Comments of New York, California, Connecticut, Delaware, Hawaii, 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) on

the Environmental Protection Agency's proposed Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 82 Fed. Reg. 48,035 (Oct. 16, 2017)

April 26, 2018

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I. EXECUTIVE SUMMARY

The states of New York, California, Connecticut, Delaware, Hawaii, 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 Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units 82 Fed. Reg. 48,035 (Oct. 16, 2017). The rule EPA seeks to repeal, commonly known as the "Clean Power Plan" or "CPP," 80 Fed. Reg. 64,662 (Oct. 23, 2015), sets the first nationwide emission limits on one of our country's largest sources of harmful greenhouse gases—existing fossil-fueled power plants. EPA's proposed repeal of the Clean Power Plan would violate the Clean Air Act. The statute requires EPA to set limits on carbon pollution from existing power plants, yet the agency is proposing to repeal the Clean Power Plan without replacing it with *any* alternative rule, much less a substitute that requires equivalent or greater pollution reductions. As described below, EPA's about-face, contending that the Clean Power Plan conflicts with section 111(d) of the Act, is erroneous.

As explained in Section II of these comments, scientific reports issued after EPA finalized the Clean Power Plan further demonstrate the need to promptly reduce greenhouse gas emissions from power plants and other large sources to mitigate ongoing and anticipated public health and environmental harms. We highlight threats the States and Cities are facing from climate change and the need for EPA to perform its duty under the Clean Air Act to set nationwide limits on power plant carbon pollution.

In Section III of these comments, we discuss how EPA's proposed repeal of the Clean Power Plan without simultaneously replacing it with a lawful alternative would violate the Clean Air Act. After more than a decade of litigation led by the States and Cities, EPA's statutory obligation to regulate the emission of pollutants such as greenhouse gases from power plants is well-established. EPA recognizes that the emission of greenhouse gases poses a risk to human health and the environment, and EPA cannot simply ignore its obligation to regulate the stationary sources that emit the most of this pollution. Repeal without replacement is an impermissible action under the Clean Air Act.

Section IV of the comments addresses how EPA has fundamentally failed to explain the statutory interpretation that is the sole reason provided for the proposed repeal and how the Clean Power Plan, properly characterized, is inconsistent with the interpretation as presented. EPA's proposed repeal, thus, appears to be improperly and unlawfully based on a mischaracterization of the Clean Power Plan, rather than a properly explained new interpretation of the statute.

Section V details why EPA's attempts to read section 111 as precluding the Clean Power Plan are contrary to law and arbitrary and capricious. This section also provides comments on each of the five specific areas on which EPA sought comment as bases for the proposed repeal: statutory text, congressional intent, EPA's prior understanding, statutory context, and broader

policy concerns. As discussed in detail below, EPA's new embrace of legal arguments made by now-Administrator Pruitt and other petitioners in the *West Virginia v. EPA* litigation in each of these areas is unpersuasive. EPA carefully considered—and rejected—these same contentions in the Clean Power Plan rulemaking and in the subsequent litigation. These arguments are no more meritorious now than they were then. The agency's new approach to statutory interpretation is analogous to a horse with blinders (if not a blindfold): a constrained vision of the nation's most protective environmental statute, one that completely ignores the dire threat climate change poses, the interconnected nature of power plants, and the nature of the pollutant (carbon dioxide) that is the subject of regulation in the Clean Power Plan.

Section VI critiques EPA's revised analysis on the economic impacts of the Clean Power Plan. In a thinly-veiled attempt to provide factual support for its predetermined conclusion to repeal the Clean Power Plan, EPA's revised analysis underestimates the benefits of the Clean Power Plan while exaggerating its costs. The agency's revised analysis contains numerous errors, including substantially discounting the social cost of carbon and abandoning EPA's past practice in valuing co-benefits for human health associated with reducing particulate matter and ozone pollution.

Finally, Section VII explains why the agency's proposed revocation of the legal memorandum issued together with the Clean Power Plan is unjustified.

Because EPA's proposed repeal of the Clean Power Plan is unsupported by the facts or law, EPA should abandon it and encourage the D.C. Circuit Court of Appeals to complete its review of the rule forthwith.

II. CLIMATE CHANGE HARMS AND THE NEED FOR MEANINGFUL LIMITS ON POWER PLANT CARBON POLLUTION NATIONWIDE

A. Recent Scientific Reports Further Demonstrate the Need to Aggressively Reduce Greenhouse Gas Emissions.

Since EPA's publication of the Clean Power Plan in October 2015, the Earth experienced the warmest year on record—2016—breaking the records set previously in 2014 and 2015.[1] Recent observations of air and ocean temperatures and other climate-related metrics, in combination with improved understanding of the underpinnings of the Earth's climate system, confirm the already well-accepted scientific consensus: the Earth's climate system is changing rapidly primarily due to human activities, especially from emissions of greenhouse gases.

Recent major scientific assessments strengthen EPA's 2015 findings outlined in the Clean Power Plan, including that "[c]limate change impacts touch nearly every aspect of public welfare."[2] In 2017, the United States Global Change Research Program released the Fourth National Climate Assessment ("Fourth Assessment"), a 470-page report summarizing the current

[1] https://climate.nasa.gov/vital-signs/global-temperature/, last accessed 4/9/2018.

[2] 80 Fed. Reg. at 64,683.

state of climate change science, and ongoing and projected future physical impacts.[3] Coordinated by lead authors representing the National Science Foundation, National Oceanic and Atmospheric Administration (NOAA), and National Aeronautics and Space Administration (NASA), with contributions from leading scientists from other federal organizations, including the Department of Energy and its National Laboratories, Army Corps of Engineers, National Center for Atmospheric Research, Department of Defense, Department of Agriculture, Department of Health and Human Services, and EPA, the Fourth Assessment concludes:

Global annually averaged surface air temperature has increased by about 1.8°F (1.0°C) over the last 115 years (1901–2016). This period is now the warmest in the history of modern civilization. The last few years have also seen record-breaking, climate-related weather extremes, and the last three years have been the warmest years on record for the globe. These trends are expected to continue over climate timescales.

This assessment concludes, based on extensive evidence, that it is extremely likely that human activities, especially emissions of greenhouse gases, are the dominant cause of the observed warming since the mid-20th century. For the warming over the last century, there is no convincing alternative explanation supported by the extent of the observational evidence.

In addition to warming, many other aspects of global climate are changing, primarily in response to human activities. Thousands of studies conducted by researchers around the world have documented changes in surface, atmospheric, and oceanic temperatures; melting glaciers; diminishing snow cover; shrinking sea ice; rising sea levels; ocean acidification; and increasing atmospheric water vapor.

As the climate system continues to respond to anthropogenic impacts, the Fourth Assessment found that the United States and its residents are increasingly experiencing effects from climate change. Different temperature and precipitation extremes are becoming more common. For example, the increasing intensity and frequency of heavy rainfall is contributing to flooding, especially in the Northeast. Heat waves are increasing while extreme cold events have decreased since the 1960s. As the ocean warms and land ice continues to melt, global mean sea level rose faster during the last century than in any previous century in at least 2,800 years,

[3] 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, 470 pp., doi: 10.7930/J0J964J6. This document, and others cited in these Comments that are not attached, were prefiled with EPA. *See* Joint Appendix of Environmental and Public Health Organizations and States Regarding the Proposed Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Generating Units (submitted in person by John Bullock on April 20, 2018) (documents cited hereinafter as "JA, Att. __").

contributing to daily tidal flooding increases in more than 25 Atlantic and Gulf Coast cities. Reduced snowpack and earlier seasonal melting are negatively affecting water resources in the western United States, and the incidence of large forest fires has increased.[4]

In addition, since 2015, the ability of scientists to attribute the increased likelihood of observed extreme events to climate change, a discipline termed "event attribution," has significantly evolved. In a National Academies of Sciences, Engineering, and Medicine overview report, Attribution of Extreme Weather Events in the Context of Climate Change, scientists found the likelihood that individual extreme events are attributable to climate change is increasing.[5] The likelihood that climate change is increasing the odds of extreme events is "greatest for those extreme events that are related to an aspect of temperature, such as the observed long-term warming of the regional or global climate, where there is little doubt that human activities have caused an observed change."[6]

For the past seven years, the journal of the American Meteorological Society (AMS) has published an annual special supplement describing studies of the connection between specific extreme weather events and anthropogenic climate change. In previous AMS reports, scientists found a total of 89 extreme weather events for which climate change increased the likelihood of the event occurring.[7] In the 2017 AMS report, for the first time, the authors found several of the extreme weather events occurring in 2016 would not have been "possible without the influence of human caused climate change."[8] These extreme weather events are happening because of the ongoing anthropogenic alteration of the Earth's climate and are beyond the bounds of the "natural" climate system. The three such extreme events AMS identified in year 2016 were: (1) record-breaking global temperatures, (2) record-breaking regional temperatures over the Asian continent, and (3) the anomalous warm water temperatures in Alaska's Bering Sea. These events *would not have occurred* in a pre-industrial climate.

Next, two independent research teams, including one from the Department of Energy's Lawrence Berkeley National Laboratory, recently released studies identifying a clear anthropogenic climate signal in the torrential precipitation that inundated Houston during Hurricane Harvey, reporting the precipitation was up to 38 percent greater due to climate change.[9,10] It is estimated that Hurricane Harvey was the second costliest natural disaster on

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[4] USGCRP 2017 (JA, Att. B69).

[5] National Academies of Sciences, Engineering, and Medicine. 2016. Attribution of Extreme Weather Events in the Context of Climate Change. Washington, DC: The National Academies Press. https://doi.org/10.17226/21852 (JA, Att. K24).

[6] *Id.*

[7] Herring, S. C., N. Christidis, A. Hoell, J. P. Kossin, C. J. Schreck III, and P. A. Stott, Eds., 2017: Explaining Extreme Events of 2016 from a Climate Perspective. *Bull. Amer. Meteor. Soc.*, 98 (12), S1–S157 (attached hereto as ***Exhibit 1***).

[8] *Id.*

[9] Risser M., and M.F Wehner (2017), Attributable human-induced changes in the likelihood and magnitude of the observed extreme precipitation during Hurricane Harvey, Geophys. Res. Lett., 44, doi:10.1002/2017GL075888 (JA, Att. B53).

record in United States history, resulting in approximately $125 billion in total damages.[11] Consistent with scientists' long-standing expectations that climate change will increase extreme precipitation events, studies indicate the intensity and frequency of such events have increased since 1901, especially in the northeastern United States.[12] For instance, in New York State, communities and infrastructure have incurred significant damage from heavy rains in recent years.[13]

The Fourth Assessment evaluated how the climate may continue to change in the future. Historical emissions of greenhouse gases, including carbon dioxide, have locked-in additional warming. The concentration of carbon dioxide in the atmosphere now exceeds 400 ppm, a level the Earth's climate last experienced about three million years ago.[14] Since 1901, global mean surface air temperatures have increased by approximately 1.8°F.[15] Rates of greenhouse gas emissions over the last few decades are consistent with the higher emission scenarios climate modelers use to assess future climate change. Depending upon future emission rates, global mean temperatures over the next few decades are projected to increase between 0.5°F and 1.3°F, while longer-term warming will depend primarily on cumulative greenhouse gas, aerosol emissions, and climate system sensitivity. Projected long-term global temperature changes for the end of the century range from 4.7-8.6°F under the high emission scenario to 0.5-1.3°F for the low emission scenario.[16] Temperature changes are expected to be even higher for the contiguous United States. Increases of about 2.5°F are projected for the period 2021-2050 relative to the average from 1976-2005 in all Representative Concentration Pathway ("RCP") emission scenarios, implying recent record-setting years may be "common" in the next few decades. Much larger rises are projected by end of century, as high as 5.8°-11.9°F for the highest emission scenario.[17]

The Fourth Assessment finds the scope of resulting impacts for the United States to be significant, including:

- The frequency and intensity of extreme high temperature events are virtually certain to increase in the future as global temperatures increase. Extreme precipitation events will very likely continue to increase in frequency and intensity throughout most of the world.

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[10] Geert Jan van Oldenborgh *et al* 2017 *Environ. Res. Lett.* 12 124009 (attached hereto as ***Exhibit 2***).

[11] https://coast.noaa.gov/states/fast-facts/hurricane-costs.html, last accessed 4/9/2018.

[12] USGCRP 2017.

[13] Current & Future Trends in Extreme Rainfall Across New York State, A Report from the Environmental Protection Bureau of New York State Attorney General Eric T. Schneiderman (Sept. 2014) available at https://ag.ny.gov/pdfs/Extreme_Precipitation_Report%209%202%2014.pdf. (JA, Att. B9).

[14] USGCRP 2017.

[15] USGCRP 2017.

[16] USGCRP 2017.

[17] USGCRP 2017.

- The frequency and intensity of heavy precipitation events in the United States are projected to continue to increase over the 21st century.
- The incidence of large forest fires in the western United States and Alaska, which increased since the early 1980s, is projected to further increase in those regions as the climate warms, with profound changes to certain ecosystems.
- Relative to the year 2000, global mean sea level is very likely to rise by 0.3–0.6 feet by 2030, 0.5–1.2 feet by 2050, and 1.0–4.3 feet by 2100. Relative sea level rise is likely to be greater than the global average for states bordering the western Gulf of Mexico and those in Mid-Atlantic and the Northeast.
- Assuming storm characteristics do not change, sea level rise will increase the frequency and extent of extreme flooding associated with coastal storms, such as hurricanes and nor'easters.
- The current rate of ocean acidification is unparalleled in at least the past 66 million years. Under the higher emission scenario (RCP 8.5), the global average surface ocean acidity is projected to increase by 100–150 percent.

B. The States and Cities Are Experiencing Harms from Climate Change Now that Will Worsen Unless Prompt Steps Are Taken to Mitigate that Pollution.

The States and Cities are home to approximately 144 million people, or roughly 45 percent of the population of the United States. We are already suffering from the deleterious impacts of global climate change caused by manmade emissions of greenhouse gases. Our residents have lost property, been displaced from homes, and even been killed as a result of severe weather events exacerbated by climate change. Our infrastructure has been damaged, and our economies have been affected by more extreme heat, shorter winters, and rising sea levels. Appendix A to these comments contains a detailed description, with citations, of significant harms and threats each of the States and Cities is facing. Those threats are highlighted in this section.

- ***Heat waves.*** Premature deaths caused by more frequent and intense heat waves are a pressing public health problem, especially in our cities. For example, in Maryland, the Centers for Disease Control and Prevention found that there were twelve heat-related deaths in the state resulting from the heat wave in 2012; yearly premature deaths from extreme heat are expected to more than double that amount for just the city of Baltimore by 2050. In Washington, D.C., the number of heat emergency days (days when the heat index exceeds 95°F), could more than double from the current 30 days per year to 80 days per year by the 2050s under a high emission scenario. Similarly, 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.

- ***Wildfires.*** Climate change creates more favorable conditions for wildfires. California experienced its worst wildfire season ever in 2017: wildfires have killed dozens of people, destroyed thousands of homes, forced hundreds of thousands to evacuate, and burned more than half a million acres of forests and land. The 2013–15 fire seasons were

some of the largest and most intense that Oregon has ever experienced. And in Washington, under a business-as-usual greenhouse gas emissions scenario without the Clean Power Plan, the state is facing up to a 300-percent increase in the land area in eastern Washington burned annually by forest fires and up to a 1,000-percent increase in land area burned annually on the west side of the state.

- ***Severe storms.*** Because of greater energy in the climate system, scientists anticipate that climate change will result in more damaging storms, a trend that the States and Cities have already begun to experience. For example, in 2014, Long Island, NY received more than 13½ inches of rain—nearly an entire summer's worth—in a matter of hours, breaking the state's rainfall record. That deluge flooded over 1,000 homes and businesses, opened massive sinkholes on area roadways, and forced hundreds of residents to evacuate to safer ground. In 2013, the City of Boulder 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. And in 2011, Hurricane Irene dumped up to 11 inches of rain on Vermont, impacting 225 municipalities and causing $733 million in damage; the same storm left 800,000 Connecticut residents without power for up to nine days.

- ***Sea level rise and associated flooding.*** Coastal flooding exacerbated by sea level rise increasingly plagues the States and Cities. For example, the Hampton Roads area of Virginia has experienced the highest rates of sea level rise along the East Coast. Ordinary rain events now cause flooding in the streets of Norfolk, including large connector streets disappearing underwater. 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.[18] In South Florida, extreme high tides have become increasingly frequent and dramatic due to rising sea levels, over-topping seawalls, pushing up through stormwater systems and contributing to flooding in communities far from the waterfront and coastal canals. In Delaware, over 17,000 homes and almost 500 miles of roadway are at risk of permanent inundation from sea level rise by the end of the century. And the more than 12 inches of sea level rise New York City has experienced since 1900 expanded 2012 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.

- ***Diseases.*** Warmer temperatures from climate change have facilitated the spread of infectious diseases. For example, warmer temperatures are contributing to the rise in deer populations in Massachusetts, resulting in loss of underbrush habitat for forest species and the spread of tick-borne diseases like Lyme disease. In Pennsylvania, climate change is expected to increase the prevalence of West Nile disease in the higher-elevation areas and the duration of the transmission season. Disease outbreaks threaten our natural resources as well. In California, a majority of the ponderosa pine in the foothills of the

[18] Section 335 of the National Defense Authorization Act of 2018 (H.R. 2810) requires the Secretary of Defense to submit a report on the vulnerabilities to military installations and combatant commander requirements resulting from climate change, including a listing of the ten most vulnerable military installations for each service based on rising sea tides, increased flooding, drought, wildfires, and other climate change impacts.

central and southern Sierra Nevada Mountains have already died, killed by the western pine beetle and other bark beetles. The increasing threat from these insects is driven in large part by warmer winters and a lengthening summer season attributable to climate change.

- ***Drinking water.*** Water supplies are being threatened in states that rely on snowpack for drinking water. In Washington's Cascade Mountains, snowpack has already decreased by about 25 percent since the mid-20th century and is anticipated to decrease even more substantially by the 2040s. In California, during the recent drought, the Sierra snowpack—critical to California's water supply (and other uses)—was the smallest in 500 years. Similarly, 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 in New Mexico. In Broward County (FL), water supplies are threatened by rising seas, which drives saltwater contamination into well fields. U.S. Geologic Survey modeling in collaboration with the County reveals a predicted loss of 35 million gallons per day in water supply capacity by 2060 (40 percent of Broward's coastal well field capacity), due entirely to additional sea level rise.

- ***Air quality.*** Warmer temperatures also increase the formation of ground level ozone, which impairs lung function and can cause increased hospital admissions and emergency room visits for people suffering from asthma, particularly children. Massachusetts already has the nation's highest incidence of asthma: among children in grades K–8, more than 12 percent suffer from pediatric asthma, and 12 percent of the state's adult population suffers from asthma. Similarly, in 2010, nearly a quarter of the children in Philadelphia County had asthma, among the highest rates in the nation.

- ***Ocean fisheries***. Carbon dioxide emissions into the atmosphere are increasing the acidity of Atlantic and Pacific Ocean waters, harming aquatic species. In Oregon, ocean waters are now more acidified, hypoxic (low oxygen), and warmer, and such impacts are projected to increase, with a particularly detrimental impact on oysters and other shellfish, which will threaten marine ecosystems, fisheries, and seafood businesses. In Maine, the increasing acidity is inhibiting shell formation in soft-shell clams, oysters, and Maine's world famous lobsters. Also, the Gulf of Maine is warming faster than 99 percent of the world's ocean waters, and soft-shell clam flats throughout southern and mid-coast Maine have been destroyed by an invasion of non-native green crabs that have expanded their range northward as these waters warm.

- ***Agriculture***. Climate change is also disrupting agricultural production. In California's Central Valley, the historic five-year drought (2012–17) cost the farming industry about $2.7 billion and more than 20,000 jobs in 2015 alone. In Maryland, predicted hotter temperatures and increased inundation of soils from the rising seas threaten the state's produce and livestock industry. In Illinois, an increase in temperature and a shift in rain patterns could mean a 15-percent yield loss in field crops such as corn and soybeans in the next 5 to 25 years and up to a 73-percent average yield loss by the end of the next

century. Similarly, in Iowa, absent significant adaptation by Iowa farmers, the state could face declines in its corn crop of 18–77 percent.

- ***Biodiversity and ecosystem health.*** Warming temperatures and changing precipitation patterns are threatening native marine and terrestrial species in the States and Cities. For example, warmer water temperatures in Narragansett Bay off Rhode Island are causing many changes in ecosystem dynamics and fish, invertebrate, and plankton populations. Cold-water iconic fish species (cod, winter flounder, hake, and lobster) are moving north out of Rhode Island waters, and warm-water southern species are becoming more prevalent (scup, butterfish, and squid). A recent study 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. In Washington, Douglas fir accounts for almost half the timber harvested in the State. Under a moderate greenhouse gas scenario, Douglas fir habitat is expected to decline 32 percent by the 2060s relative to 1961–1990.

C. EPA Has Acknowledged the Critical Importance of Nationwide Carbon Pollution Reductions from Power Plants.

In the *West Virginia* litigation, EPA recognized that "[n]o serious effort to address the monumental problem of climate change can succeed without meaningfully limiting [power] plants' CO_2 emissions."[19] Although the States and Cities have taken significant steps, national emission standards are necessary. And the Supreme Court has described EPA as the "expert agency" that is "best suited to serve as primary regulator of greenhouse gas emissions." *Amer. Elec. Power v. Connecticut*, 564 U.S. 410, 428 (2011) (*AEP*). In the *AEP* case, several states, New York City, and land trust organizations brought federal common-law public nuisance claims directly against power plants, seeking reductions in the greenhouse gas pollution harming the health and welfare of their citizens. Citing EPA's commitment to proceed with rulemaking (which culminated in the Clean Power Plan), the Supreme Court rejected plaintiffs' federal common-law claims, holding that the Clean Air Act "directly" authorized EPA to regulate greenhouse gases from power plants under section 111(d). *Id*. at 424 (quotation marks omitted). Because of this statutory authority, "the Clean Air Act and the EPA actions it authorizes displace any federal common-law right to seek abatement of carbon-dioxide emissions from fossil-fuel fired powerplants." *Id.* Although the Supreme Court's decision left open the possibility that parties could use state law common law nuisance actions against power companies to compel reductions in carbon pollution, there is no question that it would be more efficient for EPA to use its authority under the Clean Air Act to require such emission limits nationwide.

[19] EPA Final Brief in *West Virginia v. EPA,* D.C. Cir. No. 15-1363 (Doc. #1609995, filed April 22, 2016), at 61 (JA, Att. A7).

III. EPA CANNOT REPEAL THE CLEAN POWER PLAN WITHOUT SIMULTANEOUSLY ISSUING A REPLACEMENT RULE TO REGULATE CARBON DIOXIDE FROM EXISTING POWER PLANTS

A. Repeal Without Replacement Would Put EPA in Violation of its Statutory Duty to Regulate Carbon Dioxide from Power Plants.

When it promulgated the Clean Power Plan, EPA did so pursuant to its obligation under section 111(d) of the Clean Air Act to regulate carbon dioxide from existing fossil-fueled power plants, the largest stationary sources of greenhouse gas emissions. The rule marked the fruition of more than a decade of efforts led by several of the States and Cities to compel EPA to address power plant emissions. And while EPA does not dispute its statutory obligation to regulate power plant carbon pollution under section 111(d), the agency is not proposing to replace the Clean Power Plan at the time of repeal. With respect to a possible replacement rule, EPA says only that "EPA continues to consider whether it should issue another CAA section 111(d) rule addressing GHG emissions from existing [power plants] and, if so, what would be the appropriate form and scope of that rule." 82 Fed. Reg. at 48,038. The recent "Advance Notice of Proposed Rulemaking" is equally noncommittal regarding the timing or nature of a replacement rule, if any. *See* 82 Fed. Reg. 61,507 (Dec. 28, 2017). If EPA now wishes to repeal the Clean Power Plan, it cannot simply return to a legal landscape of non-regulation; rather, EPA must replace the Clean Power Plan with an alternative rule that fulfills EPA's regulatory duty to meaningfully limit carbon pollution for existing power plants.

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. *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, which requires that state plans be submitted within three years of promulgation of a standard); 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 carbon dioxide from power plants. The Clean Air Act specifically contemplates that EPA will review and revise standards of performance from stationary sources from time to time, but it does not empower EPA to repeal the existing standards and start the rulemaking process anew each time the standards are revised. *See* 42 U.S.C. § 7411(b)(1)(B), (g).

By way of additional background, in 2003, several of the States and Cities, as well as other parties, sued EPA to compel regulation of greenhouse gas emissions from new motor vehicles under section 202 of the Clean Air Act. The Supreme Court held that the Act's broad definition of "air pollutant" unambiguously covers greenhouse gases, and that EPA was accordingly obliged "to regulate emissions of the deleterious pollutant" if it found that greenhouse gas emissions endanger public health or welfare. *Massachusetts v. EPA*, 549 U.S. 497, 528-29, 533 (2007). EPA subsequently found that greenhouse gases, including carbon dioxide, endanger public health and welfare by causing more intense, frequent, and long-lasting heat waves; worse smog in cities; longer and more severe droughts; more intense storms,

hurricanes, and floods; the spread of disease; and a dramatic rise in sea levels. 74 Fed. Reg. 66,496, 66,497, 66,524-25, 66,532-33 (Dec. 15, 2009) (the Endangerment Finding). The D.C. Circuit upheld the Endangerment Finding, and the Supreme Court declined review. *Coal. for Responsible Regulation, Inc. v. EPA*, 684 F.3d 102, 120-21 (D.C. Cir. 2012) (per curiam), *cert. granted in part on other grounds*, 134 S. Ct. 418 (2013), *aff'd in part, rev'd in part, Util. Air Regulatory Grp. v. EPA*, 134 S. Ct. 2427 (2014). The Endangerment Finding remains in effect and is not at issue here. 82 Fed. Reg. at 48,037. As two judges of the D.C Circuit recently recognized, the Endangerment Finding "triggered an affirmative statutory obligation to regulate greenhouse gases." Per Curiam Order, *West Virginia v. EPA*, D.C. Cir. No. 15-1363 (Aug. 8, 2017) (Tatel, Millett, concurring); *see also AEP*, 564 U.S. at 426-427 (Clean Air Act "directs the EPA to establish emissions standards for categories of stationary sources" where pollution from those sources endangers public health or welfare).

To spur EPA to regulate greenhouse-gas emissions, some of the States and Cities and nonprofit organizations sued EPA for failing to establish emission standards and guidelines for carbon dioxide from new and existing power plants under section 111 of the Act. *See New York v. EPA*, No. 06-1322 (D.C. Cir., filed Sept. 13, 2006). After the Supreme Court decided *Massachusetts*, the D.C. Circuit remanded *New York* to the agency for further proceedings in light of that case. Per Curiam Order, *id.*, ECF#1068502 (Sept. 24, 2007). In 2010, the parties settled *New York* after EPA agreed to proceed with rulemaking under section 111 by May 2012. *See* 75 Fed. Reg. 82,393 (Dec. 30, 2010). EPA's rulemaking process culminated – more than three years after the agreed-upon deadline – in the Clean Power Plan.

In short, through litigation, the States and Cities have compelled EPA to fulfill its statutory duty to regulate greenhouse gas emissions from power plants in the form of the Clean Power Plan. EPA now proposes to return to the pre-*New York* remand state of affairs by repealing the Clean Power Plan without promulgating any replacement or even providing any concrete timeframe for when a replacement might be promulgated. Although EPA may change its policy with respect to how to regulate carbon pollution from power plants (provided that new policy is lawful), it cannot simply announce a policy of non-regulation in contravention of its statutory duties. Rather, the "new policy" must be "permissible under the statute." *FCC v. Fox Television Stations, Inc.*, 556 U.S. 502, 515 (2009).

The Supreme Court held more than ten years ago that "[i]f EPA makes a finding of endangerment, the Clean Air Act requires the Agency to regulate emissions of the dangerous pollutant." *Massachusetts*, 549 U.S. at 533. According to the Court, "[u]nder the clear terms of the Clean Air Act, EPA can avoid taking further action only if it determines that greenhouse gases do not contribute to climate change or if it provides some reasonable explanation as to why it cannot or will not exercise its discretion to determine whether they do." *Id.* In light of this clear description of EPA's obligation to regulate greenhouse gas emissions as air pollutants, the D.C. Circuit remanded *New York v. EPA* to the agency for further proceedings. As discussed above, EPA later determined in the Endangerment Finding that greenhouse gas emissions do endanger public health and welfare. 74 Fed. Reg. 66,496.[20] In light of the Supreme Court's

[20] Although *Massachusetts* related only to greenhouse gas emissions from mobile sources, the Supreme Court in *AEP* recognized that the Clean Air Act also "directs the EPA to establish emissions standards for categories of stationary sources" where pollution from those sources endangers public

decisions and EPA's Endangerment Finding, doing nothing with respect to stationary sources that emit the most carbon pollution—as EPA's proposed repeal contemplates—is not permissible under the Clean Air Act. *FCC v. Fox Television*, 556 U.S. at 515.

B. EPA Failed to Consider Alternatives to Non-Regulation Supported by the Record.

Repeal without replacement is not only an impermissible construction of the statute, but also arbitrary and capricious because EPA did not consider whether the pollution reductions required in the Clean Power Plan could be achieved through the application of systems of emission reduction that EPA previously rejected as the "best" systems, but that EPA apparently still considers to be systems under its interpretation discussed in the proposed repeal.[21] EPA fails to demonstrate that the emission limits set forth in the Clean Power Plan could not be established based on EPA's identification of a different "best system of emission reduction" ("best system" or "BSER") supported by the existing administrative record. Instead, EPA simply states that it "is not taking comment on on-site efficiency measures with this proposal." 82 Fed. Reg. at 48,039 n.5. However, EPA does not need to take comment "on on-site efficiency measures" or other measures such as co-firing or carbon capture and storage (CCS) because the record is already full of information regarding their availability and cost-effectiveness. EPA arbitrarily and capriciously failed to engage with its own record in this regard. *See Motor Vehicle Mfrs Ass'n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 42 (1983) ("*State Farm*") (noting that Congress "established a presumption . . . *against* changes in current policy that are not justified by the rulemaking record") (emphasis added).

In the Clean Power Plan, EPA found that coal-fired power plants could reduce carbon dioxide emissions by "co-firing" with natural gas or by implementing carbon capture and storage (CCS). *See* 80 Fed. Reg. at 64,727. These measures are ones that would qualify as "systems of emission reduction" even under a constrained view of section 111.[22] EPA previously concluded that these measures could not be considered part of the best system because "co-fired and CCS measures are more expensive than other available measures for existing sources" – specifically, the generation shifting measures represented by building blocks two (reducing generation from

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health or welfare. *AEP*, 564 U.S. at 426-427. EPA previously concluded in a separate rulemaking that a separate endangerment finding for greenhouse gas emissions from stationary sources is not required, *see* 80 Fed. Reg. at 64,529-31, and has not proposed to depart from that interpretation. *See* 82 Fed. Reg. at 61,508-509. In any case, the Clean Power Plan confirmed that the 2009 Endangerment Finding for greenhouse gas emissions applies and extends to power plants. *See, e.g.*, 80 Fed. Reg. at 64,683-88 (concluding that "recent scientific assessments" since the 2009 endangerment finding "confirm and strengthen the conclusion that GHGs endanger public health," and "public welfare," and noting that power plants "are by far the largest emitters of GHGs among stationary sources").

[21] As noted below, EPA has failed to reasonably explain its purported new interpretation of the Clean Air Act or how building blocks two and three of the Clean Power Plan do not satisfy it. *See* Points IV.B and V, *infra*.

[22] *See* 80 Fed. Reg. at 64,727 (identifying "co-firing" a coal plant with natural gas and CCS as "measures that reduce individual affected [power plants'] CO2 emission rates," which presumably would fit within a constrained interpretation of the Clean Air Act that would preclude EPA from considering building blocks two and three of the Clean Power Plan as "system[s] of emission reduction;" *see also* 82 Fed. Reg. at 61,517.

higher-emitting affected steam generating units by an amount that can be replaced by increased generation from lower-emitting existing natural gas combined cycle units) and three (reducing generation from affected fuel-fired generating units by an amount that can be replaced by increased generation from new zero-emitting renewable energy generating capacity). *See id.* at 64,667, 64,727-28. If EPA now thinks that the less-expensive building blocks two and three are legally impermissible, it must evaluate the degree of emission limitation achievable through application of a best system that includes the co-firing and CCS methods that it previously ruled out based on the availability of those less expensive measures. *See id.* at 64,728 (even if EPA set emission guidelines based on co-firing and CCS, most power plants "would rely on the lower cost option of substituting lower- or zero-emitting generation or, as a related matter, reducing generation"). The Clean Air Act specifically contemplates that EPA will review and revise standards of performance from stationary sources from time to time, without empowering EPA to repeal the existing standards, leaving sources of that harmful pollution unregulated while EPA contemplates starting the rulemaking process anew. 42 U.S.C. § 111(b)(1)(B), (g).

EPA appears to have presumed the outcome of this analysis of alternative systems by stating—without support—that the Clean Power Plan "established performance standards for coal-fired plants assuming a uniform emissions rate well below that which could be met by existing units through any retrofit technology of reasonable cost available at the time." 82 Fed. Reg. 48,037. Although EPA is unclear on this point, this statement can only mean either that EPA did not consider co-firing because it does not believe that it is a "retrofit technology" or that EPA reached a different conclusion about co-firing in the proposed repeal without describing, in any way, the basis or analytical path for that conclusion. Neither of these meanings passes muster. Failure to consider an available alternative technology as a basis for regulation is among the "most obvious reason[s]" for finding an agency's rescission of a rule arbitrary and capricious. *State Farm*, 463 U.S. at 46-48. That would be particularly true here, given that section 111 is not limited to consideration of "retrofit technolog[ies]." And, of course, agencies must support and explain the bases for their conclusions.

EPA has consistently stated that generation shifting is not the only system of emission reduction that can achieve the limits in the Clean Power Plan; it is just the least costly of the systems that can. 80 Fed. Reg. 64,727-28, 64,769; *see also* EPA's Brief in *West Virginia v. EPA*, No. 15-1363 (D.C. Cir. March 28, 2016), ECF#16059110 at 14 (generation shifting achieves a higher degree of emission limitation that might otherwise have required more expensive investments in end-of-the-stack technologies at their particular plants) (citing 80 Fed. Reg. at 64,782 n.604, 64,795-811); *see also id.* at 59 ("While the Best System informs the stringency of emission-reduction targets, the Rule grants states almost complete flexibility to decide how to meet those targets. For example, if a state prefers a plant-by-plant command-and-control technological approach to reducing emissions, it could compel its coal plants to switch their fuel to natural gas, or require carbon sequestration where feasible.").

In addition, more recently when it denied petitions to reconsider the Clean Power Plan last year, EPA made a number of findings regarding significant emission reductions achievable at existing power plants using alternatives to best system measures, such as fuel switching, CCS, and demand side energy efficiency. *See* EPA, *Basis for Denial of Petitions to Reconsider and Petitions to Stay the CAA section 111(d) Emission Guidelines for Greenhouse Gas Emissions*

and Compliance Times for Electric Utility Generating Units (Jan. 11, 2017) ("EPA Reconsideration Denial"), Appendix 3 (JA, Att. F6). EPA concluded that "[a]t the state level, we observe that application of the non-BSER measures [] to the 2012 baseline data for each state results in an emissions estimate that is lower than the 2030 goal for nearly every state [subject to the Clean Power Plan] (except New Jersey and Rhode Island." *Id.*, Appendix 3 at 17.

By erroneously assuming that there is no other basis for establishing the Clean Power Plan's emission limits other than through the best system that EPA chose (and which the repeal proposal wrongly disavows), the repeal proposal 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.

C. The Clean Air Act and the Record Contradict EPA's Assertion that the Clean Power Plan's Magnitude Requires Repeal without Replacement.

EPA contends that it must repeal the Clean Power Plan now (without a replacement in effect) because "[i]t is not in the interests of the EPA . . . to expend its resources along the path of implementing" the Clean Power Plan, 82 Fed. Reg. at 48,038. This contention is unfounded. EPA fails to acknowledge that the Supreme Court has stayed the Clean Power Plan, making any expenditure of resources by EPA to implement it wholly conjectural at this point. Indeed, the EPA Administrator previously relied on the Supreme Court stay to assure states that they "have no obligation to spend resources to comply" with the Clean Power Plan. *E.g.* Letter from E. Scott Pruitt to Governor Andrew Cuomo (Mar. 30, 2017) (attached hereto as ***Exhibit 3***).[23] It is wholly disingenuous for EPA to now claim that it must rush through a repeal of the Clean Power Plan and fail to meaningfully engage with its own record to avoid the expenditure of resources.

EPA also claims that "it is not appropriate" for a rule of the "magnitude" and "level of impact" of the Clean Power Plan to remain in existence during "a potential, successive rulemaking process." 82 Fed. Reg. at 48,038. EPA fails to acknowledge its recent conclusion that trends in the power sector towards low- and zero-emitting electricity generation since the promulgation of the Clean Power Plan have significantly reduced any such impact, making it *easier* for states to design their plans and for sources to comply with the rule at a significantly lower cost than initially projected. EPA Reconsideration Denial at 22-26.

Moreover, EPA's concerns regarding what is in its "interests" or what is "appropriate" amount to policy preferences. "The agency's policy preferences cannot trump the words of the statute." *National Treasury Employees Union v. Chertoff*, 452 F.3d 839, 865 (D.C. Cir. 2006). Although EPA under the current Administration might prefer not to regulate greenhouse gas emissions from stationary sources at all, it cannot simply ignore its statutory obligation to do so. The open-ended Advance Notice of Proposed Rulemaking for a replacement rule to regulate greenhouse gas emissions—which seeks to reset the administrative process when EPA already

[23] As discussed in the response to this letter by many of the States and Cities, Administrator Pruitt's view of the impact of the Supreme Court's stay on future compliance obligations of states and power plants (*i.e.*, once the stay is lifted), is erroneous. See Letter from Michael J. Myers, New York State Attorney General's Office, to Kevin S. Minoli, EPA (Aug. 30, 2017), available at: https://ag.ny.gov/sites/default/files/2017_0830_letter_to_epa_re_cpp_stay.pdf.

has an ample administrative record to form the basis for regulation before it—is wholly inadequate to meet EPA's obligations under the Clean Air Act. *See* 82 Fed. Reg. at 61,510 (outlining a broad range of solicited comments, including on issues relating to possible heat-rate improvements and CCS measures at existing power plants). *See*, *generally*, Comments of States and Cities on EPA's Advance Notice of Proposed Rulemaking (Feb. 26, 2018).[24]

IV. EPA HAS FAILED TO REASONABLY EXPLAIN ITS LEGAL INTERPRETATION BEHIND THE PROPOSED REPEAL OR HOW THE CLEAN POWER PLAN IS INCONSISTENT WITH THAT INTERPRETATION

As discussed below in Point V, *infra*, EPA's position that the Clean Power Plan must be repealed because it is inconsistent with the Clean Air Act is wrong. Before discussing the numerous reasons why that is so, the States and Cities initially address how EPA has fundamentally failed to explain its statutory interpretation behind the proposed repeal or how the Clean Power Plan is inconsistent with that interpretation. First, as the sole basis of the proposed repeal, EPA purports to reinterpret the phrase "best system of emission reduction" in section 111. But the interpretation described does not actually appear to be materially different from the one discussed in the Clean Power Plan, or, at a minimum, EPA has failed to adequately identify and explain the differences. Second, even accepting EPA's characterization of its interpretation as different, the "best system" identified in the Clean Power Plan fits well within that proposed interpretation, and such interpretation cannot, therefore, support repeal. In reality, what EPA appears to be doing, without saying so, is offering a new characterization of the best system identified in the Clean Power Plan. It is that new mischaracterization that is the sole basis of EPA's purported reinterpretation and its rejection of the Clean Power Plan. Mischaracterizations of prior rules cannot support the repeal of those rules. *See State Farm*, 463 U.S. at 42-43.

A. EPA Has Not Reasonably Explained Its Reinterpretation of the Statute that Supposedly Precludes the Clean Power Plan.

EPA claims its sole basis for repealing the Clean Power Plan is a different interpretation of section 111, specifically of the phrase "best system of emission reduction." *See* 82 Fed. Reg. 48,038 (stating that EPA's "reconsidered … interpretation" is the basis for proposed repeal); *id.* ("The basis for the proposed repeal of the CPP is the EPA's proposed interpretation of CAA section 111."). But the purportedly different interpretation, as described by EPA in the proposed repeal, is not actually different and cannot support the repeal.

In finalizing the Clean Power Plan, EPA interpreted "system of emission reduction" "to carry an important limitation: Because the emission guidelines for the existing sources must reflect 'the degree of emission limitation achievable *through the application of* the best system of emission reduction … adequately demonstrated,' the system *must be limited to measures that can be implemented—'appl[ied]'—by the sources themselves*." 80 Fed. Reg. at 64,720 (first emphasis and modification in original, second emphasis added). EPA also "clarified that the components of the BSER must be *implementable by the affected [electric generating units] EGUs*" and "show[ed] that all the components of the BSER have been demonstrated to be

[24] *Available at*: https://ag.ny.gov/sites/default/files/cpp_anpr_comments.pdf.

achievable on that basis." *Id.* at 64,736 (emphasis added). And EPA indicated that "system[s] of emission reduction" would include actions "designed to reduce emissions from [the] affected source … actions [that] enable the affected source to achieve its emissions limitation." *Id.* at 64,761. Further defining these limitations, EPA stated that its "interpretation of 'system of emission reduction' does not include emission reduction measures that the states have authority to mandate without the affected EGUs being able to implement the measures themselves." *Id.* at 64,736.

Here, EPA proposes a purportedly different "source-oriented reading" under which the best system must "be something that can be *applied to* or *at* the source." 82 Fed. Reg. at 48,039 (emphasis in original); *see also id.* ("best system of emission reduction" would be limited to "measures that can be *applied to or at* an individual stationary source) (emphasis in original); *id.* at 48,039, n.5 (limiting the best system to "measures … that apply at, to, and for a particular source").

The only discernible differences between this purportedly changed interpretation and the interpretation in the Clean Power Plan, however, are the prepositions used: the latter referring to whether the system can be applied *by* the source to reduce emissions *from* the source and the former referring to whether the system can be applied *to* or *at* the source. EPA fails to acknowledge these similarities, or, in fact, to actually discuss the interpretation articulated in the Clean Power Plan. EPA also fails to explain how a system that can be applied *by* the source to reduce emissions *from* that source is different from a system that can be applied *to, at,* or *for* the source to reduce those same emissions. Describing the purportedly "changed" interpretation as "source-oriented" does not provide this explanation, given that EPA's interpretation in the Clean Power Plan was also source-oriented, expressly focusing on measures that would reduce emissions at or from the affected source. *See also* 80 Fed. Reg. 64,672 (describing Clean Power Plan as "establish[ing] source-level emission performance rates"); *see also id.* at 64,674-75.

Rather than discussing the Clean Power Plan's interpretation of the best system and then distinguishing it, EPA mischaracterizes the former interpretation. For example, EPA suggests that the Clean Power Plan interpreted the best system in a way that would result in emissions standards "for other sources or entities," rather than "for any existing source" covered by the Rule. 82 Fed. Reg. at 48,039. But that is simply not true. Indeed, the Clean Power Plan could not have been more clear that the emissions guidelines, and the standards states would set, would require emissions reductions from covered sources. *E.g.*, 80 Fed. Reg. at 64,745 ("Building block 2 is a 'system of emission reduction' for steam EGUs because [it] will result in reduced generation and emission from steam EGUs"). In the proposed repeal, EPA points to no standards created for sources or entities other than those covered by the Clean Power Plan, and these mischaracterizations of the Plan do not illuminate the purportedly new interpretation.

Likewise, EPA purports to distance its changed interpretation from the one underlying the Clean Power Plan by claiming that the Plan "established performance standards for coal-fired plants assuming a uniform emissions rate well below that which could be met by existing units through any retrofit technology of reasonable costs available at the time." 82 Fed. Reg. at 48,037. Neither the interpretation in the Clean Power Plan nor the one in the proposed repeal, however, limits systems of emission reduction to "retrofit technolog[ies]," so this statement does not illuminate what is "new" about the proposed interpretation. In any event, the Clean Power Plan

did not establish performance standards that are unattainable by existing coal-fired plants. It actually set only emissions guidelines, leaving the performance standards to be established by the states in their plans. Furthermore, there is no question that a coal-fired plant could meet any uniform mass standard through existing technology, given that no technology—beyond curtailed operations—would be necessary to comply.

In the end, EPA's discussion of its purportedly new interpretation raises more questions than it answers. For example, EPA acknowledges 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, part of a recognized "system of emission reduction" can occur away from the source. EPA contends that this is still a "source-oriented" measure, and therefore a legitimate "system," because the fuel is ultimately used in the source. *Id.* This suggests that so long as some *part* of the "system" occurs at the source, then it can qualify under such an approach. But EPA appears to contradict itself on that point, suggesting in that same footnote that pre-combustion cleaning occurring off-site is only a "system" because Congress expressly said it was and that other "systems" that only partly occur at the source could not qualify. It is entirely unclear from this whether EPA is saying that systems occurring partly off-site are acceptable or that they are only acceptable if Congress has explicitly mentioned them. The former position is completely consistent with the Clean Power Plan and is thus not new. The latter position might be new, but it would be completely untethered from the statutory text. The relevant provision defines "technological system of continuous emission reduction" as "including pre-combustion cleaning or treatment of fuels." 42 U.S.C. § 7411(a)(7). The use of the word "including" makes it impossible to read this as limiting EPA's consideration to only those systems expressly listed. In any event, it is entirely unclear whether EPA proposes to interpret "system of emission reduction" as including or excluding "systems" that occur partly on-site and partly off-site.

EPA has not accurately or clearly described the interpretation it purports to reject or explained the interpretation it purports to adopt. Because this purportedly new interpretation, and its differences with the prior interpretation, is the sole basis offered in support of the repeal, a repeal would be unlawful. *See, e.g., United Food and Commercial Workers Intern. Union, AFL-CIO, Local 150-A v. NLRB*, 880 F.2d 1422, 1436 (D.C. Cir. 1989) (agencies "must accept responsibility for clarifying and identifying the standards that are guiding its decisions").

B. Even if EPA Had Reasonably Explained How Its Source-Specific Interpretation in the Repeal Proposal is Different from the One in the Clean Power Plan, the Plan, Accurately Described, Would Satisfy that Interpretation.

EPA's discussion in the repeal proposal underscores not only that its interpretation is not materially different from the one in the Clean Power Plan but also that the Clean Power Plan's best system fits within the purportedly changed interpretation. For example, EPA now proposes to interpret the best system as limited to "measures … based on a physical or operational change to a building, structure, facility, or installation at that source, rather than measures that the source's owner or operator *can implement on behalf of* the source at another location." 82 Fed. Reg. 48,039 (emphasis original). But, as discussed above, EPA at least appears to acknowledge, as it must, that the best system can include steps that occur off-site—but seems to require that a

step in the best system involves "a measure applicable to and performed at the level of, and at or within the bounds of an individual source." *Id.* at 48,040 n.13. The best system EPA described in the Clean Power Plan fits well within that frame. EPA described "the actions that may be undertaken by individual sources that are therefore also part of the BSER" as "two distinct actions," including increasing lower-emitting generation and "reducing the amount of CO_2-emitting generation." 80 Fed. Reg. at 64,723. This is no different from two distinct actions—one off-site and one on-site—involved in pre-combustion cleaning of fuel (off-site) and the use of that fuel in the facility (on-site) that Congress expressly indicated could be a system of emission reduction.[25]

There is no question that reducing operations is a measure implemented by, at, for, and on a source. In other words, EPA's choice of prepositions is irrelevant to this measure. There is also no question that it is a system of emission reduction that, for power plants, is adequately demonstrated and extremely cost-effective. Indeed, the Clean Power Plan record is replete with evidence of grid-connected power plants reducing operations and shifting generation as a strategy to reduce emissions, including emissions of carbon dioxide.

In the preamble to the Clean Power Plan and accompanying Legal Memorandum, EPA detailed how individual sources can and do achieve emission limits under pollution regulations by reducing their generation. 80 Fed. Reg. at 64,779-82; Legal Mem. at 62-82. For example, legally and practicably-enforceable limitations on a source's operating hours can reduce that source's "potential to emit" beyond levels that would otherwise trigger Clean Air Act obligations. *Id.; see also* 40 CFR 52.21(b)(4) ("Any physical or operational limitation on the capacity of the source to emit a pollutant, including air pollution control equipment and restrictions on hours of operation ... shall be treated as part of its design if [certain conditions are met]."). Illustrating the point, EPA highlighted a Title V permit obtained by Manitowoc Public Utilities in Wisconsin that "limited the operating hours" of the facility to "not more than 194 hours per month, averaged over any consecutive 12-month period." 80 Fed. Reg. at 64,781; *see also* Legal Memo at 74. These are "emissions limitations" involving a "source-oriented reading" of section 111 that is precisely how EPA now describes its purported reinterpretation. *See* 82 Fed. Reg. at 48,039; *see also id.* at 48,042 ("[T]he BSER should be interpreted as a source-specific measure. . . "). As the discussion of the "potential to emit" provisions related to New Source Review and hazardous air pollutants indicate, the Clean Power Plan is also "in line with other CAA standard-setting provisions." *See id*. at 48,039. And the reduced operation of higher-emitting sources is certainly no less "integral to the operation of a regulated source" than the pre-combustion cleaning or treatment of fuels that Congress indicated, and EPA acknowledges, could lawfully be considered part of a "system." *See id*. at 48,040 n.13. At a minimum, EPA has not identified or explained any differences. Thus, EPA's assertion in the proposed repeal that individual coal-fired plants could not meet the Clean Power Plan's uniform emission rate for

[25] Furthermore, the best system set forth in the Clean Power Plan did not actually require any particular source to engage in the off-site activity. Sources could comply simply by reducing their operations and, therefore, their emissions. *See* 80 Fed. Reg. at 64,709 ("Building blocks 2 and 3 may be implemented through a set of measures, including reduced generation from the fossil fuel-fired EGUs.").

fossil fuel-fired steam generating units through measures taken "at" or "to" the unit, *id.* at 48,037/3, is mistaken.

EPA previously rejected the premise of its purported changed interpretation—that generation-shifting measures are not measures that can be applied at or to a source itself—as false. *See* EPA Br. at 45-46. 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 repeal: "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." *Id.*

In sum, EPA is not proposing to reinterpret the statute. It is proposing, rather, to re-characterize the Clean Power Plan (inaccurately). An agency's mischaracterization of its own rule cannot form the basis for repeal of that rule. Otherwise, agencies could repeal rules at will, without providing the reasoned basis the law requires. *See State Farm*, 463 U.S. at 43.

V. EPA'S PROPOSED REPEAL OF THE CLEAN POWER PLAN IS CONTRARY TO LAW AND ARBITRARY AND CAPRICIOUS

If, as EPA claims, it is proposing a different interpretation of the best system of emission reduction with which the Clean Power Plan is incompatible, that interpretation would be unlawful as a matter of statutory construction, congressional intent, and facts on the ground. Such interpretation would exceed the agency's statutory authority and be inconsistent with the language and intent of section 111 of the Clean Air Act. It would irrationally cabin EPA's authority to address the largest sources of carbon pollution, which pose a "monumental threat to Americans' health and welfare," *see* EPA Br. at 1, and read the statute as mandating that EPA ignore how regulated sources already operate and reduce their emissions.

Section 111 plainly instructs EPA to consider any "system" of emission reduction that has been adequately demonstrated when establishing emission guidelines. Congress intentionally used language in the Clean Air Act that compels EPA to consider a broad array of emission-reduction measures to best meet the statutory purpose of protecting public health and welfare. After thoroughly considering the way in which power plants operate due to their connection on the grid and how their output of electricity—and pollution—are closely related, EPA concluded that measures through which power plants already reduce emissions through replacing higher-emitting generation with lower-emitting generation, or "generation shifting," was a "system" of emission reduction that was adequately demonstrated. EPA cited the widespread use by power generators of this method to control emissions and EPA's reliance on such measures in prior Clean Air Act programs and rules for the power sector. EPA further determined that, based on the unique characteristics of carbon pollution and the interconnected nature of the power sector, these were the "best" measures to reduce emissions considering the degree of reductions achieved, costs, energy requirements, and non-air quality health and environmental impacts.

In the preamble to the Clean Power Plan and accompanying Legal Memorandum, EPA explained in detail its determination that a "system of emission reduction"—as defined under

section 111(a)(1) of the Act and applied under section 111(d)(1)—encompasses a broad range of pollution reduction measures including generation shifting. 80 Fed. Reg. at 64,760-76; Legal Mem. 5-9, 14-18, 84-117. EPA explained that such interpretation: (1) is supported by the plain meaning of "system of emission reduction" and statutory context; (2) accommodates the very design of section 111(d)(1), which acts as a "gap-filler" to address a range of source categories and air pollutants; (3) is supported by the legislative history of section 111(a)(1) and 111(d)(1), which indicates Congress's intent to have EPA consider a wide array of measures, including ones that might be carried out by parties other than the affected sources; and (4) is reasonable in light of other Clean Air Act provisions that give EPA similar authority to consider such measures and by a comparison with other provisions that arguably require controls on the design or operation of an affected source. 80 Fed. Reg. at 64,761-66. EPA further cited several other considerations that supported the reasonableness of its interpretation, including the fact that fossil fuel-fired power plants already can and do apply generation shifting measures to reduce carbon emissions, the fact that prior EPA action under section 111(d) was based in part on generation shifting measures, and the combination of the unique characteristics of carbon dioxide pollution and the utility power sector. *Id.* at 64,724-26, 64,768-76; Legal Mem. at 5-6. EPA vigorously defended these interpretations in the *West Virginia* litigation.

EPA explicitly rejected the arguments of certain commenters that ultimately challenged the rule, such as Utility Air Regulatory Group (UARG) and Oklahoma, that the statutory text precludes EPA from considering generation shifting as a "system" of emission reduction. 80 Fed. Reg. at 64,760-61, 64,766-68. EPA stated that the phrase "system of emission reduction," by its terms and when read in context, contains no such limits and that consideration of generation shifting was consistent with the plain meaning of the deliberately-broad statutory language and context, and EPA's historical interpretation of section 111. In the proposed repeal of the Clean Power Plan, EPA now summarily adopts, in the span of a mere four pages, the very arguments that it had explicitly and in great detail previously concluded were mistaken.

EPA's proposed repeal of the Clean Power Plan fails basic tenets of rational decision-making. To justify its proposal, EPA is required to "examine the relevant data and articulate a satisfactory explanation for its action including a rational connection between the facts found and the choice made." *State Farm*, 463 U.S. at 43. An agency action is "arbitrary and capricious if the agency has relied on factors which Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, [or] offered an explanation for its decision that runs counter to the evidence before the agency." *Id.* Although agencies are free to change existing policies (within statutory boundaries), they must provide a reasoned explanation for the change. *FCC v. Fox Television*, 556 U.S. at 515. The agency must at least "display awareness that it is changing position" and "show that there are good reasons for the new policy." *Id.* Further, where, as here, a new policy rests on factual or legal determinations that contradict those underlying the agency's prior policy, the agency must provide a more detailed explanation for its policy. *Id.* "Unexplained inconsistency" in agency policy is "a reason for holding an interpretation to be an arbitrary and capricious change from agency practice." *National Cable & Telecommunications Ass'n v. Brand X Internet Servs.*, 545 U.S. 967, 981 (2005). An arbitrary and capricious regulation of this sort is itself unlawful and receives no deference. *Encino Motorcars, LLC v. Navarro*, -- U.S. -, 136 S. Ct. 2117, 2126 (2016).

EPA fails to provide a reasoned explanation for its proposed repeal of the Clean Power Plan. Its contention that the Clean Power Plan is unlawful based on a consideration of the statutory text, Congressional intent, EPA's prior understanding, statutory context, and broader policy concerns is completely erroneous. Rather, an interpretation of section 111 that requires EPA to disregard measures that sources actually use to reduce emissions, such as generation shifting, in determining the best system of emission reduction, is inconsistent with the language and purposes of the Clean Air Act, as well as with EPA's previous interpretation and applications of the statutory language. Further, EPA fails to provide any explanation, let alone the required detailed or reasoned one, for "disregarding facts and circumstances that underlay or were engendered by [its] prior policy," *see FCC v. Fox Television*, 556 U.S. at 515. Specifically, 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. Rather, in proposing to repeal the Clean Power Plan, EPA fails to acknowledge or explain crucial inconsistencies between its prior position and its new position, which is based on both a misreading of the Clean Air Act and a fundamental misconstruction of the Plan itself. The agency's interpretation in the proposed repeal is also completely devoid of any recognition of the dire threat posed by climate change, the interconnected nature of power plant generation of electricity and pollution, and the nature of carbon dioxide as a widely-dispersed pollutant.

A. Statutory Text

1. EPA's proposed repeal of the Clean Power Plan is contrary to the plain meaning and context of the relevant statutory language.

EPA proposes to interpret the phrase "through application of the best system of emission reduction" contained in section 111(a)(1) "as requiring that the BSER be something that can be *applied to* or *at* the source and not something that the source's owner or operator can implement *on behalf* of the source at another location." 82 Fed. Reg. at 48,039 (emphasis in original). As discussed above in Point IV.B, the "system of emission reduction" identified in the Clean Power Plan comports with this proposed interpretation. Any narrow and contrary interpretation, including the one on which EPA purports to base its repeal, would read textual limitations into the statutory language that would conflict with the plain meaning and context of the phrase "system of emission reduction" as it appears in section 111(a)(1) and as it is applied under section 111(d)(1).

The phrase "system of emission reduction," which itself is not defined in the Clean Air Act, appears in the definition of "standard of performance" under section 111(a)(1). EPA's determination of the "best system of emission reduction" under section 111(a)(1) serves as the basis for standards of performance that EPA establishes for new sources under section 111(b), and that states establish for any existing source under section 111(d)(1). In neither section 111(a)(1) nor section 111(d)(1) does the statute say the best system must be applicable "to" or "at" a source. Those words simply do not appear in the statutory text. Thus, even if generation shifting was not applicable "to" or "at" covered sources, that would still not provide a lawful basis for repeal of the Clean Power Plan. Reading those words into the statute is contrary to the plain meaning and context of the operative language that actually appears in the statute: "system of emission reduction."

Because the phrase "system of emission reduction" is not defined, EPA must look to its ordinary meaning. *See, e.g.*, 80 Fed. Reg. at 64,762; *see also Engine Mfrs. Ass'n v. S. Coast Air Quality Mgmt. Dist.*, 541 U.S. 246, 252-53 (2004) (where words used in a statute are not defined, the assumption is that "the ordinary meaning of that language accurately expresses the legislative purpose."). At the time Congress created the new source performance standards (NSPS) program in 1970, "system" was defined as "a complex unity formed of many often diverse parts subject to a common plan or serving a common purpose." Webster's Third New Int'l Dictionary of the English Language Unabridged 2322 (1968). Generation shifting is unquestionably a "system" of emission reduction under this definition. It involves actions that power plants—diverse parts that are integrated on a common power grid—can take to reduce emissions.

As EPA 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. In other words, consistent with congressional intent in the Act, whether or not a measure can be a "system of emission reduction" turns on whether it reduces emissions from the covered sources. This reading is supported by the context in which the phrase appears in section 111. Although that context does contain important limitations, *see, e.g., id.* (stating that "because the 'degree of emission limitation' must be '*achievable* through the *application* of the best system of emission reduction,' . . ., the 'system of emission reduction' must be limited to a set of measures that work together to reduce emissions and that are implementable by the sources themselves"), EPA found that generation shifting measures fall within such limitations. *See, e.g.*, 80 Fed. Reg. at 64,709 ("All of these measures are components of a 'system of emission reduction' for the affected EGUs because they entail actions that the affected EGUs may themselves undertake that have the effect of reducing their emissions."). Further, because the statute requires the "system of emission reduction" EPA selects to be "adequately demonstrated" and the "best" available system, statutory context clearly requires EPA to look at methods sources themselves use to reduce emissions and to select the best such method. Generation shifting must be a "system of emission reduction" within the plain meaning and context of the statutory text because it is the 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 the means by which 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 arbitrary and capricious in light of the plain meaning and context of the statutory language in section 111.

EPA specifically rejected in the Clean Power Plan the additional limitation it now proposes 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., id.* at 64,766-77 ("We see nothing in CAA section 111(d)(1) or (a)(1) which by its terms limits CAA section 111 to measures that must be integrated into the sources' own design or operations."). EPA's cursory explanation in the proposed repeal for its complete reversal of position fails to satisfy *FCC v. Fox Television's* more detailed justification standard.

EPA further attempts to justify a repeal of the Clean Power Plan by asserting that the best system interpretation "is also guided by CAA section 111(d)'s direction that standards be established '*for* any existing source,' . . . and not for other sources or entities." 82 Fed. Reg. at 48,039. EPA properly rejected this reasoning in rulemaking and in litigation as conflating the future emission standards that states set for particular sources with the "best system of emission reduction" that EPA uses to establish the degree of emission limitation that those standards must collectively achieve. EPA Br. at 60-61. Under section 111(d), it is generally states, not EPA, that establish emission standards "for" individual sources. EPA's first job, and what it did in the Clean Power Plan, is to determine the degree of emission limitation that such standards must reflect based on what can be achieved by sources through application of the best system of emission reduction. Although EPA's determination of the best system of emission reduction informs the stringency of the emission standards, it is state plans that establish standards of performance "for" each affected source. The Clean Power Plan is consistent with that direction. It contemplates that states will set the emission standards for and applicable to individual sources and it does not, as EPA implies in the proposed repeal, establish standards "for other sources or entities."

2. EPA's reliance on other Clean Air Act provisions that include the word "application" is misplaced.

EPA points to other Clean Air Act "standard-setting provisions" that, like section 111, use the phrase "through application of" as support for its claim that "the term 'application' signals a physical or operational change to a source" of a kind inconsistent with generation shifting. 82 Fed Reg. at 48,040. For instance, EPA cites to the maximum achievable control technology (MACT) provision under section 112(d)(2) and the definition of best available control technology (BACT) under section 169(3), which provide for MACT or BACT to be achieved "through application of" various measures. EPA's contention that these provisions support its position that the Clean Power Plan is unlawful is without merit.

First, the fact that these provisions specifically refer to the implementation of "technology" arguably suggests a narrower construction compared to section 111's purposefully more inclusive "system of emission reduction" language. Also, these provisions include specific lists of measures to be used to achieve the required emission limitation, arguably suggesting a narrower class of measures than intended by section 111. In any event, the measures listed under the MACT provision are non-exclusive and on their face are not limited to on-site measures. *See* 42 U.S.C. § 7412(d)(2) (calling for "application of measures, processes, methods, systems or techniques *including, but not limited to* …") (emphasis added). Even if the measures allowed under these provisions were more limited, the Supreme Court has recognized that in light of the differences between the NSPS and Prevention of Significant Deterioration programs, it is reasonable for EPA to adopt different meanings of the same statutory term to further the aims of those provisions. *See Environmental Defense Fund v. Duke Energy*, 549 U.S. 561 (2007).[26]

[26] The position that these three statutory provisions must be identically construed is also undercut by Congress's deliberate decisions throughout the history of the NSPS program to make clear that section 111(d) guidelines, in contrast, need not require the implementation of technology to limit emissions. *See* 80 Fed. Reg. at 64,701-02 (discussing changes made in the 1977 and 1990 amendments to section 111); *see also* Section V.B, *infra* (detailing additional indicia of congressional intent refuting EPA's position).

Second, EPA is simply incorrect in its apparent assumption that generation shifting measures do not qualify as operational changes to a source. For example, the agency has previously noted that decreasing operations at more carbon-intensive plants (coal or natural gas) constitutes an operational change applied at each affected source. *See* EPA Br. at 45-46.

B. Congressional Intent

1. Congress intended EPA to consider a broad range of measures to protect public health and welfare from a range of air pollutants and sources.

EPA's proposed repeal of the Clean Power Plan is also contrary to Congressional intent. Congress passed the Clean Air Act to protect public health and welfare from dangerous air pollutants by comprehensively addressing air pollution, encouraging pollution prevention, and, particularly, protecting against urgent and severe threats. 80 Fed. Reg. at 64,761, 64,773-75. In the 1970 amendments to the Clean Air Act, Congress established a regulatory regime for existing stationary sources of air pollutants designed to comprehensively address three categories of pollutants emitted from stationary sources: (1) criteria pollutants (regulated under section 110); (2) hazardous air pollutants (regulated under section 112); and (3) other pollutants "that are (or may be) harmful to public health or welfare but are not" criteria or hazardous air pollutants. 40 Fed. Reg. 53,340 (Nov. 17, 1975) (EPA regulations implementing section 111(d)). Congress specifically designed section 111(d) to cover this third category, intending it to apply to a wide range of source categories and air pollutants. 80 Fed. Reg. at 64,763 & n.474 (citing S. Rep. No. 91-1196, at 20 (Sept. 17, 1970), 1970 CAA Legis. Hist. at 420 ("[T]here should be no gaps in control activities pertaining to stationary source emissions that pose any significant danger to public health or welfare").

EPA identified the "catch-all" or "gap-filling" nature of section 111(d)(1) as support for its plain meaning interpretation that a "system of emission reduction" encompasses a broad range of measures, including generation shifting. 80 Fed. Reg. at 64,763 ("Because Congress designed CAA section 111(d) to cover a wide range of air pollutants—including ones that Congress may not have been aware of at the time it enacted the provision—and a wide range of industries, it is logical that Congress intended that the BSER provision, as applied to CAA section 111(d), have a broad scope so as to accommodate the wide range of air pollutants and source categories"). EPA also detailed in the Clean Power Plan how including generation shifting measures as a "system of emission reduction" is compelled by the protective purposes of the Clean Air Act. 80 Fed. Reg. at 64,773-75. EPA summarized:

> Climate change has become the nation's most important environmental problem. We are now at a critical juncture to take meaningful action to curb the growth in CO_2 emissions and forestall the impending consequences of prior inaction. CO_2 emissions from existing fossil fuel-fired power plants are by far the largest source of stationary source emissions. They emit almost three times as much CO_2 as do the next nine categories combined, and approximately the same amount of CO_2 emissions as all of the nation's mobile sources. The only controls available that can reduce CO_2 emissions from existing power plants in amounts commensurate with the problems they pose are the measures in building blocks 2 and 3, or far more expensive measures such as CCS.

Id. at 64,774-75.

By contrast, EPA fails to explain how its interpretation in the proposed repeal of the Clean Power Plan is consistent with the protective purposes of the Clean Air Act and the catch-all nature of section 111. As discussed above, EPA is obligated to regulate the largest stationary source of greenhouse gases that endanger human health and the environment. The Clean Power Plan is designed to address what EPA has acknowledged is a serious and global problem. *See* 74 Fed. Reg. 66,496. Yet, the proposed repeal notice barely even acknowledges the massive risks posed by global climate change, much less makes the case for its narrow reading of "system" that would allow EPA to ignore how these very sources currently reduce this very pollution. *See* 82 Fed. Reg. at 48,044 (only reference to "climate change" in proposed repeal, in regulatory impact analysis section).

2. EPA's proposed repeal of the Clean Power Plan is contrary to Congress's intent, manifest in the plain language of the statute, that EPA choose the "best" system of emission reduction that has been "adequately demonstrated."

In the Clean Power Plan, EPA identified measures including the generation shifting measures of building blocks two and three, that EPA determined collectively 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. 80 Fed. Reg. at 64,744-51. EPA determined that these measures were not only adequately demonstrated but the most cost-effective available system for sources to meaningfully limit their carbon dioxide emissions. *Id.* EPA considered other methods for reducing emissions from affected sources, such as co-firing with natural gas, implementation of CCS, conversion to natural gas, and efficiency improvements. However, EPA determined that such methods for reducing carbon dioxide emissions from power plants are either more expensive than generation shifting (such as natural gas co-firing and CCS), or are capable of achieving far less reduction in carbon dioxide emissions (such as heat rate improvement measures). 80 Fed. Reg. at 64,727-28, 64,769.

A restrictive interpretation that prohibits consideration of generation shifting measures would be inconsistent with Congress's specific instruction to EPA in section 111 to choose the "best" system of emission reduction that has been "adequately demonstrated." Because EPA's restrictive interpretation unreasonably forecloses EPA from considering the very measures that are most effective at reducing emissions, already widely used, and that power plants themselves choose to reduce emissions, it 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); *Utility Air Regulatory Group v. EPA*, 134 S. Ct. 2427 (2014) (holding that an agency must "operate within the bounds of reasonable interpretation," that a "reasonable statutory interpretation must account for both 'the specific context in which . . . language is used' and 'the broader context of the statute as a whole,'" and "an agency interpretation that is 'inconsisten[t] with the design and structure of the statute as a whole,' . . ., does not merit deference") (citations omitted).

Similarly, such an interpretation would be arbitrary and capricious because by ignoring evidence of how power plants have successfully reduced carbon pollution, the agency would have "entirely failed to consider an important aspect of the problem[.]" *State Farm*, 463 U.S. at

43. Specifically, EPA ignores the fact that "generation shifting" is a well-established "system" of emissions control, that industry has long used, and that industry commenters asked EPA to consider. *See* Legal Mem. at 14-18 (detailing industry comments that endorse the view that the best system of emission reduction under section 111(d) can encompass generation shifting measures, such as UARG's comments on EPA's Endangerment Finding that: "[f]acility-wide, plant-wide, and company-wide standards would provide valuable flexibility but also complexity in trying to integrate such standards into potential economy-wide programs like trading"). EPA noted in the Clean Power Plan that power plants "have long implemented, and are continuing to implement, the measures in building blocks 2 and 3 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" or "by" sources to reduce emissions at and of those sources, which EPA made no attempt to rebut in the repeal proposal. *See, e.g.*, Response to Comments § 3.2, at 4-5 (JA, Att. F26). 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 (JA, Att. D3); RGGI States' Comments (EPA-HQ-OAR-2013-0602-22395) at 3 (JA, Att. D4); California Air Resources Board's Comments (EPA-HQ-OAR-2013-0602-23433), Attachment, at 43 (JA, Att. D1).

As set forth in detail in Appendix B to these comments, 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. A few highlights from Appendix B regarding the successes of these state and local programs include:

- ***Substantial reductions in greenhouse gas emissions from the power sector.*** Under the Regional Greenhouse Gas Initiative (RGGI), ten northeastern states (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey,[27] New York, Rhode Island, and Vermont) have cut carbon pollution from the power sector by more than 40 percent since the program began in 2008.

- ***Significant cuts in other harmful pollutants, including mercury, nitrogen oxides, and sulfur dioxide.*** In shifting to cleaner generation, Minnesota has reduced nitrogen oxides and sulfur dioxide from coal-fired boilers by 76 percent and 80 percent, respectively, and mercury emissions by 90 percent.

- ***Continued reliability in the electricity grid.*** Iowa has added large amounts of wind energy to the grid (approximately 7,000 megawatts (MW) of installed capacity) without experiencing reliability problems. More than one-third of the state's electricity generation in 2016 was provided by wind energy.

[27] New Jersey was a member of RGGI during the first three-year compliance period (2009-11), before withdrawing in 2012. New Jersey Governor Philip Murphy has announced that the state will be rejoining RGGI this year. *See* Letter from Gov. Murphy to Governors of Nine RGGI States (Feb. 16, 2018), available at: http://www.nj.gov/dep/docs/letter-to-rggi-governors20180222.pdf.

- ***Lower consumer electricity prices.*** The RGGI states have used the proceeds from allowance auctions to fund investments in energy efficiency, further reducing demand for electricity. 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. In California, due in large part to the state's energy efficiency policies, per-capita electricity use is lower than every other state in the continental U.S. California residents pay some of the lowest monthly power bills out of any state in the country, according to the U.S. Energy Information Administration.

- ***Better economic growth, including green energy jobs.*** According to a September 2017 report by the Clean Energy Trust, Illinois has over 119,000 clean energy jobs (the highest out of twelve Midwestern states) and posted a 4.8 percent clean energy job growth from 2015-16. Similarly, in Minnesota, clean energy jobs grew more than 75 percent between 2000 and 2014, while the total Minnesota economy grew 11 percent during the same time period. Pennsylvania's renewable energy portfolio standard, which requires that 18 percent of electric power come from clean energy sources such as wind and solar by 2021, has helped to grow the clean energy industry: more than 1,300 MW of wind power 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. According to a recent report by the Analysis Group (attached hereto as ***Exhibit 4***), in 2015-17, the RGGI program led to $1.4 billion of net positive economic activity in the nine-state region.[28]

EPA previously concluded that even if it selected other emission control measures such as co-firing or CCS as the best system of emission reduction, power plants would use generation-shifting—due to its cost-effectiveness—to reduce emissions. 80 Fed. Reg. at 64,728. EPA's proposed repeal 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 allow shifts in generation in order to reduce greenhouse gas emissions. 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 in 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 relationship between the way electricity—and emissions—are generated in the power sector, and the proposed repeal now fails to account for that recognition whatsoever.

[28] The Analysis Group, *The Economic Impacts of the Regional Greenhouse Gas Initiative on Nine Northeast and Mid-Atlantic States* (April 17, 2018)

3. The selected snippets of legislative history cited by EPA in the proposed repeal fail to support EPA's reading.

With respect to the issue of Congressional intent, EPA confines its discussion in the proposed repeal to select pieces of the legislative history in isolation, in contrast to when EPA adopted the Clean Power Plan, where it comprehensively assessed such history in the context of the larger protective purposes of the Clean Air Act. *Compare* 82 Fed. Reg. at 48,040 *with* 80 Fed. Reg. at 64,763-66. As with the plain language of the statutory text, there is nothing in the legislative history of the Clean Air Act to suggest that Congress intended to limit the measures that EPA could consider or that a source could use in a way that would exclude generation shifting.

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).

Regardless, as EPA admits in the proposed repeal, "[t]he question of whether a control technique or emission reduction system is or is not 'technological' is a distinct question from whether it applies at and is limited to the level of the individual source." 82 Fed. Reg. at 48,040. There is simply nothing in the legislative history to suggest that, whether technological or not, Congress intended to prohibit EPA from considering methods, such as generation shifting, that are already in use at affected sources. On the contrary, Congress recognized that such measures could include techniques that occurred 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 a standard of performance could be based on fuel-cleaning techniques implemented by other entities. 80 Fed. Reg. at 64,765 ("Congress intended 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)"); *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's attempt in the proposed repeal to distinguish pre-combustion cleaning or treatment of fuels from generation shifting measures by arguing that the former does not necessarily occur off-site and that the use of the cleaned/treated fuels occurs within the bounds of the individual source, 82 Fed. Reg. at 48,040, n.13, is unavailing. 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, under the Clean Power Plan, when clean energy

generation increases—whether on-site or off-site—it supports on-site emission reductions from the regulated source. EPA has failed to account for its inconsistent treatment of the issue of coal-cleaning as a beyond-the-unit measure previously utilized by EPA and endorsed by Congress. *See FCC v. Fox Television*, 556 U.S. at 515-16.

C. EPA's Prior Understanding

In the proposed repeal, EPA erroneously claims that its interpretation of its authority in the Clean Power Plan was novel and that it is proposing to return to its historical understanding of section 111(d) as reflected in prior regulatory actions under this provision. 82 Fed. Reg. at 48,041. However, EPA has never previously adopted such a cramped interpretation of the "best system," and this flawed rationale is not a legitimate basis for the proposed repeal.

1. EPA mischaracterizes prior relevant regulatory actions under section 111.

As EPA explained in the Clean Power Plan, it relied on generation shifting as part of the best system of emission reduction in the only other section 111(d) rule for power plants that EPA has previously promulgated. 80 Fed. Reg. at 64,772. In a rulemaking to control mercury emissions from fossil fuel-fired power plants under section 111(d), 70 Fed. Reg. 28,606 (May 18, 2005) ("Mercury Rule"), EPA established a cap-and-trade program and based the level of the cap partly on the ability of sources to cost-effectively shift generation to lower-emitting plants. As EPA explained in the Clean Power Plan litigation: "By identifying the cap-and-trade program as part of the Best System, EPA recognized that sources need not reduce emissions at their own plants using add-on controls, but could instead use other approaches to reduce emissions, including using 'dispatch changes' (*i.e.*, generation shifting) or buying allowances from sources that had reduced emissions at their plants." EPA Br. at 34 (citing 70 Fed. Reg. at 28,619). Although the Mercury Rule was vacated on grounds unrelated to the nature of the emissions control program, *New Jersey v. EPA*, 517 F.3d 574, 583-84 (D.C. Cir. 2008), it shows that EPA's approach in the Clean Power Plan is not novel. Further, industry representatives strongly supported a cap-and-trade system in the Mercury Rule. *See* UARG Mercury Rule Comments; Joint Respondent Intervenors' Brief in *New Jersey v. EPA*.

EPA now claims in the proposed repeal of the Clean Power Plan that the cap-and-trade program in the Mercury Rule was "ultimately predicated on measures taken at the level of individual sources," 82 Fed. Reg. at 48,041, n.14, and based solely on "control technology available" for installation on individual sources. *Id.* at 48,042, n.21 (citing 70 Fed. Reg. at 28,617). These statements are specious. In the preamble to the Mercury Rule, EPA expressly stated that: "Under the cap-and-trade approach [*i.e.*, the approach it adopted in the rule] we are projecting that Hg reductions result from units that are most cost-effective to install control, which enables those units that are not cost effective to use other approaches for compliance including buying allowances, switching fuels, or making dispatch changes." 70 Fed. Reg. at 28,619 (emphasis added); *see also* Legal. Mem. at 113-16. EPA now ignores this contradictory language and fails to acknowledge—let alone adequately explain—its reversal of its former treatment of the Mercury Rule as set forth in the Clean Power Plan preamble, Legal Memorandum, and litigation briefing. This unexplained inconsistency is a sufficient basis on which to find EPA's proposed repeal to be arbitrary and capricious. *See FCC v. Fox Television*,

556 U.S. at 515-16; *National Cable & Telecommunications Ass'n v. Brand X Internet Servs.*, 545 U.S. at 981.

As support for its purported "return" to its historical understanding related to the best system, EPA also cites to prior rules it has issued under section 111 for industries other than the power sector that it claims have "limited their BSER to physical or operational measures taken at and applicable to the individual sources." 82 Fed. Reg. at 48,041. Setting aside that generation shifting is such a measure, the fact that EPA has not relied on generation shifting for rules applicable to other source categories besides power plants, and for pollutants other than carbon dioxide, is entirely irrelevant. EPA specifically explained in detail in the Clean Power Plan that the uniquely-integrated nature of the utility power sector and the unique characteristics of carbon pollution make generation shifting measures appropriate for consideration as the best system for a rule regulating carbon dioxide emissions from power plants. 80 Fed. Reg. at 64,726, 64,728, 64,768.

2. EPA relies on other prior regulatory snippets that do not support a narrow reading of the statute.

In the proposed repeal, EPA cites to a 1975 rulemaking promulgating procedures and requirements for the submittal of state plans in which EPA describes section 111 as requiring a "technology-based approach." 82 Fed. Reg. at 48,041. EPA claims that this language shows that "EPA clearly interpreted the phrase 'system of emission reduction' to be technology-based and source-based for both CAA section 111(b) standards of performance and CAA section 111(d) emission standards." *Id.* Again, setting aside the fact that the Clean Power Plan is "source-based," EPA's reliance on this language is misplaced. As with the legislative history on which EPA relies, this language does not say that the system must be applied "at" or "to" an individual source, and elsewhere in the proposed repeal EPA admits that is a separate issue from whether a system is technological. *See* 80 Fed. Reg. at 48,040. And EPA also admits that section 111 systems are not limited to technology-based measures anyway. *Id.* at 48,040.

On the other hand, EPA ignores other agency actions that are contrary to its interpretation, including implementing regulations put in place before the Clean Power Plan that clarified that section 111(d) standards may include trading programs (i.e., programs that allow a source to avoid applying controls "at" or "to" its own facilities by paying others to control pollution from their facilities). *See* 40 C.F.R. § 60.21(f) (defining an emission standard under section 111(d) as encompassing "an allowance system").

D. Statutory Context

1. EPA unreasonably dismisses other Clean Air Act programs or rules that were precedents for its selection in the Clean Power Plan of generation shifting as a "system of emission reduction" for the power sector.

EPA now dismisses the relevance of several other previous Clean Air Act programs and rules for the power sector that it determined in the Clean Power Plan provided support for its consideration of generation shifting as an adequately demonstrated system of emission reduction. *Compare* 80 Fed. Reg. 64,770-73; Legal Mem. 98-99, 102; EPA Br. at 32-33, *with* 82 Fed. Reg. at 48,042. For example, EPA previously cited to the 2011 Cross State Air Pollution Rule

(CSAPR), in which it 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. 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. 80 Fed. Reg. at 64,772 n.545, Legal Mem. at 96-98, 100-02.

EPA had also previously pointed to 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. 80 Fed. Reg. at 64,770-71 (citing S. Rep. No. 101-228, at 316 (1989) (identifying strategies for power plants to reduce emissions to include "least-emissions dispatching," *i.e.*, generation shifting)); Legal Mem. at 88-93 (detailing legislative history of Title IV demonstrating Congress's support for dispatch shifts and encouraging renewable energy technologies as cost-effective methods to "reduce emissions of acid rain precursors and *global warming gases*" (citing Sen. Fowler, Sen. Debate on S. 1630 (Apr. 3, 1990), 1990 CAA Legis. Hist. at 7106) (emphasis added)).

EPA now attempts to distinguish these programs on the grounds that Congress expressly established the cap-and-trade program under Title IV and expressly authorized use of marketable permits to implement standards under section 110, such as CSAPR. To the contrary, it is particularly appropriate for EPA to consider generation shifting as a system of emission reduction approach "already endorsed by Congress in a related context," especially given Congress's choice of a capacious word like "system." *See Van Hollen v. FEC*, 811 F.3d 486, 493 (D.C. Cir. 2016); 80 Fed. Reg. at 64,770-71; *see also* Legal Mem. at 92-93 (explicitly rejecting argument that Title IV precludes EPA from considering generation shifting as BSER and instead citing to "strong legislative history indicating that 'conservation and renewables' were intended to become 'a central part of the nation's clean air policies immediately'" (citing Additional Views of Rep. Markey & Rep. Moorhead, H.R. Rep. No. 101-490, at 674 (May 17, 1990)).

2. A narrow interpretation that precludes consideration of generation shifting measures when determining the best system of emission reduction fails to consider states' corresponding flexibility under section 111(d) to adopt standards of performance that allow generation shifting for compliance.

Sections 111(d)(1) and (d)(2) expressly reference section 110, which provides states with flexibility under the National Ambient Air Quality Standards (NAAQS) program to adopt state implementation plans to meet federal emission goals through "other control measures, means, or techniques (including economic incentives such as fees, marketable permits, and auctions of emission rights)." 42 U.S.C. § 7410(a)(2)(d). It is well-established that states may adopt section 111(d) standards of performance in the form of tradable emission rates or mass limits under appropriate circumstances. *See* 40 C.F.R. § 60.21(f); 80 Fed. Reg. at 64,840-41. And numerous states and industry stakeholders urged in comments to EPA on the Clean Power Plan that states have discretion under section 111(d) to adopt standards in the form of trading programs to facilitate the ability of industry to rely on generation shifting for compliance. 80 Fed. Reg. at 64,733 n.380; Legal Mem. 14-18.

EPA previously pointed out the incongruity of interpreting section 111(d) to allow states to have discretion to authorize and incentivize sources to use generation shifting as a pollution

control strategy, but at the same time limiting EPA's authority to interpret the phrase "best system of emission reduction" to encompass the same strategy. EPA Br. at 47-49. In its proposed repeal of the Clean Power Plan, EPA fails to acknowledge or account for this inconsistency.

3. EPA fails to consider the breadth of section 111's "best system of emission reduction" language in comparison with other, narrower language elsewhere in the statute.

As EPA found in the Clean Power Plan, the broadly inclusive nature of section 111(d)(1) and (a)(1) is also confirmed by comparing it to other Clean Air Act provisions that contain narrower language than "best system of emission reduction," and that explicitly require controls on the design or operations of an affected source. *See, e.g.*, 80 Fed. Reg. 64,767 (citing section 111(a)(7), section 407(b)(2), and section 169A). EPA also fails to address these distinctions in the proposed repeal. Rather, when describing the Clean Power Plan in the proposed repeal, EPA now appears to have improperly conflated the narrower "best available retrofit technology" (BART) language of section 169 with section 111's "best system of emission reduction" language. *See* 82 Fed. Reg. at 48,037 ("The rule established performance standards for coal-fired plants assuming a uniform emissions rate well below that which could be met by existing units though any *retrofit* technology of reasonable cost available at the time") (emphasis added). Moreover, as pointed out in the comments many of the States and Cities submitted on the proposed Clean Power Plan, EPA has in fact not required source-specific measures to demonstrate compliance with BART. Instead, EPA's regulations allow sources to comply by showing that their participation in multistate trading programs will result in "better than BART" emission reductions. *See* Joint State Comments at 49. As discussed in those comments, that approach was upheld by the D.C. Circuit, which subsequently reaffirmed the approach in a decision issued last month in *Utility Air Regulatory Group v. EPA*, Case No. 12-1342 (D.C. Cir., Mar. 20, 2018).

EPA also incorrectly argues that a constrained interpretation of section 111(d) is necessary to harmonize it with the "best available control technology" provision in the PSD program. 82 Fed. Reg. at 48,041-42. The "floor" language to which EPA refers, contained within the BACT definition in section 169(3), 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" to facilities that triggered PSD permitting as newly-constructed or major modifications would be those established by EPA under section 111(b) for new facilities and for modifications, 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.

E. Broader Policy Concerns

Under the category of "broader policy concerns," EPA contends that interpreting section 111(d) to reject consideration of generation shifting in determining the best system of emission reduction "has the advantage of not implicating" the "clear statement" doctrine, "in that it would avoid potentially transformative economic, policy and political significance in the absence of a clear Congressional statement of intent to confer such authority on the Agency." 82 Fed. Reg. at 48,042. EPA also seeks comment on "whether the CPP exceeded the EPA's

proper role and authority" by purportedly regulating the electricity sector and whether its new interpretation "would ensure that CAA section 111 has not been construed in a way that supersedes or limits the authorities and responsibilities of the Federal Energy Regulatory Commission (FERC) or that infringes on the roles of the states." *Id.* These concerns are misplaced. As the agency correctly concluded in rejecting these same claims in the Clean Power Plan rulemaking and litigation, EPA's interpretation of section 111(d) is fully authorized and also does not impermissibly infringe on FERC's or states' jurisdiction.

Finally, EPA's failure to seek comments on the "broader policy concerns" related to our country's ability to address climate change pollution and its resulting harms in the wake of repealing the Clean Power Plan is further evidence that the proposed repeal is an unreasonable interpretation of the Clean Air Act and is arbitrary and capricious.

1. A "clear statement" is not required here.

The proposal's implicit assumption that the Clean Power Plan is a "transformative" rule—thereby implicating (in EPA's new view) the need for a "clear statement" from Congress authorizing the Plan—is erroneous. EPA previously considered, and properly rejected, arguments advanced by then Attorney General Pruitt and others in the Clean Power Plan rulemaking and subsequent litigation that a "clear statement" was necessary before EPA could consider pollution reductions achieved by generation-shifting measures in promulgating the Clean Power Plan's emission guidelines. 80 Fed. Reg. at 64,782-85; EPA Br. 40-44.

The Clean Power Plan regulates air pollution from power plants, an area plainly within EPA's authority. *See* 42 U.S.C. § 7411. The fact that the Clean Power Plan would encourage cleaner generation by requiring that the cost of carbon pollution reduction be factored into the cost of generating electricity is hardly unique. Rather, this is a common feature of power plant regulations under the Clean Air Act, such as those requiring power plants to reduce emissions of nitrogen oxides, sulfur dioxide, and mercury. Those regulations—such as CSAPR and the Mercury Air Toxics Standards—have been adjudged under the traditional *Chevron* standard, despite their incidental effects on the cost of generating electricity. *See EPA v. EME Homer City Generation, L.P.*, 134 S. Ct. 1584 (2014); *Michigan v. EPA*, 135 S. Ct. 702 (2014). Furthermore, the Supreme Court has recognized that Congress gave EPA authority under section 111(d) to balance environmental protection with energy needs in regulating carbon pollution from these sources. *See AEP*, 564 U.S. at 427 (EPA's mandate under section 111(d) is to make an "informed assessment of competing interests[,] including not only 'the environmental benefit potentially achievable,' but also our Nation's energy needs").

The generation shifting aspect of the Clean Power Plan does not make it a "transformative" regulation requiring further delegation of authority from Congress. As explained in Sections III, IV, and V above, EPA's consideration of generation-shifting as a "system of emission reduction" is well supported by the statute and the administrative record. In the Clean Power Plan rulemaking and the litigation that followed, EPA properly rejected the contention that "textual snippets" relied on by then Attorney General Pruitt and other petitioners prohibit the agency from considering these proven measures in reducing carbon pollution. EPA Br. 60-68 (citing 80 Fed. Reg. 64,762, 64,765, 64,767, 64,773, 64,826, 64,841). EPA cited

previous regulations that either considered generation shifting in setting emission standards or as a means of compliance, or otherwise accounted for emission reductions that may have physically occurred off the plant site (*e.g.*, coal washing). EPA Br. 32-34. Furthermore, as the States and Cities explained in the Clean Power Plan rulemaking, the subsequent litigation, and above in these comments, power plants in our jurisdictions have successfully cut carbon dioxide emissions by shifting from coal to natural gas and renewables in the generation of electricity. *See* Joint State Comments at 15-19, 22-24; Brief of State Intervenor-Respondents in *West Virginia v. EPA* (D.C. Cir. 15-1363) (Apr. 29, 2016) at 25-29 (JA, Att. A6); *see also* Comments of Fourteen State Agencies on EPA's Proposed Repeal of the Clean Power Plan (Apr. 17, 2018) at 6 ("Compliance with the CPP would involved actions of the same nature as changes already occurring in the electricity sector and actions that our states already use to successfully reduce emissions of both carbon dioxide and other pollutants from the power sector"). Similarly, power companies explained that it was "business as usual" to shift generation among sources as a means of achieving numerous objectives, including the reduction of carbon dioxide and other emissions. *See* Brief of Industry Intervenor-Respondents in *West Virginia v. EPA* (D.C. Cir. 15-1363) (Apr. 29, 2016) at 2-3.

Nor does the scope of the emission reductions required under the Rule trigger any "clear statement" requirement. When it promulgated the Clean Power Plan, EPA determined that the use of coal to generate electricity would be 5.4 percent less with the rule than without it. *See* EPA Br. 39 (citing Regulatory Impact Analysis at 3-27 (tbl. 3-11)). As Judge Griffith remarked during the *en banc* oral argument, such a change "hardly seems transformative." *See* Trans. of Oral Arg. in *West Virginia v. EPA* (D.C. Cir. No. 15-1363, Sept. 27, 2016) at 5 (JA, Att. A9). In addition, when EPA denied reconsideration of the Clean Power Plan in January 2017, it found that even with the Clean Power Plan stayed, "trends away from coal-fired generation and towards cleaner generation have accelerated." EPA Reconsideration Denial at 2. For 24 states, emissions from fossil-fueled power plants in 2015 were lower than their 2022 emission goals under the Clean Power Plan, and downward trends continued through the first nine months of 2016. *Id.* at 3. The agency further noted that "[s]everal different modeling studies show that approximately one-third to more than one-half of the states are expected to achieve the 2030 goals as a result of business-as-usual trends, including at least some that at present are coal heavy." *Id.*; *see also id.* at 22 ("[T]his information demonstrates that the state emission targets required by the CPP can be achieved with significantly less impact on the generation mix in the industry, and at much lower cost, than the EPA projected at the time of promulgation"). This further demonstrates EPA's conclusion that the Clean Power Plan is a "trends following" rule, not a transformative one.

In a recent case, the Third Circuit rejected a similar "clear statement" argument. There, the court held that the Clean Water Act contained sufficiently clear direction for EPA to issue a regulation on the Total Maximum Daily Load of non-point source pollution causing water quality degradation in Chesapeake Bay. In *Am. Farm Bureau Fed'n v. EPA*, 792 F.3d 281, 303 (3d Cir. 2015), the court rejected petitioners' argument that a "clear statement" from Congress was required because of the regulation's alleged intrusion on state authority in regulating land use. The court reasoned that "once an agency is operating in the weeds of a statute that obviously requires federal oversight of some state functions, we will not require subordinate clear statements of congressional intent every time an interpretation arguably varies the usual balance

of responsibilities between federal and state sovereigns." *Id.* at 304. Likewise, EPA's interpretation of another technical term, the "best system of emission reduction," does not require "subordinate statements of congressional intent" to enable the agency to consider common-sense, practical emission reduction measures that are used routinely in the industry.

2. Because the Clean Power Plan regulates air pollution, not electricity generation, EPA was correct in previously rejecting claims that the Plan infringes on the jurisdictions of the states or FERC.

Under the Clean Air Act, EPA has a mandate to serve "as primary regulator of greenhouse gas emissions" from power plants. *AEP*, 564 U.S. at 427-28; *see also Texas v. EPA*, 726 F.3d 180, 197 (D.C. Cir. 2013). The Clean Power Plan is similar to other air pollution rules for power plants and effects on types of electricity generation are ancillary and commonplace. Therefore, it does not intrude on the authority of the states or FERC to regulate the generation and sale of electricity.

First, the Clean Power Plan does not infringe on the right of states to regulate electricity generation. As explained in the States and Cities' rulemaking comments and merits brief in the *West Virginia v. EPA* litigation, state decisions regarding electricity generation have long been constrained by the concurrent regulatory authority of Congress, which has delegated authority to federal agencies over many aspects of operating power plants. *See* State Br. 9-12. Concurrent federal jurisdiction over aspects of running a power plant properly reflects the fact that many of those aspects likely affect multiple states due to safety and environmental risks that cross state lines, as well as the interconnected nature of the electricity market. *See, e.g.*, *Pac. Gas & Elec. Co. v. State Energy Res. Conservation & Dev. Comm'n*, 461 U.S. 190, 205 (1983).

EPA's pollution regulations are an example of one of these federal constraints. Air pollutants—including carbon dioxide emissions—have substantial interstate effects that the Clean Air Act was designed to address. *See EME Homer City Generation*, 134 S. Ct. at 1593-94; *Massachusetts*, 549 U.S. at 521-22. State policy choices in this area thus appropriately account for and yield to federal pollution regulations. *Cf. Hodel v. Va. Surface Mining & Reclamation Ass'n*, 452 U.S. 264, 290 (1981) (rejecting state Tenth Amendment claim against surface mining regulations, citing "congressional authority to displace or pre-empt state laws regulating private activity affecting interstate commerce when these laws conflict with federal law"). Although states make policy-based decisions about their electricity generation markets (and would continue to do so under the Clean Power Plan), states do not have unfettered discretion to determine their energy-generation mix without regard for the requirements of federal environmental laws. And as explained in our previous filings in the *West Virginia* litigation, state energy commissions are well-accustomed to dealing with power-plant implementation of federal air pollution requirements. *See* State Br. 11, 20-23; *see also* Comments of Fourteen State Agencies on EPA's Proposed Repeal at 5 ("Under the CPP, state energy regulators would maintain their independent authority to oversee retail electricity prices and to license new electric generating capacity").

Moreover, the Clean Power Plan is a lawful exercise of EPA's statutory authority because any changes to a State's energy mix would merely be an incidental effect of the Rule's permissible focus on reducing carbon dioxide emissions. As the Supreme Court explained in

FERC v. EPSA, 136 S. Ct. 760, 776 (2016), whether a federal regulation improperly intrudes on an area of state control should be judged by assessing what it directly regulates, not by looking at any downstream effects it may have. In that case, the Court addressed a federal rule that directly "regulate[d] what takes place on the *wholesale* [electricity] market"—an area of federal regulation under the Federal Power Act (FPA)—but that also "of necessity" "affect[ed]" retail electricity rates—an area expressly reserved to the states under the Act. *Id.* (emphasis added). The Court held that the rule's effect on retail rates was "of no legal consequence" and did not "run afoul" of the FPA's grant of authority to states over retail electricity. *Id.* The same is true here. The Clean Power Plan directly regulates pollution, a subject squarely within EPA's regulatory jurisdiction; it is thus permissible regardless of its potential downstream effects on a State's energy mix. *Cf. Nat'l Ass'n of Regulatory Util. Comm'rs v. FERC*, 475 F.3d 1277, 1280 (D.C. Cir. 2007) (recognizing that FERC's "indisputable authority" over entities directly subject to its jurisdiction "may, of course, impinge as a practical matter on the behavior of non-jurisdictional" entities).

The Clean Power Plan permissibly focuses on pollution reduction rather than direct energy regulation, as evidenced by the fact that the rule is indifferent about the specific means by which states and power plants achieve the rule's emission limits. The Clean Power Plan gives states substantial flexibility to determine how emission limits will be met, so long as the rule's pollution-reduction goals are satisfied. So, although EPA determined that cost-effective and readily available reductions could be achieved in part by increasing electricity generation from cleaner fuels or renewable energy—methods that power plants have used to comply with air quality regulations for years, *see* 80 Fed. Reg. at 64,666-67, 64,710—nothing in the Clean Power Plan requires states or sources to adopt such measures in the manner or at the level that EPA has determined is achievable. *See id.*

The Clean Power Plan thus operates in a manner similar to many previous Clean Air Act regulations by controlling air pollution from power plants without dictating the precise manner by which states and sources comply with these pollution limits. *See, e.g.*, *Michigan v. EPA*, 213 F.3d 663, 687-688 (D.C. Cir. 2000) (EPA's rule provided states with "real choice" in implementing the "assigned reduction levels"). This balance between federal and state authority appropriately helps to ensure that the Clean Power Plan will achieve meaningful reductions in carbon-dioxide emissions without improperly intruding on state regulation of electricity generation.

Finally, to the extent EPA believes that repealing the Clean Power Plan would avoid the need for state public utility commissions to be involved in reviewing decisions made by power plant operators to comply with carbon pollution limits, such a belief would be mistaken, and contradicted by the Clean Power Plan rulemaking record. State regulators routinely choose to play a role in this area by reviewing changes in power generation—whether caused by state or federal regulations, economic forces, industry practice, or power-plant owners' private business decisions. It is common for state regulators to evaluate and decide applications from power plants seeking to comply with federal air-quality regulations or seeking to recover the costs of such compliance, including regulations such as the Mercury Air Toxics Standards. *See* State Br. 20-21.

The Clean Power Plan likewise does not intrude on FERC's authority. As EPA explained in its brief in the *West Virginia* litigation, the rule does not infringe on FERC's authority under the Federal Power Act to regulate interstate sales of electricity because it does not regulate *any* kind of electricity sales or rates: interstate or intrastate. *See* EPA Br. at 59. In addition, EPA coordinated extensively with FERC during the development of the Clean Power Plan on the design and subsequent implementation of the rule. *See* 80 Fed. Reg. at 64,875-76. FERC did not object that the rule was encroaching on its regulatory authority. This point was recently reaffirmed in the letter submitted by several former FERC commissioners last month objecting to the proposed repeal of the Clean Power Plan. *See* Comments of Former FERC Commissioners Norman C. Bay, John Norris, and Jon Wellinghoff (March 27, 2018). And as discussed above, state public utility commissions (as well as independent and regional transmission operators) have extensive experience in ensuring that power plant operators' compliance with new federal pollution requirements does not undermine the reliability of the electrical grid. *See* State Br. 11, 20-23.

3. EPA's proposed repeal completely ignores important "broader policy concerns" regarding the pressing need to address climate change harms.

An erroneous (and inexplicable) omission from the agency's "broader policy concerns" section in the proposed repeal is what repealing the Clean Power Plan—without a suitable replacement—would mean to efforts to combat climate change harms. As explained above, *see* Point II, *supra*, harms attributable to climate change will only worsen in the future unless we act now to substantially cut emissions of carbon dioxide and other greenhouse gases. Yet EPA's preamble discussion in the proposed repeal reads like a dry, esoteric lecture on statutory interpretation, improperly omitting any discussion of the implications for deferring action on the largest stationary source emitters of greenhouse gases in the country. *See PDK Labs v. U.S. DEA*, 362 F.3d 786, 797-98 (D.C. Cir. 2004) ("[I]t is incumbent upon the agency not to rest simply on its parsing of the statutory language. It must bring its experience and expertise to bear in light of the competing interests at stake."). As EPA noted last year during the *West Virginia* litigation, "[n]o serious effort to address the monumental problem of climate change can succeed without meaningfully limiting [power] plants' CO_2 emissions."[29] Yet that is exactly the course EPA now proposes to take, without even pausing to evaluate what such a course would mean to the public health and welfare. An agency commits reversible error when it incorrectly concludes that particular regulatory action is mandated by statute. *See Prill v. N.L.R.B.*, 755 F.2d 941, 947-48 (D.C. Cir. 1985).

EPA also fails to address the broader policy concern of what a Clean Power Plan repeal would mean with respect to anticipated reductions in conventional pollutants ("co-benefits") as a result of compliance measures power plants would have undertaken to comply with the Plan's carbon reduction requirements. EPA expected that the Plan's implementation would reduce pollutants that contribute to particulate matter and ozone pollution by more than 20 percent in 2030, including about 318,000 tons of sulfur dioxide and 282,000 tons of nitrogen oxides. *See* EPA Fact Sheet, *The Clean Power Plan by the Numbers* (Aug. 2015), at 2 (JA, Att. F14). EPA anticipated that these pollution reductions would save lives and prevent illnesses, including

[29] EPA Final Brief in *West Virginia v. EPA*, Doc. #1609995, at 61

1,500-3,600 premature deaths, 1,700 nonfatal heart attacks, 90,000 asthma attacks, 1,700 hospital admissions, and 300,000 missed school and work days. *See id.*[30]

The agency also has ignored possible international effects from a repeal. First, a repeal, especially when considered together with President Trump's announcement that he will seek to withdraw the United States from the Paris climate accord, may send a signal to other countries that the U.S. no longer views fighting climate change as a priority, which could in turn lead other countries to cut back on their commitments to address greenhouse gas emissions, further exacerbating the problem of climate change harms, such as premature deaths and illnesses caused by elevated ozone concentrations. EPA recognized the international implications of its actions when it promulgated the Clean Power Plan. *See* 80 Fed. Reg. at 64,699-700 (Clean Power Plan and related policies "encourage[] other major economies to take on similar contributions, which is critical given the global impact of [greenhouse gas] emissions"). Although the States and Cities, along with other cities and businesses, have stepped forward to renew our commitments to address greenhouse gas emissions (and many other nations have thus far confirmed their continued commitment to the Paris accord), that other countries could change their minds in response to a repeal of the Clean Power Plan is a foreseeable risk that EPA has failed to consider. *See id.* at 64,699 ("American commitment is indispensable to effective international action.").

Second, EPA has also failed to consider that the statute provides a mechanism for other countries harmed by pollution emanating from the U.S. to petition the EPA for relief. 42 U.S.C. § 7415. Repealing the Clean Power Plan would, by EPA's own analysis, increase the amount of carbon pollution from power plants. And as the agency has recognized, greenhouse gas emissions from U.S. sources contribute to elevated greenhouse gas concentrations worldwide, in turn causing climate change harms. *See* 80 Fed. Reg. at 64,699-700.

EPA's failure to take into account the national and international implications of repealing the Clean Power Plan is arbitrary and capricious. *See State Farm*, 463 U.S. at 43 (failure to consider an important aspect of the problem renders decision arbitrary).

VI. EPA'S REVISED REGULATORY IMPACT ANALYSIS SIGNIFICANTLY UNDERSTATES THE ECONOMIC IMPACTS OF REPEALING THE CLEAN POWER PLAN

The proposed repeal of the Clean Power Plan would have significant economic impacts on the States and Cities. This section provides comments on EPA's revised analysis as embodied in the October 2017 Regulatory Impact Analysis for the Review of the Clean Power Plan: Proposal (the "Revised Analysis").[31]

[30] Despite the flaws in EPA's revised Regulatory Impact Analysis, *see* Section VI, *infra*, even the revised analysis demonstrates the substantial co-benefits that would be lost if the agency were to repeal the Clean Power Plan.

[31] The original impact analysis is contained in the "Regulatory Impact Analysis for the Clean Power Plan Final Rule", EPA-452/R-15-003, August 2015 (the "Original Analysis") (JA, Att. F23).

The Revised Analysis is undermined by several fatal flaws, including: utilizing inappropriate discount rates, underestimating the co-benefits of the Clean Power Plan and the social cost of carbon, overestimating avoided compliance costs, and improperly changing the accounting method for energy efficiency and demand response measures. As a result, the Revised Analysis significantly understates the net benefits afforded by the Clean Power Plan. Therefore, any policy decision based on the Revised Analysis would be misinformed and not properly account for public health and welfare, contrary to the basic aim of the Clean Air Act.

Despite these flaws and their implications, it is worth noting that the Revised Analysis does provide further evidence that the Clean Power Plan would substantially benefit public health by preventing avoidable deaths and illnesses. *See e.g.*, Revised Analysis at 52, Table 3-10 (estimating between 1,100 and 3,600 premature deaths attributed to exposure to fine particulate matter would be avoided annually beginning in 2030 based on no-threshold and lowest measured level scenarios). This additional evidence emphasizes the significance of what is at stake and acknowledges the acute "life and death" impact of the Plan on individuals—a perspective that can be lost when distilling a complicated issue down to an aggregate cost-benefit analysis.

A. The Revised Analysis Uses Inappropriate Discount Rates

EPA's Revised Analysis incorporates net present value ("NPV") calculations that utilize various discount rates. The Revised Analysis utilizes a 7-percent discount rate in many of its cost, benefits, and net benefits calculations that differs from the Original Analysis's use of discount rates of 2.5 percent, 3 percent, and 5 percent.[32,33] 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 leads to a significant underestimate of the NPV of the Clean Power Plan.

A 7-percent discount rate overstates the opportunity cost of compliance with the Clean Power Plan. The costs of the Clean Power Plan occur relatively sooner than many of the expected benefits. Therefore, all else being equal, using a higher discount rate will increase the NPV of compliance costs relative to benefits. To the extent that the 7-percent discount rate is used as a proxy for the opportunity cost of capital,[34] it overstates the actual return the entities making compliance investments would expect to realize from alternative investments.

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[32] *See e.g.*, Revised Analysis, pp. 43; Original Analysis, Tables ES-7 and ES-9.

[33] 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.

[34] Revised Analysis, pp. 43, 166.

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 Revised Analysis 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," but does not provide any justification for why this discount rate should be used to discount future Clean Power Plan benefits including "uncertainness associated with demand-side energy investments," "uncertainty in health benefits estimation," and "characterization of uncertainty in monetizing climate-related benefits."[35]

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, hence why 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 at 12. 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.*,[36] EPA failed to explain its departure from the discount rates used in the Original Analysis and its choice of a 7-percent rate in the proposed repeal.

B. The Revised Analysis Significantly Underestimates the Public Health Benefits of the Clean Power Plan.

In addition to the issues regarding discount rates mentioned above, EPA's Revised Analysis changes the methodology used in the Original Analysis resulting in an underestimation of the public health benefits of the Clean Power Plan. In particular, the Revised Analysis'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 associated with the Clean Power Plan. There is no scientific or legal basis for the agency to ignore these benefits.

The NAAQS were set as reasonable benchmarks for limiting "unacceptable risks to public health."[37] EPA's use of the NAAQS as thresholds in its Revised Analysis fundamentally ignores the public health costs resulting from exposures below those limits. Furthermore, this use contradicts the EPA's own findings that some risk is expected at and below the levels of the

[35] Revised Analysis, pp. 2-3.

[36] *See also* Guidelines for Preparing Economic Analysis, Section 6-15; Original Analysis, p. ES-19.

[37] The Clean Air Act "does not require that NAAQS be set at zero-risk levels, but rather at levels that avoid unacceptable risks to public health." October 2010, Policy Assessment for the Review of the Carbon Monoxide National Ambient Air Quality Standards (EPA 452/R-10-007), 2-76.

NAAQS and considers these to be legitimate components of the total benefits estimate.[38] Put differently, EPA's use of the NAAQS assumes that these standards represent limits below which there are no discernible benefits. This assumption is wrong, contrary to findings in current policy research,[39] and contrary to EPA's own findings establishing the NAAQS for non-threshold pollutants, such as particulate matter and ozone.[40,41,42]

The exclusion of these valuable public health benefits renders the Revised Analysis fatally incomplete.

C. The Revised Analysis Significantly Underestimates the Social Cost of Carbon.

EPA's Revised Analysis also underestimates the social cost of carbon by only considering impacts "within U.S. borders."[43] This approach is 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."[44] By narrowing consideration of the social cost of carbon to impacts "within U.S. borders," the Revised Analysis erroneously assumes (1) any benefits that occur 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 independent of U.S. climate change policy.[45]

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[38] Regulatory Impact Analysis for the Final Revisions to the National Ambient Air Quality Standards for Particulate Matter. U.S. Environmental Protection Agency, Washington, DC, EPA-452/R-12-005, 2013. Chapter 5.7.5, page 5-89 (JA, Att. F24).

[39] Kimberly Castle & Richard Revesz, Environmental Standards, Thresholds, and the Next Battleground of Climate Change Regulations, *Minnesota Law Review* (forthcoming), vol. 103, 2018, *available at*: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3154669.

[40] Policy Assessment for the Review of the Particulate Matter National Ambient Air Quality Standards. U.S. Environmental Protection Agency, Washington, DC, EPA 452/R-11-003. April 2011. Chapter 1.2.1, pp. 1-3 (JA, Att. F22).

[41] U.S. EPA. Integrated Science Assessment (ISA) for Particulate Matter (Final Report, Dec 2009). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-08/139F, 2009 (JA, Att. F15).

[42] U.S. EPA. Integrated Science Assessment (ISA) of Ozone and Related Photochemical Oxidants (Final Report, Feb 2013). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-10/076F, 2013 (JA, Att. F16).

[43] Revised Analysis. p. 4.

[44] 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 (JA, Att. I8).

[45] EPA's policy in this regard is also inconsistent with section 415 of the Clean Air Act, which requires that EPA consider impacts of domestic pollution when it affects foreign countries when those foreign countries have given the United States "essentially the same rights with respect to prevention or control." *See* 42 U.S.C § 7415.

EPA's assumption that any Clean Power Plan 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 many 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 import to U.S. electricity consumers.[46]
- 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.[47]
- 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).

These logical flaws do not withstand elementary scrutiny. Therefore, many benefits that deserve consideration in the determination of a domestic social cost of carbon are ignored by the Revised Analysis, which consequently underestimates the true social cost of carbon "within U.S. borders."

EPA's implicit assumption that other countries' climate change policies are made completely independent of U.S. policy is also fundamentally flawed. This assumption ignores economic theory showing that when domestic policy creates externalities that are enjoyed by a foreign entity (and vice versa), the optimal policy will be one in which both parties (domestic and foreign) expend more than they otherwise would if they were to ignore these externalities.[48] Put differently, by taking the welfare of foreign entities into consideration in estimates of the social cost of carbon, a domestic entity will encourage the foreign entity to do the same, hence allowing entities to enjoy the benefits created from coordinated action. Therefore, ignoring non-domestic benefits in the social cost of carbon underestimates the true cost because the additional costs of carbon pollution imposed by the resulting policy changes that could be made in retaliation by foreign entities, many of which currently rely on estimates that consider global costs. For example, the United Nations Framework Convention on Climate Change ("UNFCCC") featured elements that demonstrate how the members considered the interdependence of policy decisions across countries including the importance of repeated

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[46] *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 (JA, Att. B75).

[47] *Valuing Climate Damages* at 53.

[48] *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.

interaction between nations, complete information, the potential use of transfer payments between nations, and commitments for climate finance to developing countries.[49]

D. The Revised Analysis Significantly Overestimates Compliance Costs.

EPA's Revised Analysis overstates compliance costs both in relative and absolute terms. As mentioned above, EPA's choice of a 7-percent discount rate overstates the magnitude of compliance costs relative to benefits. In addition, EPA's Revised Analysis ignores the structural changes that have taken place in the energy markets since 2015 that would decrease expected compliance costs in absolute terms, all else being equal.

The relevant energy markets have changed since the Original Analysis in 2015. This fact is evidenced by EPA's observation in January 2017 in its reconsideration denial that "information, data, and analyses published since the release of the CPP in August 2015 demonstrate that the 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."[50] These trends represent Clean Power Plan compliance costs that have already been realized (*i.e.*, these costs are sunk). Therefore, EPA's failure to deduct the portion of compliance costs that have already been realized results in an overestimate of the remaining compliance costs in the Revised Analysis.

E. The Revised Analysis Improperly Changes the Way in Which EPA Accounts for Avoided Costs from Energy Efficiency and Demand Response.

In addition to other assumptions that affect net benefit estimates of the Clean Power Plan in the Revised Analysis, EPA has also improperly changed the accounting methods for energy efficiency and demand response programs. In the Revised Analysis, efficiency and demand response programs are treated as increases in benefits as opposed to decreases in costs. This change in accounting overstates the actual costs of the Clean Power Plan. Furthermore, this change in accounting potentially ascribes any uncertainty of potential benefits from the other aspects of Clean Power Plan to potential uncertainty for costs savings from demand response and efficiency programs, which are substantial and readily quantifiable. Ascribing general uncertainty to these programs that are more readily quantifiable underestimates the net benefits of the Clean Power Plan.

* * *

In sum, the myriad flaws in the Revised Analysis only add to the arbitrary and capricious nature of EPA's proposed repeal of the Clean Power Plan. Thus, even if EPA had sought to rely on the Revised Analysis to justify the proposed repeal—which the agency has not sought to do—it could not provide a lawful basis for such action.

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[49] *Id*. at 13

[50] *See "Basis for Denial of Petitions to Reconsider and Petitions to Stay the CAA section 111(d) Emission Guidelines for Greenhouse Gas Emissions and Compliance Times for Electric Utility Generating Units,"* U.S. Environmental Protection Agency, January 11, 2017, p. 22.

VII. EPA'S PROPOSED REPEAL OF THE LEGAL MEMORANDUM SUPPORTING THE CLEAN POWER PLAN IS UNSUPPORTED, ARBITRARY AND CAPRICIOUS, AND CONTRARY TO LAW

EPA, almost as an after-thought, proposes to repeal the entire Legal Memorandum supporting the Clean Power Plan. 82 Fed. Reg. at 48,042-43. The 150-page Legal Memorandum was an integral basis of support for the CPP, referenced numerous times in the final rule. *E.g.* 80 Fed. Reg. at 64,710, 64,718, 64,735, 64,764, 64,773, 64,777-79, 64,781, 64, 872-74. The Legal Memorandum was subject to notice and comment along with the draft Clean Power Plan. In four short paragraphs, EPA acknowledges that the issues addressed in the Legal Memorandum may be relevant to a future rulemaking, but nonetheless proposes to repeal the entire Legal Memorandum as "inconsistent with this proposal or rendered moot by it." 82 Fed. Reg. at 48,043. However, an agency must provide a "reasoned explanation" for departing from a prior policy – it may not "depart from prior policy *sub silento*[.]" *FCC v. Fox Television*, 556 U.S. at 515.

EPA has failed to provide a reasoned basis for departing from the Clean Power Plan's interpretation of section 111, as discussed above. EPA has also failed to provide a reasoned basis for departing from many of the policies announced in the Legal Memorandum. For example, the Legal Memorandum discussed EPA's role in regulating greenhouse gas emissions from power plants following the Supreme Court's decision in *AEP*. Legal Memorandum, at 11-14. The proposed repeal does not propose to alter EPA's understanding of these obligations, and yet proposes to repeal the entire Legal Memorandum. In fact, the vast majority of the Legal Memorandum presents EPA's policy positions on matters unrelated to the determination of the best system that EPA now proposes to change. EPA cannot depart from those policies without providing a reasoned explanation. *See* State Farm, 463 U.S. at 42-43.

CONCLUSION

In conclusion, EPA's proposed repeal of the Clean Power Plan is contrary to the Clean Air Act and arbitrary and capricious. To propose to repeal the Plan—without having first put in place a replacement rule that requires equivalent or greater pollution reductions—is nothing less than an abdication of EPA's duty to protect public health and welfare from what it has recognized to be the nation's most urgent environmental threat. The agency's new position that the Clean Power Plan must be repealed is neither compelled by the language of the Clean Air Act nor reasonable in light of the statute's text, structure, and protective purpose. EPA carefully considered and rejected these same arguments when raised in the Clean Power Plan rulemaking, and they are not suddenly meritorious now. One thing that has changed is that the science supporting prompt and aggressive measures to reduce carbon pollution from power plants has gotten even stronger since EPA promulgated the Clean Power Plan. That evidence demands that EPA abandon its misguided repeal of the Clean Power Plan and instead consider how to strengthen it.

Respectfully Submitted,

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Appendix A: Climate Change Impacts

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 summer temperatures attributable to climate change.[8] The very high levels of tree mortality led

[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] *Supra* note 1, p. 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] *Supra* note 1, p. 7.

[6] *Id*.

[7] *Id*.

[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).

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

[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 (2010). *California's Forests and Rangelands: 2010 Assessment*. Ch. 3-7.

[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]

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[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. (2012). Sea-Level Rise for the Coasts of California, Oregon and Washington: Past, Present, and Future. National Academies Press.

[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*

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.[23] 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.

Heavy rainfall events, flooding, and hurricane activity have increased in frequency and intensity in recent years and are expected to continue to increase, adversely impacting Connecticut. In August 2011, Tropical Storm Irene left 800,000 Connecticut residents without power for up to nine days. This record outage was surpassed just six weeks later when an October snowstorm disrupted power for 880,000 Connecticut customers. And in October 2012, Superstorm Sandy struck many of the areas still recovering from Tropical Storm Irene and disrupted power for the greater portion of a week to more than 625,000 customers. Rising sea levels increase the prospect that states like Connecticut will be increasingly vulnerable to these types of storms in the years ahead. The estimated cost to Connecticut for the 2011 storms will exceed $750 million dollars, which does not include uninsured losses that could push the total losses over $1 billion dollars.[24]

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 has proposed Senate Bill 9 to enact the necessary statutory changes to ensure 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, SB 9 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.

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

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

[23] Adaptation Subcommittee to the Governor's Steering Committee on Climate Change. (2010). The Impacts of Climate Change on Connecticut Agriculture, Infrastructure, Natural Resources and Public Health.

[24] Report of the Two Storm Panel Presented to Governor Dannel P. Malloy. (January 9, 2012). http://www.governor.ct.gov/malloy/lib/malloy/two_storm_panel_final_report.pdf

have already risen 13 inches this century.[25] 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.[26]

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 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.[27]

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.[28] 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.

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[25] Callahan, John A., Benjamin P. Horton, Daria L. Nikitina, Christopher K. Sommerfield, Thomas E. McKenna, and Danielle Swallow, 2017. 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.

[26] DNREC, 2012. 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.

[27] See, e.g., https://www.huffingtonpost.com/2014/08/28/climate-change-study-hawaii_n_5731956.htmlhttps://www.theatlantic.com/science/archive/2017/05/the-ghost-of-climate-change-future/528471/

[28] A Framework for Addressing Climate Change Adaptation ... - Hawaii.gov

files.hawaii.gov/dbedt/op/czm/ormp/.../climate_change_adaptation_framework_final

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.[29]
- Over the past century, 70% of the beaches in Hawaii have eroded and over 13 miles of beach have been completely lost to erosion.[30]
- This dominant trend of beach erosion could be driven by local sea-level rise.[31]
- 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.[32]
- 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.[33]
- Antarctic and Greenland ice sheets are melting faster than previously predicted, which is contributing to the acceleration of global sea-level rise.[34]
- More tropical cyclones have developed from storms in the Pacific between 1991 and 2010 than previously recorded from the last century.[35]

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[29] NOAA Center for Operational Oceanographic Products and Services (CO-OPS)). 2013. Mean Sea Level Trends for Global Network Stations, available at: http://tidesandcurrents.noaa.gov/sltrends/sltrends_global.shtml (11/22/13) (Figure 9)

[30] 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

[31] Romine, B.M., C.H. Fletcher, M.M. Barbee, T.R. Anderson, and L.N. Frazer. 2013. Are beach erosion rates and sea-level rise related in Hawaii? *Global and Planetary Change* 108:149-157.

[32] University of Hawaii (UH) Coastal Geology Group. Hawaii Coastal Erosion website. http://www.soest.hawaii.edu/asp/coasts/maui/indez.asp.; Fletcher, C.H. 2010. Hawaii's Changing Climate, Briefing Sheet, 2010. Honolulu: Center for Island Climate Adaptation and Policy. University of Hawaii Sea Grant College Program.

[33] Guidry, M.W. and F.T Mackenzie. 2006. 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., Fletcher, 2010; Rotzoll, K. and C.H. Fletcher. 2013. Assessment of groundwater inundation as a consequence of sea-level rise. Nature Climate Change 3:477-481.).

[34] Fletcher, C.H. 2009. Sea level by the end of the 21st century: A review. *Shore and Beach* 77(4):1-9

[35] Webster, P.J, G.J. Holland, J.A. Curry, and H.-R. Chang. 2005. Changes in Tropical Cyclone Number, Duration, and Intensity in a Warming Environment. *Science* 309:1844-1846

- 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.[36]

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—but especially threatens its cities, agriculture, and use and enjoyment of Lake Michigan. There are a number of extreme weather hazards that have affected Illinois in recent years, including the deadly November 2013 tornadoes and the 2014 polar vortex.[37] Illinois has also struggled with urban flooding caused by heavy rains falling on impervious surfaces.[38]

The farming sector is particularly vulnerable to the extreme precipitation conditions being intensified by climate disruption. In 2012, Illinois suffered severe impacts from the third driest summer in 120 years of record-keeping. The very next year, heavy rainfall in 2013 caused very bad flooding in parts of the state that, together with the wettest January-June ever recorded in Illinois, forced farmers to delay planting and lose revenue.[39] Heat waves during the pollination of field crops such as corn and soybeans may reduce yields in the future: An increase in temperature and a shift in rain patterns could mean a 15 percent yield loss in the next 5 to 25 years and up to a 73 percent average yield loss by the end of the next century.[40] More mild winters will lead to more weeds, insects, and diseases surviving throughout winter, hurting yield and quality.[41]

Climate disruption also has contributed to a whipsawing of Lake Michigan's water levels. In January 2013, the lake had fallen to an all-time low. By 2015 it had climbed to its highest level since 1998, the second-largest gain over a 24-month span since record-keeping began in

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[36] Spada, G., J.L. Bamber, R.T.W.L. Hurkmans. 2013. The gravitationally consistent sea-level fingerprint of future terrestrial ice loss. *Geophysical Research Letters* 40(3):482-486

[37] https://www.weather.gov/ilx/17nov13, https://www.weather.gov/lot/2014jan28

[38] https://statesummaries.ncics.org/il

[39] *Id.*

[40] http://cu-citizenaccess.org/2016/09/01/illinois-could-see-effects-of-climate-change-as-soon-as-2020/

[41] *Id.*

1918.[42] These rapid swings in water levels hurt the commercial shipping industry, recreational boaters, wildlife, beach-goers, and shoreline property owners. For example, for every inch of immersion a freighter loses to *low* water, it must forgo 270 tons of cargo. *High* water causes erosion of beaches and property damage.[43]

Iowa

Changes in temperatures and weather patterns are exacerbating Iowa's flooding, droughts, agricultural challenges, and public health risks. With the continued effects of climate change, Iowans will only become more susceptible to these harms.

Climate change is influencing the frequency and duration of precipitation events, and Iowa is feeling the effects.[44] Over the past century, Iowa has seen a nearly eight percent increase in annual precipitation and a larger amount of extreme rain events.[45] Meanwhile, the latest science suggests that while precipitation is increasing as a whole, future trends will be toward a wider swing between extreme wet and dry spells.[46] The increased rain events are due to higher surface evaporation from a warmer world, while dry spells increase due to reduced evaporation stemming from a lack of moisture.[47] In other words, warmer temperatures will continue to make Iowa's wet seasons wetter and dry seasons dryer.

Iowa has over 70 interior rivers[48] that flow into the Mississippi and Missouri Rivers along its east and west borders, so flooding or drought from wet or dry seasons can threaten Iowa's many riverfront communities and river navigation. In a recent wet weather spell in April and May of 2011, a combination of heavy rainfall and melting snow led to flooding that closed the Mississippi River to navigation and caused billions of dollars in damage downstream.[49] That

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[42] http://www.chicagotribune.com/news/local/breaking/ct-lake-michigan-water-levels-met-20150710-story.html

[43] http://www.chicagotribune.com/news/local/breaking/ct-lake-michigan-water-levels-met-20150710-story.html

[44] *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.

[45] Eugene S. Takle, *Climate Changes in Iowa - Part 1*, AGMRC (July 2011), http://www.agmrc.org/renewable-energy/climate-change-and-agriculture/climate-changes-in-iowa-part-1.

[46] IOWA CLIMATE CHANGE IMPACTS COMMITTEE, CLIMATE CHANGE IMPACTS ON IOWA (2011) p. 9, www.iowadnr.gov/portals/idnr/uploads/air/environment/climatechange/complete_report.pdf?amp;tabid

[47] *The Water Cycle and Climate Change*, NASA, https://earthobservatory.nasa.gov/Features/Water/page3.php (last visited Oct. 5, 2017).

[48] *Interior Rivers*, IOWA DEP'T OF NAT. RESOURCES, http://www.iowadnr.gov/Fishing/Where-to-Fish/Interior-Rivers (last visited Oct. 5, 2017).

[49] HENRY DEHAAN ET. AL., USACE, MISS. VALLEY DIV., MISSISSIPPI RIVER AND TRIBUTARIES SYSTEM 2011 POST-FLOOD REPORT V-12 (2012).

same year, flooding along the Missouri River led to hundreds of millions of dollars in damages[50] and also closed the river to navigation.[51] Iowa's Sioux City and Council Bluffs were two of the cities affected most by the flood, experiencing extensive property damage and crop loss.[52] The following year exemplified the effect warmer temperatures can have on Iowa in a dryer season. Iowa's 2012 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.[53]

Iowa also must deal with climate change's prospective effects on its agriculture in a state that leads the nation in corn, soybean, egg, and hog production.[54] Climate change will force farmers to adapt to the additional heat stress being put on their crops and livestock or risk substantial decreases in crop yields and livestock productivity.[55] 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 corn industry currently worth nearly $10 billion.[56] Crop production can be inhibited by changing rain patterns such as wetter springs—which delay planting and increase flood risk—and less rain during the increasingly hot summers.[57] Farmers may also face the survival and spread of more unwanted pests because of warmer winters and a longer growing season.[58]

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[50] DEP'T OF HOMELAND SEC., MISSOURI RIVER FLOOD COORDINATION TASK FORCE REPORT, 12, 39 (2011).

[51] David Bailey & David Hendee, *The Mighty Missouri River: The Flooding and the Damages 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.

[52] *Id*. at 39.

[53] 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. 5, 2017).

[54] *Iowa's Rank in United States Agriculture*, USDA (June 2016), https://www.nass.usda.gov/Statistics_by_State/Iowa/Publications/Rankings/2016_Iowa_Rankings.pdf.

[55] *Supra* note 46, at 14–16;

J. L. Hatfield et al., *Climate Impacts on Agriculture: Implications for Crop Production*, 103 AGRONOMY J. 351, 355-70 (2011).

[56] 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

[57] *Supra* note 46, at 15.

[58] 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).

In addition, climate change will likely continue to increase the risk of adverse public health effects to Iowans. The higher temperatures can increase air pollutants such as ozone and fine particulates, which increases the risk of heart and lung-related illness.[59] Allergic diseases and asthma are expected to become more widespread and more severe due to exposure to new plants and increases in pollen counts.[60] 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.[61] Iowans' public health problems will only increase as climate change continues.

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.[62] 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.[63] 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.[64] 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.[65] These symptoms of climate change threaten both the health of the State's marine ecosystem and a coastal economy that depends on it.

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

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[59] *What Climate Change Means for Iowa*, EPA (August 2016), https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-ia.pdf.

[60] *Climate Change*, IOWA DEP'T OF NAT. RESOURCES , http://www.iowadnr.gov/Conservation/Climate-Change (last visited Oct. 5, 2017).

[61] *Supra* note 46.

[62] 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/

[63] *Id.*

[64] 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.

[65] *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/.

more frequent droughts are shrinking brook trout habitat[66] and undermining efforts to restore sea-run salmon in Maine's downeast rivers.[67] A plague of winter ticks brought on by decreased snowpack has taken a significant toll on Maine's moose population.[68] Milder winters have also hurt the ski industry,[69] while shorter and earlier springs are interfering with maple sugaring operations.[70]

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 of Maryland's Greenhouse Gas Emissions Reduction Act (GGRA) of 2009.[71]

As determined by the MCCC's Science and Technical Working Group ("STWG") estimates show that "Maryland is projected to experience between 2.1 and 5.7 feet of sea level rise over the next century. In fact, sea level could be as much as 2.1 feet higher in 2050 along

[66] 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.

[67] The National Academies Press, *Atlantic Salmon in Maine*, 2004, at 50-53, https://www.nap.edu/read/10892/chapter/5.

[68] 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/.

[69] 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.

[70] Taylor, C., *How Climate Change Threatens Your Breakfast*, Science Friday, March 17, 2017, https://www.sciencefriday.com/segments/how-climate-change-threatens-your-breakfast/.

[71] 2016 Annual Report, Maryland Commission on Climate Change 7, http://mde.maryland.gov/programs/Air/ClimateChange/MCCC/Documents/MCCC_2016_final.pdf (last visited Dec. 7, 2017).

Maryland's shorelines than it was in 2000."[72] The STWG recommends that it would be prudent to plan for such an occurrence.[73]

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 2014, the Port of Baltimore generated more than $3 billion in business revenue and wages while moving more than $52.5 billion of cargo.[74]

The state's $15.4 billion tourism sector is also likely to feel the impact of climate change.[75] In 2015, tourism resulted in $2.3 billion in tax revenue, which directly supported more than 140,625 jobs with a payroll of $5.7 billion.[76] Rising sea levels, increased flooding and elevated storm surges from severe weather are likely to put an additional strain on Maryland's already vulnerable 3,100 miles of low-lying urban and coastal lands. These problems could make it more difficult for tourists to travel to the region and increase the costs to coastal communities and the state of maintaining bridges, roads and boardwalks.[77] In addition, the Maryland Department of the Environment's 2012 plan for reducing greenhouse gas emissions stated, "it is estimated that beaches will move inland at a rate 50 to 100 times faster than the rate of sea level elevation and that the cost of replenishing the coastline after a 20-inch rise in sea level would be between $35 million and $200 million."[78] Much of Maryland's tourism growth in 2013 stemmed from an increase in local and regional tourists taking daylong excursions. There could be an impact on regional tourism if steps aren't taken to curtail the impact of climate change, given projections that by 2050 the number of 95-plus degree days could reach five times the current 30-year average of six days. By 2100, that number could increase tenfold. Rising temperatures could result in a 5 percent loss in tourism revenues.[79] In addition, snow sports such as skiing "are at obvious risk from rising temperatures, with lower-elevation resorts facing progressively less reliable snowfalls and shorter seasons."[80] Wisp Mountain Park is a popular skiing destination in Western Maryland, and the only ski resort in the State. In late December of 2015, the resort reported that only one of their 35 trails was open, having been unable to keep snow on the

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[72] 2015 Annual Report, Maryland Commission on Climate Change 13, http://mde.maryland.gov/programs/Air/ClimateChange/MCCC/Publications/MCCC2015Report.pdf (last visited Dec. 7, 2017)

[73] *Id.*

[74] *Id.*

[75] 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/ (last visited Dec. 7, 2017).

[76] 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/ (last visited Dec. 7, 2017).

[77] 2015 MCCC Annual Report 14, *supra* n. 72.

[78] *Id.*

[79] *Id.*

[80] 2016 MCCC Annual Report 18-19, *supra* n. 76.

ground due to temperatures consistently above freezing.[81] Although this was an unusually mild winter (November's average low was 8 degrees Fahrenheit higher than the historical average, and December's was 14 degrees Fahrenheit higher), it demonstrates how important dependably cold weather is to the resort's seasonal functionality, which increasing global temperatures could debilitate.[82]

Climate change may also adversely impact Maryland's agriculture. In 2014, the market value of agricultural products sold by farms in Maryland was $2.7 billion. Of this total, about $800 million was in the form of crop sales and $1.9 billion was in dairy and livestock.[83] By 2050, if no additional action is taken and summer temperatures rise above thresholds where corn, soy and wheat can be grown, median annual losses for these crops could approach $150 million.[84] While the added warmer days could extend the growing season, there could be an increase in invasive species and new animal and plant disease. The health of livestock could also be at risk as the number of 95-plus degree days rises and livestock would need access to cooler areas. Flooding of fields from sea rise or severe rain events can lead to increased salt-water intrusion of soil, decreased crop production, excessive soil erosion and nutrient runoff as well as declining water quality. Increasingly frequent tidal inundation of fields in low-lying areas due to sea-level rise would impair soil drainage and cause soils to become saline, ultimately resulting in abandonment of valuable farmland from cultivation. Sea-level rise may also cause salt water to infiltrate into some aquifers used for irrigation. More extreme rainfall events, a trend that is already being observed, could also result in greater soil erosion and the runoff of fertilizer nutrients, exacerbating water quality impairment of streams and the tidal waters of the Chesapeake Bay.[85]

Forests contribute an estimated $2.2 billion to Maryland's economy and $24 billion in ecological services.[86] The condition of these ecosystems and the services they provide will be affected by climate change. Climate change will alter distributions of species and habitats and exacerbate existing stressors at a rate and degree that cannot be fully predicted. Native species populations are likely to decline or migrate from the State while new species are likely to migrate in due to habitat shifts. Services provided by forests such as temperature regulation, water filtration, aesthetic value and habitat can be altered and existing stressors can be exacerbated by climate change.[87]

Climate change also threatens the Chesapeake Bay, the largest estuary in the United States, which is fed by a watershed that stretches from mountains to sea across 64,000 square miles (166,000 square kilometers), spanning six states - Maryland, Delaware, Virginia, West

[81] *Id.*

[82] *Id.*

[83] *Id.*

[84] *Id.*

[85] *Id.*

[86] *Id.*

[87] *Id.*

Virginia, Pennsylvania, and New York - and the District of Columbia. Currently, revenues provided by the Bay and its watershed are estimated to be approximately $1 trillion annually.[88] However, human development and pollution have degraded the natural resilience of the ecosystems of the Bay and its watershed, leaving them more vulnerable to extreme events. Climate change will likely exacerbate this problem, creating a greater threat to these ecosystems. The Bay has already warmed by 3 degrees Fahrenheit and additional temperature increases could change the composition of commercial fisheries and increase anoxia, the absence of oxygen needed for aquatic life to survive, in the Bay.[89] Many commercially important fisheries species are projected to move northward as waters warm and suitable habitats shift; and similarly to pests and diseases on land, this shift could also bring new pests, or increase the damages done by diseases such as bacteria that thrive in warmer waters.[90] Maryland fisheries, including blue crabs, clams and oysters, were valued at $67 million in 2013.[91]

In terms of health impacts, the average number of days for which Maryland is likely to exceed temperatures of 90 degrees or higher is expected to rise considerably, markedly exacerbating heat-related illnesses and mortality, particularly among the elderly.[92] Pollution, excessively warm temperatures and other environmental factors such as extreme precipitation have been shown to increase the risk of a number of infectious diseases. In a 2013 Morbidity and Mortality review, the U.S. Centers for Disease Control and Prevention assessed the 12 heat-related deaths in Maryland resulting from the heat wave of June 30 to July 13, 2012.[93] Heat-related deaths were reported most frequently among males and those living alone. In 2012, to forecast heat-related mortality over the 21st century, an independent review of the scientific literature found that for Baltimore, the only Maryland city included, could see an increase of eight excessive heat days on average per summer to 45 such days by mid-century, resulting in 27 additional deaths per summer.[94]

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 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.[95]

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[88] *Id.*

[89] *Id.*

[90] *Id.*

[91] *Id.*

[92] 2015 MCCC Annual Report 17, *supra* n. 72.

[93] *Id.*

[94] *Id.*

[95] 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

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.[96] 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.[97] 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).[98] 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.[99] 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.[100] Superstorm Sandy, a post-tropical storm in 2012, was the most extreme and destructive event to affect the 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.[101] Massachusetts suffered an estimated

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Change Means for Massachusetts (Aug. 2016), at https://ia801602.us.archive.org/9/items/climate-change-ma/climate-change-ma.pdf.

[96] 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.

[97] *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.

[98] Horton, *supra* note 95, at 373.

[99] Massachusetts Climate Action Partnership, *Massachusetts Wildlife Climate Action Tool – Stressors: Storms and floods* (2015), at https://climateactiontool.org/content/storms-and-floods.

[100] Runkle et al., *Massachusetts State Summary*, NOAA TECHNICAL REPORT NESDIS 149-MA, 4 (2017), at https://statesummaries.ncics.org/MA.

[101] *Id.*

$375 million in property losses alone.[102] 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.[103]

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.[104]

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 live near the coast.[105] According to the National Climate Assessment, in Boston alone, cumulative damage to buildings, building contents, and associated emergency costs could potentially be as high as $94 billion between 2000 and 2100, depending on the sea level rise scenario and which adaptive actions are taken.[106]

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[102] *Id.*

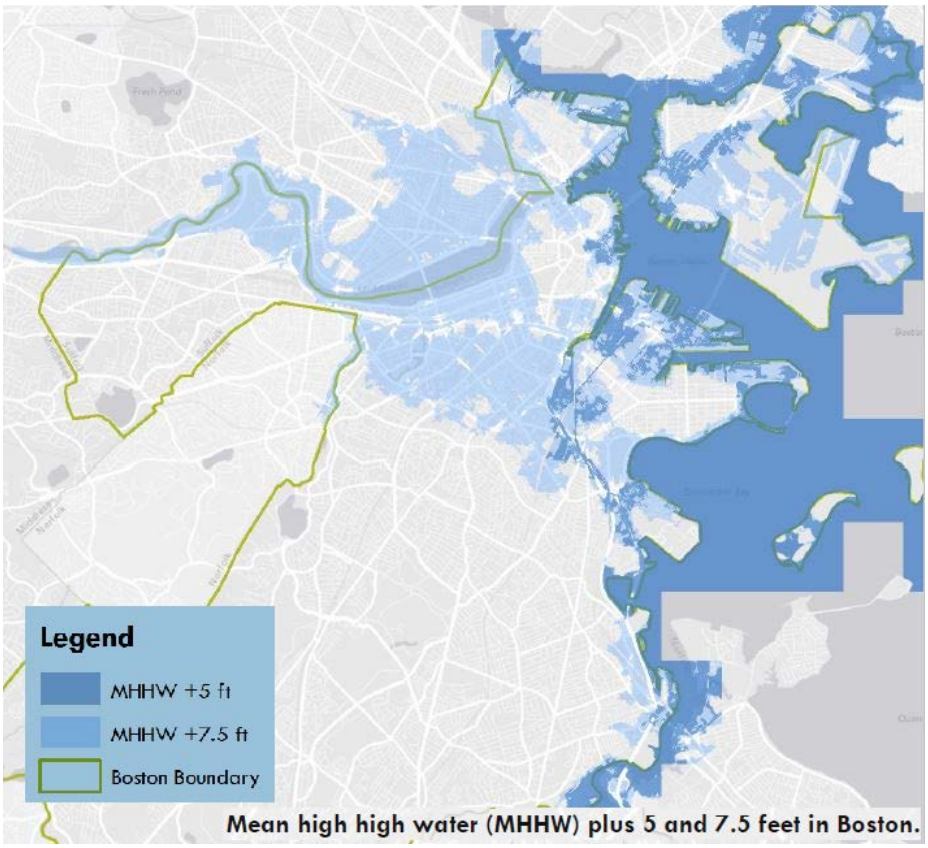
[103] Martin Finucane, *It's official: Boston breaks tide record*, BOSTON GLOBE, Jan. 5, 2017, *at* https://www.bostonglobe.com/metro/2018/01/05/official-boston-breaks-tide-record/UPbwDxgF0QXNOWvB9bcQ7L/story.html.

[104] 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.

[105] NOAA, National Coastal Population Report, 9 (2013), *at* https://aamboceanservice.blob.core.windows.net/oceanservice-prod/facts/coastal-population-report.pdf.

[106] Horton, *supra* note 95, at 379.

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. 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.[107]



Mean high high water (MHHW) plus 5 and 7.5 feet in Boston.

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 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.[108]

[107] City of Boston, *supra* note 104, at 60.

[108] EPA, *supra* note 95; Massachusetts Climate Action Partnership, *supra* note 99, *Ecology and Vulnerability: Alewife*, *at* http://climateactiontool.org/species/alewife.

Minnesota

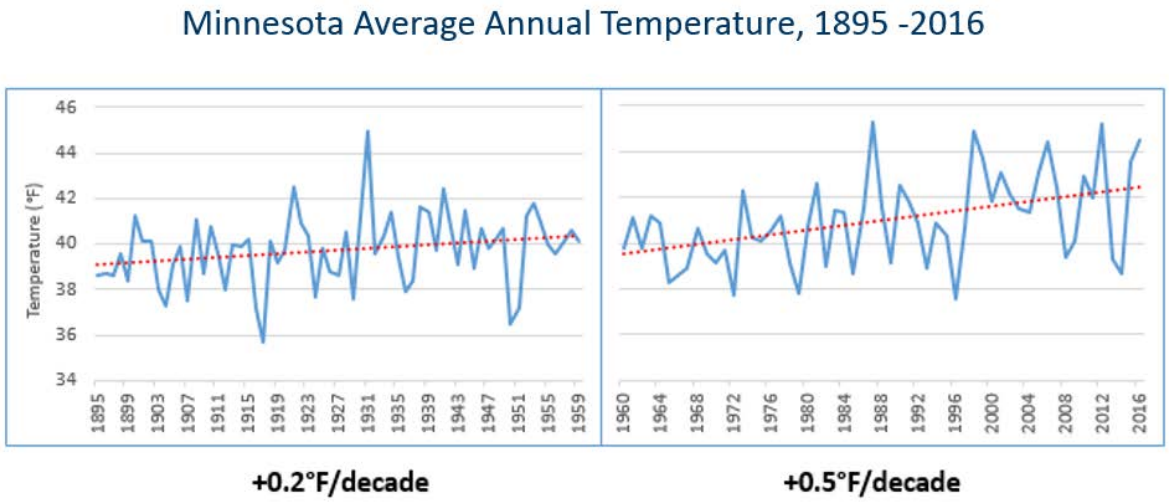
Minnesota's climate is changing, and it's already affecting residents' health and the state's environment and economy. Rising temperatures may interfere with winter recreation, extend the growing season, change the composition of trees in the North Woods, and increase water pollution problems in lakes 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.[109] 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.[110] 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).

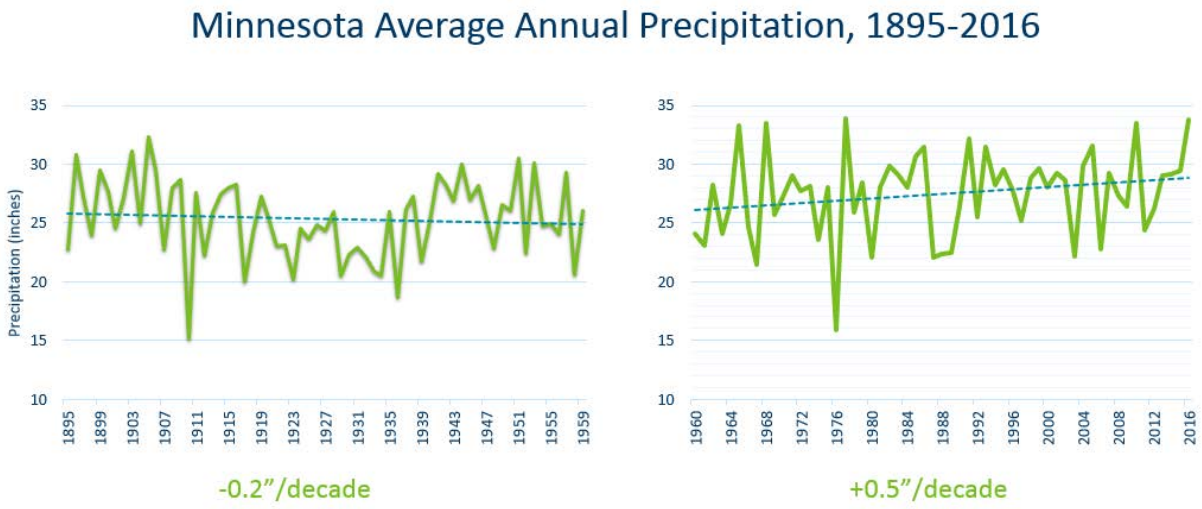
[109] Available at https://www.eqb.state.mn.us/content/climate-change

[110] *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.[111]



Source: NOAA, 2017

[111] *See* www.health.state.mn.us/divs/climatechange/climate101.html (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.[112] But rainfall during the four wettest days of the year has increased about 35 percent.[113] 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.[114] 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 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.[115] 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.[116] Temperatures in the Upper Rio Grande River basin are increasing at a rate of roughly 0.7° F per decade, contributing to an average warming of 2.5° F since 1971. Mountains have shown a higher rate of temperature rise when compared to lower elevations.[117] 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

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[112] 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

[113] *Id.*

[114] Minnesota and Climate Change at 6; *see also* Saunders, S. et al., (2012), *Doubled Trouble: More Midwestern Extreme Storms. Rocky Mountain Climate Organization; Natural Resources Defense Council* (2012).

[115] Minnesota and Climate Change at 6; *see also* Office of the Legislative Auditor, State of Minnesota (2012), *Helping Communities Recover from Natural Disasters: Evaluation Report Summary*

[116] Nature Conservancy, *Implications of Recent Climate Change*, at iii; Robert Repetto, *New Mexico's Rising Economic Risks from Climate Change*, DĒMOS, at 1 (2012).

[117] 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); http://www.usbr.gov/WaterSMART/wcra/docs/urgia/URGIAMainReport.pdf (last visited Jan. 8, 2018).

1950. Heat waves lasting longer than four days have also significantly increased since 1960.[118] These occurrences do not only affect a specific part of the state; over 95 percent of New Mexico has experienced mean temperature increases.[119]

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.[120] (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.[121]).

- 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.[122]

- 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 that of the general U.S. population – constrain tribes' abilities to respond effectively to climate challenges.[123]

- 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

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[118] Repetto, *New Mexico's Rising Economic Risks from Climate Change*, at 1; *see also* Nature Conservancy, *Implications of Recent Climate Change*, at 4.

[119] Nature Conservancy, *Implications of Recent Climate Change*, at iii.

[120] 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).

[121] 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).

[122] *Id.*

[123] 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 accessed Jan. 4, 2018); *see also* Funk, et al., *Confronting Climate Change in New Mexico* at 6-7, 9 (Union of Concerned Scientists, April 2016). Available at: https://www.ucsusa.org/sites/default/files/attach/2016/04/Climate-Change-New-Mexico-fact-sheet.pdf (last accessed Jan. 4, 2018).

heat. Reduced yields from increasing temperatures and increasing competition for scarce water supplies will displace jobs in some rural communities.[124]

- 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.[125]

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.[126]

- Drought and increased temperatures due to climate change have caused extensive tree death across the Southwest. Winter warming due to climate change has exacerbated bark beetle outbreaks by allowing more beetles, which normally die in cold weather, to survive and reproduce.[127] Wildfire and bark beetles killed trees across one fifth of New Mexico and Arizona forests from 1984 to 2008.[128] Climate changes caused extensive piñon pine mortality in New Mexico between 1989 and 2003.[129]

- 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.[130]

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[124] U.S. Global Change Research Program, *2014 National Climate Assessment*, at 463.

[125] *Id.*

[126] *Id.*

[127] *Id.*

[128] *Id.* at 468.

[129] *Id.* at 484.

[130] The White House, Office of the Press Secretary, *FACT SHEET: What Climate Change Means for New Mexico and the Southwest*, at 2-3 (2014). Available at: https://obamawhitehouse.archives.gov/sites/default/files/docs/state-reports/NEWMEXICO_NCA_2014.pdf (last accessed Jan. 4, 2018).

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.[131]

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 hundred 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.[132] 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.[133]

New York

New York has begun to experience adverse effects from climate change. In 2014, Attorney General Schneiderman 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.[134] 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 extreme rainfall already being felt across New York State are consistent with scientists' predictions of new weather patterns attributable to climate change.

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[131] 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 accessed Jan. 4, 2018).

[132] Funk, et al., *Confronting Climate Change in New Mexico* at 3 (Union of Concerned Scientists, April 2016). Available at: https://www.ucsusa.org/sites/default/files/attach/2016/04/Climate-Change-New-Mexico-fact-sheet.pdf (last accessed Jan. 4, 2018).

[133] The White House, Office of the Press Secretary, *FACT SHEET: What Climate Change Means for New Mexico and the Southwest*, at 1-2 (2014). Available at https://obamawhitehouse.archives.gov/sites/default/files/docs/state-reports/NEWMEXICO_NCA_2014.pdf (last accessed Jan. 4, 2018).

[134] *Current & Future Trends in Extreme Rainfall Across New York State, A Report from the Environmental Protection Bureau of New York State Attorney General Eric T. Schneiderman* (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

Hurricane Irene Flooding

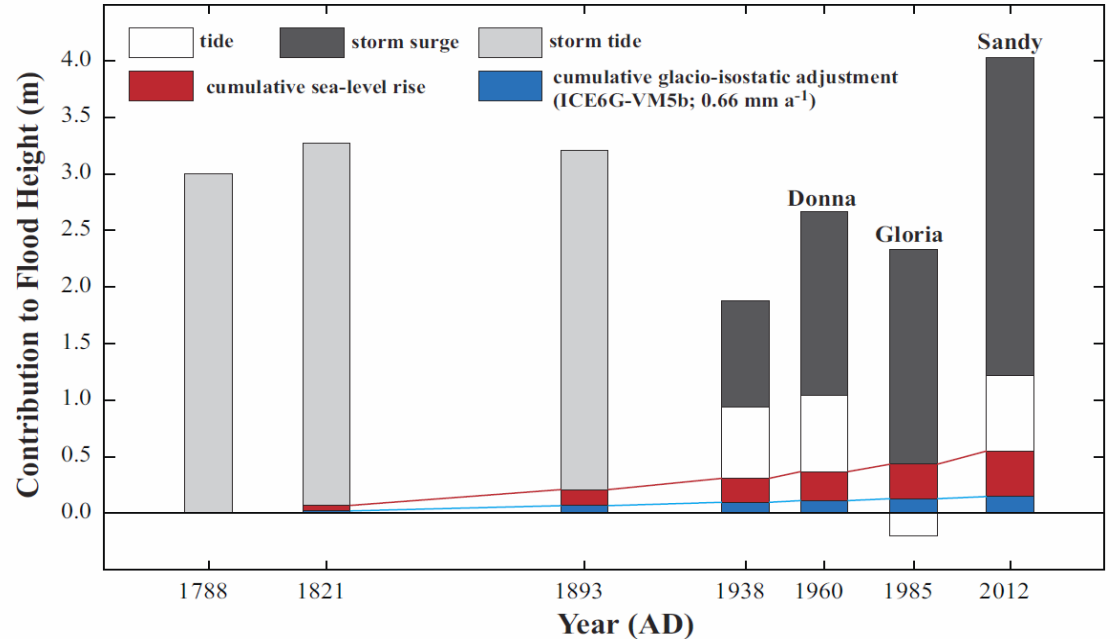
Image from ABC 7 Eyewitness News

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.[135] 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

Source: Kemp et al. (2013), Contribution of relative sea-level rise to historical hurricane flooding in New York City, *Journal of Quaternary Science 28(6), 537-541.*

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

[135] 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

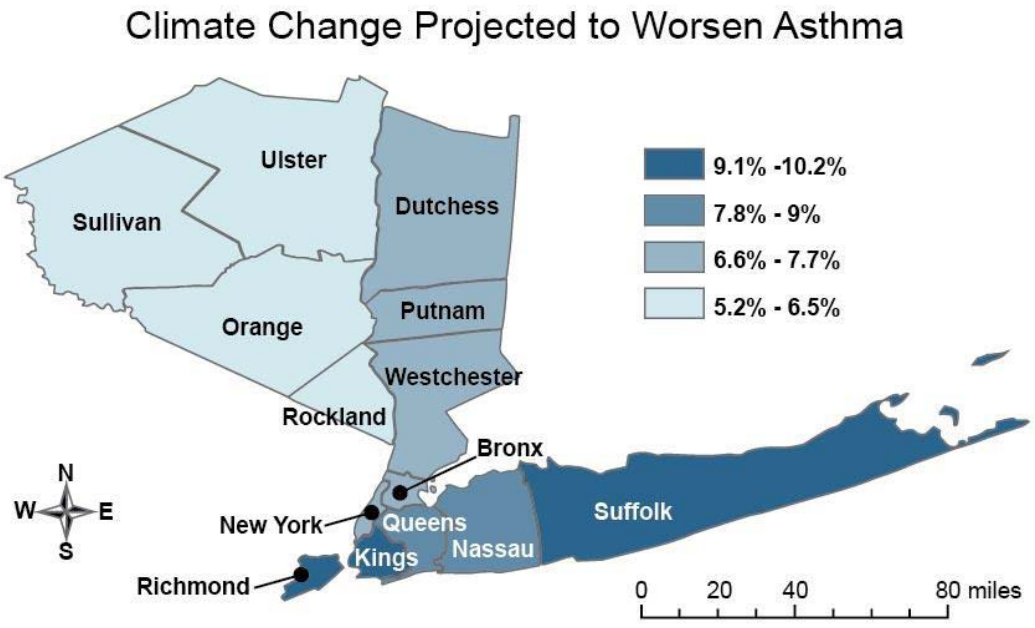
billions of gallons of untreated or partially treated sewage flowing into local waterways.

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.[136]

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.[137] The figure below, included in that report, shows that projected worsening in asthma cases in the New York City area.

[136] *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

[137] 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, 2011: Modeling of regional climate change effects on ground level ozone and childhood asthma. American Journal of Preventive Medicine, 41, 251-257, 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,[138] 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.[139] 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.[140]

Because of eastern North Carolina's low-lying topography, North Carolina faces extensive loss of land to inundation from sea-level rise.[141] In 2014, the North Carolina Division

[138] NOAA Office for Coastal Management, Shoreline Mileage of the United States, https://coast.noaa.gov/data/docs/states/shorelines.pdf.

[139] 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.

[140] 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.

[141] 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.[142] 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.[143]

North Carolina sits within a frequent hurricane path, making its coastal region especially vulnerable to hurricanes and inland flooding. Most recently, in 2016, Hurricane Matthew had devastating impacts on eastern North Carolina, killing at least 27 people and causing some $1.5 billion in damage from which the state is still recovering.[144]

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.[145] 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.[146]

Droughts caused by climate change can make a forest more prone to wildfires,[147] 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

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[142] *Id.*

[143] 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.

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

[145] N.C. Department of Health and Human Services, Division of Public Health, North Carolina Climate and Health Profile (March 2015), http://epi.publichealth.nc.gov/oee/climate/ClimateAndHealthProfile.pdf.

[146] *Id.*

[147] *Id.*

existing threat to North Carolinians' health, causing increases in respiratory and cardiovascular emergencies in downwind communities.[148]

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.[149] Major crops include corn, cotton, tobacco, sweet potatoes, pork, turkey, and chicken. Increasingly severe droughts cause crop failures, and higher temperatures reduce livestock productivity.[150] Saltwater intrusion from sea level rise can make soils too salty for native plants to grow, impacting crop yields.[151] 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.[152]

North Carolina's tourism industry, which generated $22.9 billion in visitor spending in 2016, is also at risk.[153] 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.[154]

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.[155] The North Carolina Department of

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[148] N.C. Department of Health and Human Services, Division of Public Health, North Carolina Climate and Health Adaptation Plan Update (2016), http://epi.publichealth.nc.gov/oee/climate/ClimateAndHealthAdaptationPlan.pdf.

[149] 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), http://info.ncagr.gov/blog/2016/06/07/todays-topic-economic-impact-of-nc-agriculture-agribusiness-increases-to-84-billion/

[150] 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

[151] 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)

[152] 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.

[153] North Carolina Tourism Generates Record Employment and Visitor Spending in 2016, Economic Development Partnership of North Carolina (May 8, 2017), https://edpnc.com/north-carolina-tourism-generates-record-employment-visitor-spending-2016/

[154] University of Maryland, Economic Impacts of Climate Change on North Carolina, supra note 15.

[155] EPA, What Climate Change Means for North Carolina, supra note 150.

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.[156]

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.[157] 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:

- 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.[158] Spring peak stream and river flows will come sooner,[159] increasing flooding risks,[160] and late-summer flow will decrease, depleting Oregon's supply of summer water for agriculture, wildlife, and hydropower generation.[161]

- Ocean sea levels will rise between four inches and four and a half feet on the Oregon coast by the year 2100,[162] 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.[163] Residential development, state highways, and municipal infrastructure are all at risk to such threats.[164]

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[156] U.S. Global Change Research Program, National Climate Assessment (2014), https://nca2014.globalchange.gov/report/regions/southeast.

[157] N.C. Department of Environmental Quality, Sea Level Rise, supra note 151.

[158] 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).

[159] Bibi S. Naz et al., *Regional Hydrologic Response to Climate Change in the Conterminous United States using High-Resolution Hydroclimate Simulations*, 143 Global and Planetary Change 100, 100–17 (2016).

[160] Eric P. Salathé et al., *Estimates of Twenty-First-Century Flood Risk in the Pacific Northwest Based on Regional Climate Model Simulations*, 15 J. of Hydrometeorology 1881, 1881–99 (2014).

[161] *See* Rick R. Raymondi et al., *Water Resources: Implications of Changes in Temperature and Precipitation, in Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities* 41–66 (Meghan M. Dalton et al. eds., 2013).

[162] 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).

[163] Ben Strauss et al., Climate Cent., *California, Oregon, Washington and the Surging Sea: A Vulnerability Assessment with Projections for Sea Level Rise and Coastal Flood Risk* 29 (2014).

[164] *Id.*

- Ocean waters are now more acidified, hypoxic (low oxygen), and warmer, and such impacts are projected to increase,[165] with a particular detrimental impact on some marine organisms like oysters and other shellfish,[166] which will threaten marine ecosystems, fisheries and seafood businesses.

- Fire activity is projected to increase due to warmer, drier summers that also will increase the severity of fires and the length of the fire season.[167] The 2013-15 fire seasons were some of the largest and most intense that Oregon has ever experienced.[168] And the warmer, drier summers also will exacerbate insect outbreaks in forests as drought stress increases forest vulnerability.[169] There is already evidence of altered geographic distributions of many plant species.[170]

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 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.[171] The models used in the 2015 Climate Impacts Assessment Update

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[165] Francis Chan et al., Cal. Ocean Sci. Tr., *The West Coast Ocean Acidification and Hypoxia Science Panel: Major Findings, Recommendations, and Actions* (2016).

[166] *Id.*; *see also* Julia A. Ekstrom et al., *Vulnerability and Adaptation of U.S. Shellfisheries to Ocean Acidification*, 5 Nature Climate Change 207, 207–14 (2015).

[167] Renaud Barbero et al., *Climate change presents increased potential for very large fires in the contiguous United States*, 24 Int'l J. of Wildland Fire 892, 892–99 (2015); Tim Sheehan et al., *Projected Major Fire and Vegetation Changes in the Pacific Northwest of the Conterminous United States Under Selected CMIP5 Climate Futures*, 317 Ecological Modelling 16, 16–29 (2015).

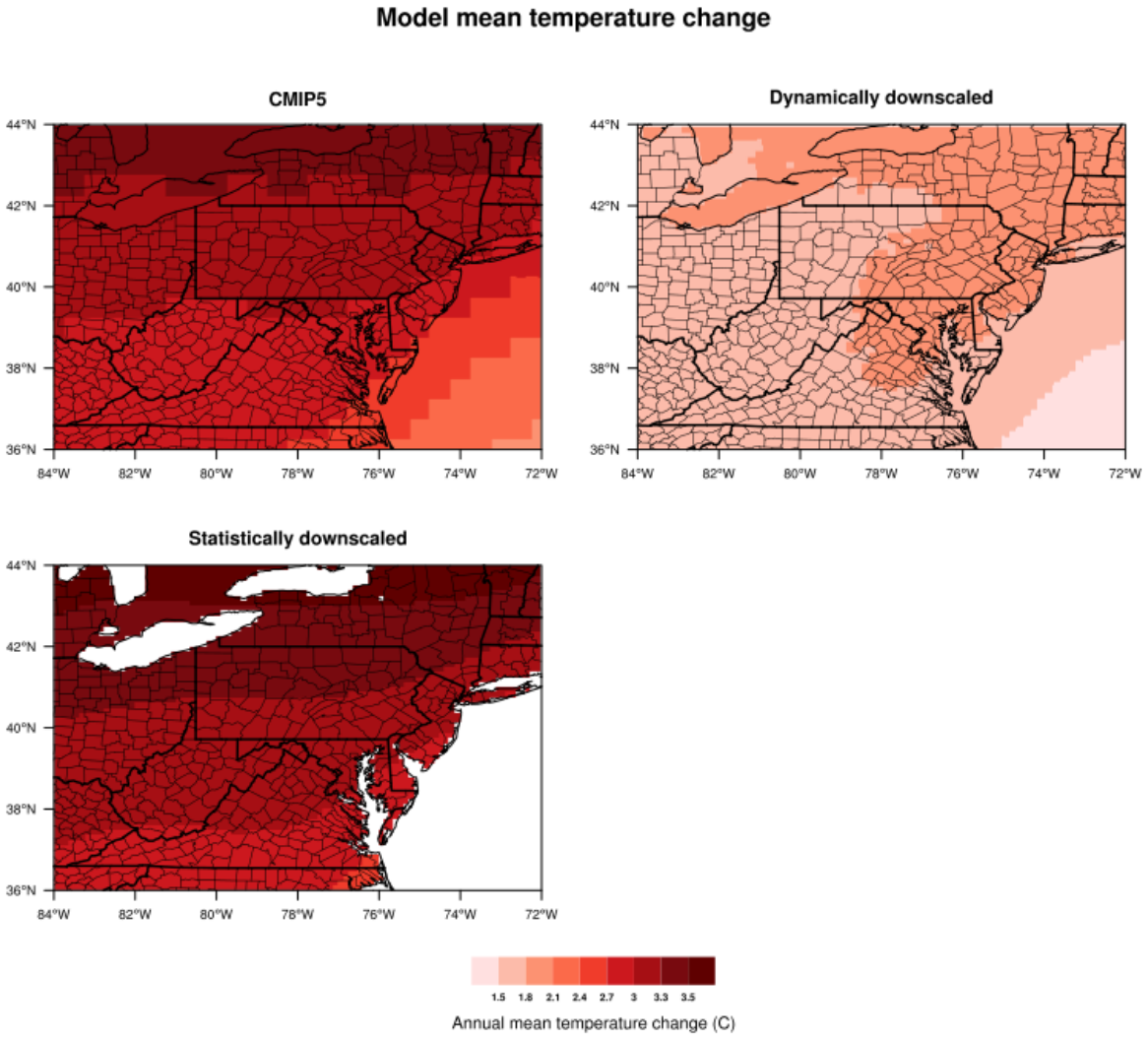
[168] *Narrative Timeline of the Pacific Northwest 2015 Fire Season*, U.S. Dept. of Agric., 7 (2015), https://wfmrda.nwcg.gov/docs/_Reference_Materials/2015_Timeline_PNW_Season_FINAL.pdf.

[169] Joshua S. Halofsky et al., *Dry Forest Resilience Varies Under Simulated Climate-Management Scenarios in a Central Oregon, USA Landscape*. 24 Ecological Applications 1908, 1908–25 (2014).

[170] Sarah L. Shafer et al., *The Potential Effects of Climate Change on Oregon's Vegetation*, in *Or. Climate Assessment Rep.* 173-208 (Kathie D. Dello and Philip W. Mote eds., 2010).

[171] *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.

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.



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.[172] 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.[173] 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.[174] 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.[175] 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.[176] 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.

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[172] 2015 Climate Impacts Assessment Update at 63.

[173] *Id*. at 114.

[174] *Id.*

[175] *Id*. at 321.

[176] *Id*. at 135.

- Climate change will have a severe, negative impact on winter recreation in Pennsylvania.[177] Downhill ski and snowboard resorts are not expected to remain economically viable past mid-century. Snow cover to support cross country skiing and 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.[178] 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.[179] 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.[180]

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[177] *Id*. at 141.

[178] *Id*. at 152.

[179] *Id*.

[180] **"**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.

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 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.[181]

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.[182] 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.[183]

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.[184] 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. [185] 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.[186]

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[181] *Id*. at 4.

[182] 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.

[183] *Id*.

[184] *Id*. at 28-30.

[185] *Id*.

[186] *Id*. at 38-40

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 Kingston, RI, Smith and Paton (2011) found a 3.0 days/decade delay in the departure time of 14 species of migratory birds.[187]

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.[188] Since 1960, average annual precipitation has increased by 5.9 inches.[189]

Of greatest concern, heavy rainfall events are becoming more common.[190] 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.[191] More than 1,500 residences sustained significant damage, temporarily or permanently displacing more than 1400 households.[192] More than 500 miles of state highway, 2000 municipal road segments, and 480 bridges were damaged.[193] Farms, water supply and wastewater treatment facilities were also damaged, and the channels of many streams were enlarged and/or relocated.[194]

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.

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. The Hampton Roads area has experienced the highest rates of sea level rise along the East Coast: in Virginia Beach, the sea has risen by approximately 30 inches since 1880. Ordinary rain events now cause flooding in the streets of Norfolk, including large connector streets going underwater.[195]

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[187] *Id.*

[188] *Vermont Climate Change Assessment (*http://vtclimate.org/vts-changing-climate/)

[189] *Id.*

[190] *Id.*

[191] https://insideclimatenews.org/news/31082016/five-years-after-hurricane-irene-2011-effects-flooding-vermont-damage-resilience-climate-change

[192] http://www.vermontbiz.com/news/august/tropical-storm-irene-numbers

[193] *Id.*

[194] *Id.*

[195] http://wavy.com/2016/09/21/rain-causes-norfolk-streets-and-neighborhoods-to-flood/

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.[196] 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, costs from three feet of sea-level rise in the Hampton Roads region are expected to range between $12 billion and $87 billion.[197] 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.[198] 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.[199] 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. [200] 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.[201]

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

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[196] 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.

[197] *Id.*

[198] Annual Estimates of the Population of Combined Statistical Areas: April 2010 to July 2011, U.S. Census Bureau, available at https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_10_5YR_B01003&prodType=table

[199] State of Knowledge: Climate Change in Puget Sound (November 2015), Climate Impacts Group, University of Washington, (State of Knowledge, Puget Sound) at 4-7; available at https://cig.uw.edu/resources/special-reports/ps-sok/

[200] *Id.*

[201] *Id.*

the Puget Sound have become about 10-40 percent more acidic since 1800.[202] This increased acidity is already affecting some shellfish species.[203] Washington has the largest shellfish industry on the west coast, contributing $184 million to Washington's economy in 2010 and employing 2710 workers.[204] 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.[205] The predicted level of ocean acidification is expected to cause a 34 percent decline in shellfish survival by 2100.[206]

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.[207] By the 2040s, snowpack is predicted to decrease 38-46 percent relative to 1916-2006,[208] and by the 2080s, snow pack is expected to decline 56-70 percent.[209] 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.[210] In addition, the decrease in summer stream flows combined with higher stream temperatures will result in stream temperatures too high to support adult salmon.[211]

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.[212] 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.[213] Climate change is threatening this industry in a number of ways. For example, Douglas fir accounts for almost half

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[202] 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 (State of Knowledge Report), at 2-6; available at https://cig.uw.edu/resources/special-reports/wa-sok/

[203] *Id* at 2-3.

[204] Washington: A Shellfish State, Washington Shellfish Initiative, at http://www.governor.wa.gov/sites/default/files/WSI%20factsheet.pdf

[205] State of Knowledge Report at ES-2.

[206] *Id* at 8-4.

[207] *Id* at 2-5

[208] *Id* at ES-2.

[209] *Id* at 6-10.

[210] *Id* at 6-5.

[211] *Id* at ES-4, 6-6, 6-11, 6-12.

[212] Sustainable Forestry, Washington Forest Protection Association, available at http://www.wfpa.org/sustainable-forestry/

[213] Washington Department of Commerce, Forest Products Sector, at http://www.commerce.wa.gov/growing-the-economy/key-sectors/forest-products/

the timber harvested in Washington.[214] Under a moderate greenhouse gas scenario, Douglas fir habitat is expected to decline 32 percent by the 2060s relative to 1961-1990.[215] 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.[216] 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[217] and up to a 1000 percent increase in area burned annually on the west side of the state (typically, the wet side).[218]

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.[219]

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.[220] By 2080, the U.S. Corps of Engineers predicts up to 3.4 feet of additional sea level rise in the District.[221] At the same time, heavy rain events are projected to grow more

[214] 2015 Washington Timber Harvest Report, September, 2016, Department of Natural Resources, at https://www.dnr.wa.gov/publications/em_obe_wa_timber_harvest_2015_final2.pdf

[215] State of Knowledge Report at 7-1.

[216] *Id* at 7-3.

[217] *Id*.

[218] *Id* at 7-4.

[219] State of Knowledge, Puget Sound at ES-7.

[220] 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.

[221] District of Columbia Department of Energy & Environment (2015), *Climate Projections & Scenario Development*, p. 46, available at

frequent and intense according to local climate change projections completed by the District. As a result, today's 100-year rain event could become a one in 25-year event by mid-century.[222] 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.[223]

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.[224] 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.[225]

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.[226] Rising

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https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/150828_AREA_Research_Report_Small.pdf

[222] *Id.* at 36.

[223] 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

[224] Climate Projections & Scenario Development at 27.

[225] https://nca2014.globalchange.gov/report/our-changing-climate/extreme-weather

[226] *Climate Change in Colorado:* http://wwa.colorado.edu/ climate/co2014report

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.[227] 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.[228]

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.[229]

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.[230]

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.

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[227] http://wwa.colorado.edu/climate/co2015vulnerability/co_vulnerability_report_2015_final.pdf

[228] https://www.fs.fed.us/rm/pubs/rmrs_gtr289.pdf

[229] https://www.bouldercounty.org/disasters/flood/2013-flood/

[230] *Climate Change in Colorado:* http://wwa.colorado.edu/climate/co2014report

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.[231]

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.[232]

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.[233]

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."[234] 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.[235]

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[231] *Climate Change in Colorado:* http://wwa.colorado.edu/climate/co2014report

[232] *Climate Change in Colorado:* http://wwa.colorado.edu/climate/co2014report

[233] http://wwa.colorado.edu/climate/co2015vulnerability/co_vulnerability_report_2015_final.pdf

[234] NCA-3 at 221, *available at* [https://nca2014.globalchange.gov/downloads] (Section on Sectors-Human Health)

[235] *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 and impact of waterborne, foodborne and vectorborne disease in Cook County, in which Chicago is the largest municipality).

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.[236] 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.[237] 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.[238]

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."[239] 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."[240]

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 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

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[236] http://www.chicagoclimateaction.org/pages/climate_change_and_chicago/5.php

[237] http://cu-citizenaccess.org/2016/09/01/illinois-could-see-effects-of-climate-change-as-soon-as-2020/

[238] *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.

[239] 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.

[240] *Id.* at 12.

1976–2005), under all plausible future climate scenarios."[241] 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."[242] Particularly concerning is that "[t]he frequency and intensity of heavy precipitation events are projected to continue to increase over the 21st century."[243]

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 limiting or eliminating the Clean Power Plan 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. *See* https://www.epa.gov/sites/production/files/2016-09/documents/climate-change-ca.pdf. 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 (2081-2100). *See* http://research.atmos.ucla.edu/csrl//LA_project_summary.html. 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

[241] *Id.* at 11.

[242] *Id.* at 20.

[243] *Id.* at 207.

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." 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. (LADWP 2015 Urban Water Management Plan, Chapter 12, pp. 5, located at www.ladwp.com.) 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. (LADWP 2015 Urban Water Management Plan, Chapter 12, pp. 6-9.)

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. (See https://www.dailynews.com/2017/12/07/by-the-numbers-the-southern-california-wildfire-battles-in-la-ventura-counties/.) Researchers project that fires driven by Santa Ana winds, and the fires that occur 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*.[244] Annual temperatures are hotter, heavy downpours

[244] 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*

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.[245] 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.[246]

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.[247] 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.[248] 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.[249]

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 twenty-one inches higher than today, doubling the probability that historic 100-year coastal floods and hurricanes will increase in frequency and intensity, and extreme precipitation events will increase.[250] 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.[251]

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

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http://onlinelibrary.wiley.com/doi/10.1111/nyas.2015.1336.issue-1/issuetoc (hereinafter "*New York City Panel on Climate Change 2015 Report*").

[245] *New York City Panel on Climate Change 2015 Report*, Chapter 2.

[246] *Id.*

[247] *Id.* at 70.

[248] *Id.* at 78-82.

[249] *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 Assessment Ch. 9, Populations of Concern* (April 2016), at https://health2016.globalchange.gov/populations-concern.

[250] *New York City Panel on Climate Change 2015 Report* at 33, 40-41.

[251] *Id.* at 27.

and severe flooding; at other times, the new extremes could subject the City to prolonged periods of drought.[252]

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.[253] Without mitigation of greenhouse gas emissions, hotter summers predicted for as soon as the 2020s could cause an estimated 30 to 70 percent increase in heat-related deaths, or about 110 to 260 additional heat-related deaths per year on average in New York City.[254] By the 2050s, the average temperature in New York City is projected to increase by 4.0 to 5.7 degrees Fahrenheit and the number of days with temperatures rising above 90 degrees will increase two to three-fold.[255]

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 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.[256]

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.[257]

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

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[252] *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.

[253] *New York City Panel on Climate Change 2015 Report* at 26.

[254] As compared to the baseline period for analysis of 1998-2002. *New York City Panel on Climate Change 2015 Report* at 31.

[255] *See id.* at 22, 31.

[256] Mayor's Office of Sustainability & ICF International, Growing Stronger: Toward A Climate-Ready Philadelphia (2015), p. 5, https://beta.phila.gov/media/20160504162056/Growing-Stronger-Toward-a-Climate-Ready-Philadelphia.pdf

[257] Id.; see also ICF Incorporated, L.L.C., Useful Climate Information for Philadelphia (2014) at 3, https://beta.phila.gov/media/20160505145605/Useful-Climate-Science-for-Philadelphia.pdf.

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.[258]

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.[259]

The impacts of climate change in Philadelphia will be costly. Just one severe hurricane could cause more than $2 billion in damages citywide.[260] On top of these additional disaster costs, climate change will increase the everyday cost of doing business.[261]

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.[262]

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

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[258] See Growing Stronger: Toward A Climate-Ready Philadelphia at 5

[259] *Id.*

[260] *Id.* at 9

[261] *Id.*

[262] *Id.* at 13

asthma. In 2010, nearly a quarter of children in Philadelphia County had asthma, among the highest rates in the nation.[263]

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.[264]

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.[265]

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.[266]

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 availability of fuel for generators and vehicles, and allow water levels to rise in buildings and other facilities.[267]

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

[263] *Id.*

[264] *Id.*

[265] *Id.*

[266] *Id.* at 14

[267] *Id.*

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.[268]

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.[269] 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 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.[270]

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.[271]

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

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[268] 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. https://doi.org/10.1016/j.jenvman.2018.01.025

[269] *Miami-Dade Expands Evacuation Order*. Miami Herald, 7 Sep 2017

[270] 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/

[271] SRS Engineering Inc. Citywide Sanitary Sewer Master Plan, September 14, 2016.

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.[272]

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.[273] 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 occurring monthly for a full six months. These conditions reveal 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 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.[274]

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, energy infrastructure, and water and wastewater infrastructure. Fort Lauderdale recently estimated that upgrades to the city's storm water system to combat rising sea levels would reach $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.[275]

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

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[272] 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

[273] Coastal county definition, NOAA Office for Coastal Management, coast.noaa.gov, November 2017

[274] Broward County, Geographic Information Systems, staff analysis

[275] 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

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.[276]

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 in water supply capacity by 2060 (40 percent of Broward's coastal wellfield capacity), due fully to the additional influence of sea level rise. 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. Pumps to replace gravity water control structures within the regional flood control system are estimated to each cost $50 million.[277] Existing pump systems are also inadequate. Provisional modeling performed by the USGS 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.[278]

In response to these risks, Broward County, partner counties in the 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.[279] This projection was developed via the activities of the Southeast Florida Regional Climate Change 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 has 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 will be used to substantiate proposed regional seawall standards. The County is modernizing regulatory standards for surface water management systems to include wet season groundwater elevations under future sea level conditions, and is preparing to remap the 100-year flood condition with an additional two feet of sea level rise to support new standards for finished

[276] 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.

[277] This is a minimum cost estimate based on FEMA reimbursement for retrofit of an equivalent structure in Miami-Dade County.

[278] Results not yet published.

[279] Unified Sea Level Rise Projection for Southeast Florida, Southeast Florida Regional Climate Change Compact. 2015

floor elevations. The implications for planning and infrastructure design will be significant, but necessary given the risk and financial exposure of inaction.[280]

[280] 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

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]

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[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. Clean energy is one of the fastest growing sectors of California's economy, employing more than a half a million people overall.[10] 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.[11] 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.[12] The workers benefiting from these job opportunities are mostly residents of low-income, rural areas, such as Kern and Imperial Counties.[13]

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 of any state in the country.[14]

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.[15] Between 2001 and 2013, Connecticut reduced gross carbon dioxide emissions from in-state power plants by 34 percent, and economy-wide per capita emissions by 18 percent.[16] Concurrently between 2001 and 2013, Connecticut's emissions of harmful criteria pollutants from in-state power plants dropped precipitously; overall emissions of

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[10] 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.

[11] *Supra* note 9, p. 13.

[12] 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.

[13] *Id*. at 7

[14] U.S. Energy Information Administration, *2016 Average Monthly Bill – Residential*, https://www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf.

[15] The Investment of RGGI Proceeds in 2015. (October 2017). https://www.rggi.org/docs/ProceedsReport/RGGI_Proceeds_Report_2015.pdf

[16] 2013 Connecticut Greenhouse Gas Emissions Inventory. (2016). http://www.ct.gov/deep/lib/deep/climatechange/2012_ghg_inventory_2015/ct_2013_ghg_inventory.pdf

nitrogen oxides (NOx) and sulfur oxides (SOx) decreased by 89 percent and 97 percent, respectively.[17]

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.[18]

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.[19]

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 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

[17] 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.

[18] 7 DE Code Ch 60 - http://delcode.delaware.gov/title7/c060/sc02a/index.shtml

[19] Delaware Sustainable Energy Utility – 2016 Annual Report. https://www.energizedelaware.org/Sustainable-Energy/2016-annual-report

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.[20]

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 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.

[20] Climate Framework for Delaware. 2014. http://www.dnrec.delaware.gov/energy/Documents/The%20Climate%20Framework%20for%20Delaware%20PDF.pdf

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.[21] 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.[22] 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.[23] 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.[24] 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.[25] 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.[26]

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.[27] 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.[28] 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 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

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[21] http://awea.files.cms-plus.com/FileDownloads/pdfs/Iowa.pdf

[22] http://www.iaenvironment.org/webres/File/Iowa%20Wind%20Energy%20Fact%20Sheet%20-%20June%202017.pdf

[23] *Id.*

[24] http://awea.files.cms-plus.com/Iowa%20Report_7.15%20%281%29.pdf

[25] http://www.iowawindenergy.org/one-year-later-wind-project-updates/

[26] https://www.midamericanenergy.com/wind-energy.aspx

[27] http://www.seia.org/sites/default/files/2017%20Q1%20IA.pdf

[28] https://www.eia.gov/electricity/annual/html/epa_03_21.html

commercial applicants.[29] 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.[30] 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[31] is building a 5 MW array around Dubuque, while Central Iowa Power Cooperative[32] announced a 5.5 MW project last March.

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.[33] 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.[34] 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.[35]

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 particularly high.[36] The results of that effort reduced annual energy costs by approximately $120,000.[37] 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.[38] Projects like these at

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[29] https://tax.iowa.gov/sites/files/idr/Solar%20Energy%20System%20Tax%20Credit%20Annual%20Report%202016%20Revised.pdf

[30] 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.

[31] http://www.thegazette.com/subject/news/business/alliant-building-iowas-largest-solar-site-in-dubuque-20170606

[32] http://www.thegazette.com/subject/news/business/cipco-plans-7-million-solar-project-20160331

[33] 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

[34] *Id.*

[35] 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.

[36] *Id.*

[37] *Id.*

[38] 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.

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.[39] Accordingly, as of December 2016, approximately 1,458 MW of generation capacity comes from renewable resources.[40] Maryland customers currently have access to over 750 MW of installed solar power, with 276.9 MW of installed solar energy having been added in 2016 alone.[41] Marylanders also have access to over 250 MW of installed wind power. During 2016, wind energy provided 1.41 percent of all electricity production in Maryland, which is an equivalent to powering 49,000 homes.[42] 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 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

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[39] *See* S.B. 300, 1999 Gen. Assemb., Reg. Sess. (Md. 1999)

[40] *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.

[41] *See* Solar Energy Industries Association, Solar State by State, https://www.seia.org/state-solar-policy/maryland-solar (last visited Oct. 16, 2017).

[42] *See* American Wind Energy Association, Maryland Wind Energy, *available at* http://awea.files.cms-plus.com/FileDownloads/pdfs/Maryland.pdf.

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[43] and study methods to promote the deployment of energy storage on all parts of the electricity grid.[44] *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 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.[45]

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

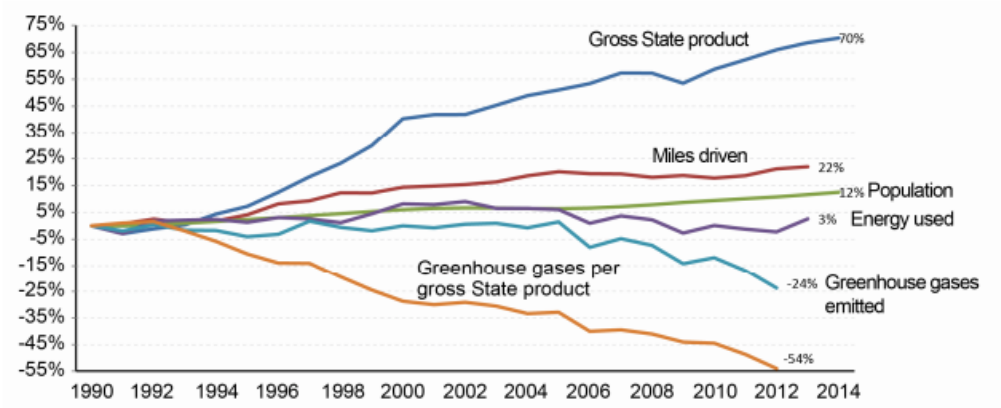
[43] Maryland's new tax credit provides for up to $5,000 for a system installed on a residential property and the lesser of $75,000 or 30% of the cost of installation of a system installed on a commercial property.

[44] 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.

[45] 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.

$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.[46] 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 has been ranked number one in the country for energy efficiency according to the American Council for an Energy Efficient Economy.[47]

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

[46] 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.

[47] *See State Energy Efficiency Scorecard,* American Council for an Energy-Efficient Economy, *at* http://aceee.org/state-policy/scorecard.

recommendations designed to spur investment in 600 MW of grid-scale energy storage in Massachusetts by 2025.[48]

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 (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

[48] 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.

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.

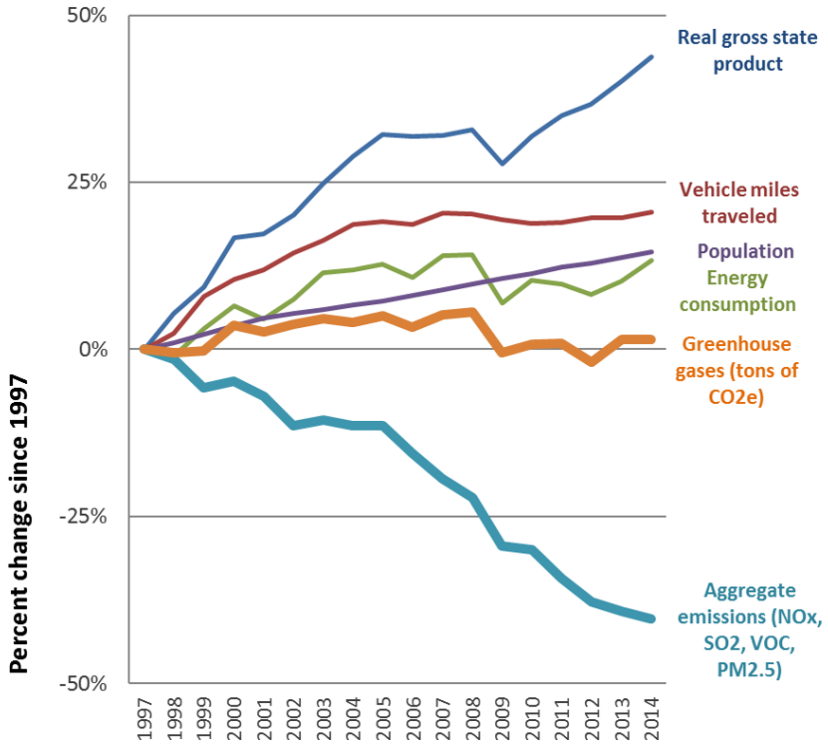
Minnesota has made substantial progress towards its clean energy future. Local utilities' Integrated Resource Plans outline a continued trend towards closing coal plants and replacing that power generation with a mix of renewables backed by natural gas. The state's analyses indicate that these plans 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.

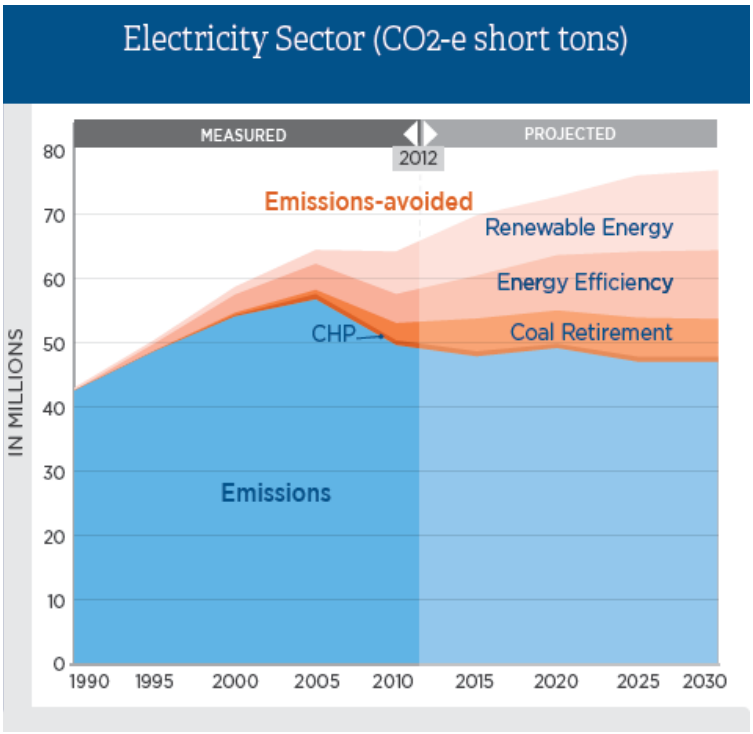
For Minnesota, clean energy means family-supporting jobs and a strong economy. During this period of greenhouse gas emission reductions, the gross state product of Minnesota has increased, surpassing pre-recession (2009) levels by 2010 and continuing to grow. The following figure shows that Minnesota has successfully decoupled its economic growth from the state's greenhouse gas emissions.

Comparison of emissions and economic indicators, 1997-2014



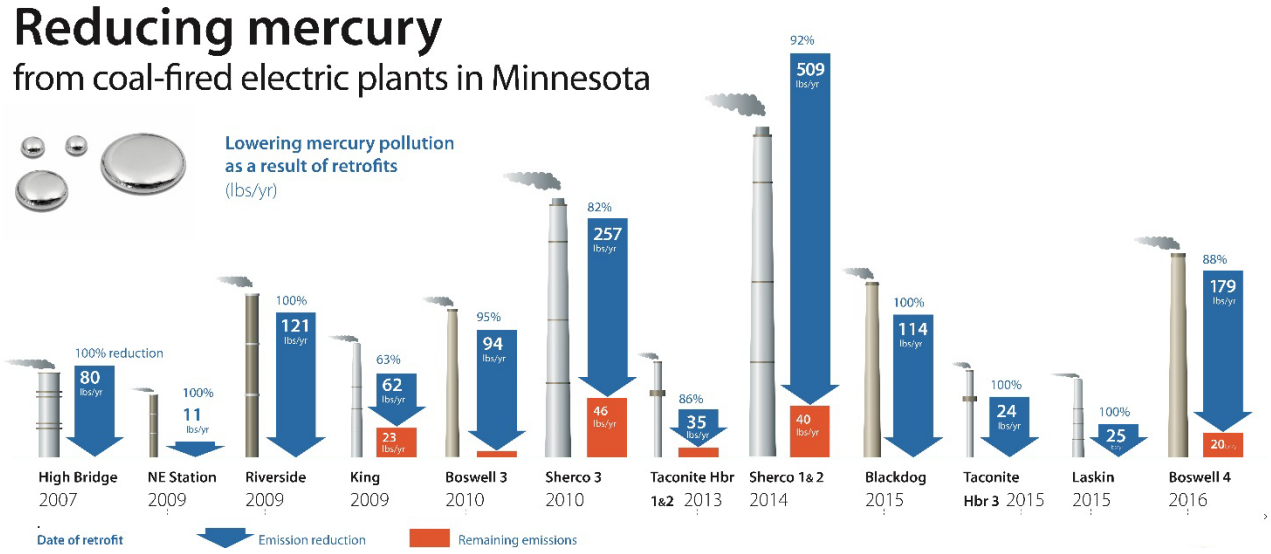
The Minnesota Department of Employment and Economic Development's 2014 report, "Minnesota's Clean Energy Economy Profile: How Industry Sectors are Advancing Economic Growth" (https://mn.gov/deed/data/research/clean-energy-economy/) notes that more than 15,300 Minnesotans work in the clean energy field, 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.[49] In 2007, SB418 doubled the amount of electricity utilities had to obtain from renewable sources from 10% by 2011 to 20% by 2020.[50] Proposals are now pending which would step up renewable portfolio standards to 80% by 2040 and 100% by 2050. New Mexico boasts 76 solar companies employing nearly 3,000 people, an increase of 54% in the past year

[49] 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 accessed Jan. 5, 2018).

[50] 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 accessed Jan. 5, 2018).

alone.[51] 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.[52] 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." Once online, these new facilities will increase New Mexico's current wind generation output by more than 128%.[53] 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% of the City's energy use via solar by 2025, all at no cost to the taxpayers.[54] 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 or not.[55]

New York

New York has demonstrated that it's 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 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.[56]

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[51] The Solar Foundation, *National Solar Jobs Census 2016* (March 2017). Available at https://www.thesolarfoundation.org/solar-jobs-census/ (last accessed Jan. 5, 2018).

[52] The Albuquerque Journal, *Xcel Wind Farm Agreement Includes Local Spending Pledge* (Dec. 14, 2017). Available at https://www.abqjournal.com/1106879/xcel-wind-farm-agreement-includes-local-spending-pledge.html

[53] The Albuquerque Journal, *Gust of Wind-Generated Energy Sweeping Toward New Mexico* (Dec. 27, 2016). Available at: https://www.abqjournal.com/915514/gust-of-windgenerated-energy-sweeping-toward-nm.html

[54] Available at https://www.cabq.gov/council/find-your-councilor/district-6/news/city-announces-25m-solar-project-to-increase-solar-and-grow-local-jobs

[55] The Farmington Daily Times, *Clean Power Plan Repeal Won't Affect San Juan Generating Station Retirement Plans* (Oct. 11, 2017). Available at http://www.daily-times.com/story/news/2017/10/11/clean-power-plan-repeal-wont-affect-san-juan-generating-station-retirement-plans/752156001/

[56] New York State Energy Research and Development Authority, *2017 New York Clean Energy Industry Report* (Dec. 2017), available at: https://www.nyserda.ny.gov/About/Publications/2017-New-York-Clean-Energy-Industry-Report.

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.[57]

In addition, as a result of the investment of RGGI proceeds and other government programs, New York has grown its clean energy sector, which now employs about 146,000 workers, about 75 percent of which are in the energy efficiency sector.[58] The growth in clean energy jobs was 3.4 percent in 2016.

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 improvements, and other cleantech products and services.[59] 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.[60] 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,[61] 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

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[57] 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

[58] *2017 New York Clean Energy Industry Report*

[59] 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.

[60] 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.

[61] *See, e.g.*, "NYC Solar Summit 2013," Sustainable CUNY, June 2013; *see also* Green NYC 2025.

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.[62] The state has also incentivized growth of the renewable energy sector through the state's Utility Savings Initiative,[63] property tax abatements for solar energy electric systems,[64] and most recently, the passage of the Competitive Energy Solutions for NC Act.[65]

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[66] and is ranked second nationally in installed solar capacity.[67] 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.[68] 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. [69]

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

[62] N.C. Gen. Stat. § 62-133.8 (2017)

[63] 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)

[64] N.C. Gen. Stat. § 105-275(45) (2017)

[65] N.C. Session Law 2017-192 (July 27, 2017)

[66] 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.

[67] Solar Energy Industries Association, Solar Industry Data, https://www.seia.org/solar-industry-data (last visited Jan. 4, 2018).

[68] U.S. Energy Information Administration, State Profiles and Energy Estimates: North Carolina (Aug. 17, 2017), https://www.eia.gov/state/?sid=NC

[69] 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.

Carolina reduced its CO_2 emissions by 14.6% while growing its GDP by 26.3%.[70] In 2016, it is estimated that more than 3 million tons of CO2 emissions were avoided due to REPS.[71]

Between 2007 and 2016, approximately $10,024.5 million was invested in clean energy development in the state.[72] 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

Oregon is quickly adapting to the challenges of climate change by developing a robust clean economy focused on the development of renewable energy to replace carbon-intensive energy and innovative strategies to reduce use of limited natural resources.

- Between 2010 and 2014, clean economy jobs in Oregon grew at an overall rate of 11%, faster than the economy as a whole.

- Oregon's clean energy supply sector grew at an overall rate of 22 percent, largely due to efforts to expand its clean tech clusters.

Oregon has invested strategically in programs that transform lab research into jobs by helping grow university research revenue, driving commercialization of new technologies, and ensuring Oregon's economy thrives. Examples include companies like TryEco, which is developing a superabsorbent, biodegradable polymer that could revolutionize agriculture by dramatically reducing demands on irrigation, and eWind Solutions, that is developing a tethered kite system to harvest clean energy from higher-velocity, higher-altitude winds unreachable by small wind turbines.

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

[70] 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.

[71] 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

[72] Research Triangle Institute International, Economic Impact Analysis of Clean Energy Development in North Carolina – 2017 Update, supra note 5.

power 99,229 homes for a full year) and is estimated to save Pennsylvanian ratepayers over $95 million on their electricity bills annually.[73]

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.[74]

"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.[75]

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.[76]

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.[77]

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[73] *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

[74] *See* "Clean Jobs in Pennsylvania," available at http://cleanenergyworksforus.org/wp-content/uploads/2014/11/CleanJobsPennsylvania.pdf

[75] *Id.*

[76] *Id.*

[77] *Id.*

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 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.[78]

Vermont

As of May 2016, clean energy jobs in Vermont had increased by 20% since 2013, and 17,715 Vermonters comprising about 6% of the state's workforce were employed in clean energy jobs. *Vermont Clean Energy 2016 Industry Report* (http://publicservice.vermont.gov/sites/dps/files/documents/Renewable_Energy/CEDF/Reports/VCEIR%202016%20Final.pdf). These 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.*

Vermont has long been a leader in promoting energy efficiency. In 1999 it became the first state to create a statewide energy efficiency utility. As of April 2016, energy efficiency related jobs comprised about half of the state's clean energy jobs. However, renewable energy generation jobs have been growing more rapidly in recent years. The greatest number of those jobs, 2,100, are in solar electric generation.

Clean energy is poised to continue as a source of significant job growth in Vermont. However, such growth may be negatively impacted by declining prices for fossil fuels such as natural gas and oil, and/or federal regulatory developments or policies that favor fossil fuel development.

[78] 2016 Rhode Island Clean Energy Jobs Report, Rhode Island Office of Energy Resources (OER) and the Executive Office of Commerce

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.[79] While Virginia does not offer state incentives such as tax credits, it still has seen significant increases in the deployment of solar power. In 2015, Virginia had only 28.6 megawatts of installed solar.[80] In 2016, that number increased to 188.4 MW, and by the end of 2017, should be at 386 MW.[81] This ramp up in solar development has corresponded to an increase in clean energy jobs, which now number an estimated 33,057.[82] In Accomack County, developers with support from state government and incumbent utility recently installed the largest solar facility (80 MW) east of the Mississippi.

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*.[83] Dominion is one of numerous corporate amici on behalf of EPA. Dominion argued that 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."[84]

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[85] to increase the amount of eligible new

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[79] Va. Acts ch. 296 (2018) (amending Va. Code 56-585.1(A)(6)).

[80] 2016 Update to the Virginia Energy Plan, available at: http://governor.virginia.gov/media/7935/energy-in-the-new-virginia-economy-update-to-the-2014-energy-plan.pdf

[81] *Id.* at 8

[82] *Id.* at 3

[83] USCA Case #15-1363 Document #1606778

[84] Amicus brief at 5

[85] 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.

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.[86]

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%.[87] 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.[88] Many have already acquired sufficient renewables to meet the 2020 15% standard.[89] These clean energy benefits are a bargain, adding on average only $1 per month to Washington investor-owned utility customers' bills.[90]

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 generation from renewable resources,[91] with hydroelectric power typically accounting for between two-thirds and four-fifths of Washington's electricity generation.[92] In addition, Washington is among the top 10 states in the nation in electricity generation from renewable resources other than hydropower.[93] More than 3,000 megawatts of installed capacity make wind energy the second largest contributor to the state's renewable generation.[94] Washington is also a substantial producer of electricity from wood and wood waste.[95] 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.[96]

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[86] 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.

[87] 2017 Biennial Energy Report and State Energy Strategy Update, Dept of Commerce, 2016; see also RCW 19.285.

[88] I-937 is working, see also RCW 19.285.

[89] *Id*.

[90] *Id.*

[91] EIA US Energy Information Administration, Washington State Energy Profile, last updated November 17, 2016.

[92] *Id*.

[93] *Id*.

[94] *Id*.

[95] *Id*.

[96] *Id.*

In addition, in 2015, including hydropower, more than 65% of the electricity consumed in Washington came from renewables.[97] 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.[98] Analysts have concluded that the generation lost from retiring coal plants can be replaced with existing and limited new generating resources and energy efficiency. [99]

Energy efficiency is the Northwest's second largest resource after hydropower.[100] 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.[101] In addition, efficiency is about four times less expensive than other generation, saving ratepayers $4.06 billion in 2015.[102] 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.[103]

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 revenue.[104] The wind and solar industries support more than 4,500 jobs and nearly 150 businesses throughout Washington.[105] 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.[106]

Studies indicate that the western grid can handle high renewables in both normal and challenging conditions.[107] 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.[108]

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[97] Pacific Coast Collaborative at COP23 Bonn.

[98] EIA US Energy Information Administration, Washington State Energy Profile, last updated November 17, 2016. See also RCW 80.80.040.

[99] Northwest Power and Conservation Council, 2017 Overview

[100] *Id.*

[101] *Id.*

[102] *Id.*

[103] *Id.*

[104] I-937 is working, NW Energy Coalition and Renewable Northwest, February 2015

[105] I-937's energy efficiency and renewable energy success benefits workers, businesses, and bill payers, NW Energy Coalition and Renewable Northwest, January 20, 2016

[106] *Id.*

[107] National Renewable Energy Laboratory, Energy System Integration, November 2015

[108] Western Wind and Solar Integration Study, National Renewable Energy Laboratory, Executive Summary

Integrating renewables at current levels is not causing any problems with grid reliability.[109] 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.[110]

[109] 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.

[110] 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.