sufficient renewables to meet the 2020 15% standard.[111] These clean energy benefits are a bargain, adding on average only $1 per month to Washington investor-owned utility customers' bills.[112]

The renewable energy required by I-937 is in addition to the renewable energy already being generated in Washington when I-937 was passed - mostly from hydropower. The US Energy Information Administration reports that now, Washington leads the nation in electricity

---

[106] Amicus brief at 5

[107] Energy Independence Act 2017 Report Summary and Detail; available at http://www.commerce.wa.gov/growing-the-economy/energy/energy-independence-act/eia-reporting/; last accessed November 10, 2017; see also RCW 19.285.

[108] I-937 is working, NW Energy Coalition and Renewable Northwest, February 2015. Energy Independence Act 2017 Report Summary and Detail; available at http://www.commerce.wa.gov/growing-the-economy/energy/energy-independence-act/eia-reporting/; last accessed November 10, 2017 ("I-937 is working"); see also RCW 19.285.

[109] 2017 Biennial Energy Report and State Energy Strategy Update, Dept of Commerce, 2016; see also RCW 19.285.

[110] I-937 is working, see also RCW 19.285.

[111] *Id.*

[112] *Id.*

generation from renewable resources,[113] with hydroelectric power typically accounting for between two-thirds and four-fifths of Washington's electricity generation.[114] In addition, Washington is among the top 10 states in the nation in electricity generation from renewable resources other than hydropower.[115] More than 3,000 megawatts of installed capacity make wind energy the second largest contributor to the state's renewable generation.[116] Washington is also a substantial producer of electricity from wood and wood waste.[117] When the production of these other types of energy is included, renewable resources account for more than nine-tenths of Washington's total overall energy production.[118]

In addition, in 2015, including hydropower, more than 65% of the electricity consumed in Washington came from renewables.[119] Washington's one coal powered power plant is scheduled to phase out coal, with one turbine to be retired in 2020 and the other in 2025.[120] Analysts have concluded that the generation lost from retiring coal plants can be replaced with existing and limited new generating resources and energy efficiency. [121]

Energy efficiency is the Northwest's second largest resource after hydropower.[122] Since 1980, the region has saved 6,000 average megawatts (more than 52 billion kilowatt hours) through energy efficiency - enough power for five cities the size of Seattle.[123] In addition, efficiency is about four times less expensive than other generation, saving ratepayers $4.06 billion in 2015.[124] The Northwest Power and Conservation Council has determined that efficiency and demand response can meet nearly all energy and capacity needs in Washington (and the Pacific Northwest) for the next 20 years.[125]

Reports show that new renewable energy resource development in Washington has led to more than $8 billion in investment in the state, generating more than $145 million in tax

---

[113] EIA US Energy Information Administration, Washington State Energy Profile, last updated November 17, 2016.

[114] *Id.*

[115] *Id.*

[116] *Id.*

[117] *Id.*

[118] *Id.*

[119] Pacific Coast Collaborative at COP23 Bonn.

[120] EIA US Energy Information Administration, Washington State Energy Profile, last updated November 17, 2016. See also RCW 80.80.040.

[121] Northwest Power and Conservation Council, 2017 Overview

[122] *Id.*

[123] *Id.*

[124] *Id.*

[125] *Id.*

revenue.[126] The wind and solar industries support more than 4,500 jobs and nearly 150 businesses throughout Washington.[127] In an average year, (based on 2008-2012 data), nearly $500 million is spent on energy efficiency in Washington, creating more than 4,660 direct and indirect jobs a year, and bringing more than $300 million a year in net income to Washington workers.[128]

Studies indicate that the western grid can handle high renewables in both normal and challenging conditions.[129] The Western Wind and Solar Integration Study determined that it is operationally possible to accommodate 30% wind and 5% solar energy in the Western Interconnection if utilities substantially increase their coordination of operations over wider geographic areas and schedule their generation and interchanges on an intra-hour basis.[130] Integrating renewables at current levels is not causing any problems with grid reliability.[131] At this time, Washington has successfully integrated more than 3,200 megawatts of non-hydro renewable generation capacity and still boasts the lowest average electricity rates in the United States.[132]

City Specific Efforts

Los Angeles

The City of Los Angeles has been active in numerous ways to reduce its emissions.

- In 2016 alone, city-wide GHG emissions decreased 11%, which is equivalent to taking 737,000 cars off the road. At the same time, Los Angeles's population continued to increase and its economy continued to grow. Los Angeles's per capita emissions are currently 6.7 metric tons CO2e – about one-third of the national average – and are on track with the goals for cities to achieve the Paris Agreement.

- From 2015 to 2016, Los Angeles Department of Water and Power decreased the percentage of its coal-generated electricity from 37% to 19% and increased renewables from 21% to 29%.

---

[126] I-937 is working, NW Energy Coalition and Renewable Northwest, February 2015

[127] I-937's energy efficiency and renewable energy success benefits workers, businesses, and bill payers, NW Energy Coalition and Renewable Northwest, January 20, 2016

[128] *Id.*

[129] National Renewable Energy Laboratory, Energy System Integration, November 2015

[130] Western Wind and Solar Integration Study, National Renewable Energy Laboratory, Executive Summary

[131] Western Interconnection Regional Advisory Body Comments on U.S. Dept of Energy Staff Report to the Secretary on Electricity Markets and Reliability, October 5, 2017 at 3.

[132] I-937's energy efficiency and renewable energy success benefits workers, businesses, and bill payers, NW Energy Coalition and Renewable Northwest, January 20, 2016., EIA US Energy Information Administration, Washington State Energy Profile, last updated November 17, 2016.

- Los Angeles Department of Water and Power launched Solar Rooftops, a community solar program to help deploy solar panels in low-solar penetration neighborhoods. At 291 megawatts, Los Angeles has the most installed solar power of any city in the United States.

- In June 2017, the Los Angeles Department of Water and Power (LADWP) launched a 100% Renewable Energy Study to determine what investments are needed to achieve a 100% renewable energy supply.

- Recently, Los Angeles signed the Fossil Fuel Free Streets Declaration, alongside 11 other C40 Mayors, pledging to procure only zero-emission buses by 2025.

- At 475 vehicles, Los Angeles has the largest municipal EV fleet in the country. Further, at nearly 1,500 charging stations, Los Angeles has the most publicly available electric vehicle chargers of any city in the country. The City and its Department of Water and Power have also committed to install a total of 10,000 EV chargers in the next 5 years.

- The Port of Los Angeles announced goals to transition all terminal equipment to zero emissions by 2030 and to transition to a zero-emissions drayage fleet by 2035.