Path to the Paris Climate Conference

American Progress in Cutting Carbon Pollution Could Pave the Way for Global Action

ENVIRONMENT VIRGINIA
RESEARCH & POLICY CENTER

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Executive Summary

In December 2015, world leaders will convene in Paris to negotiate an international agreement to address the serious threat of global warming. As the country responsible for more climate-changing pollution in the atmosphere than any other, the United States has a moral obligation to lead the world into action.

The best way to lead is by example. And, as this report demonstrates, the United States is doing just that. By following through and fully implementing policies already enacted at the local, state, and federal levels – including the Clean Power Plan, the first national policy to limit climate pollution from power plants – the nation can reduce carbon dioxide pollution from fossil fuel combustion (the leading cause of global warming) by 27 percent below 2005 levels by 2025. **In other words, these policies can prevent as much as 1.1 billion metric tons of carbon dioxide pollution annually by 2025, more than the annual emissions of the entire nation of Germany, the world's sixth largest polluter.**

U.S. action to cut pollution is a critical step on the path to the Paris climate talks. To deliver on President Obama's pledge to reduce emissions and secure America's leadership, officials at all levels of government must follow through on existing policies, including the Clean Power Plan, and defend them against attack. Meeting the president's pledge will also require the United States to do more to reduce emissions of other global warming pollutants beyond carbon dioxide.

However, meeting the pledge alone will not be enough to solve the problem. The United States should push for a strong international agreement in Paris, one capable of limiting global warming to less than 2°C (the consensus target to guide action on climate). To avoid the worst effects of global warming, we must cut emissions further, faster. The United States must deepen commitments to reduce global warming pollution and find additional ways to increase clean energy, expand energy efficiency and deploy zero-emission transportation options.

The Clean Power Plan, the first federal limit on global warming pollution from electricity generation, will drive greater reductions in carbon dioxide emissions than any other policy adopted to date.

- Coal- and natural gas-fired power plants are the largest source of global warming pollution in the United States.
- The Clean Power Plan, as proposed in 2014, could reduce carbon dioxide pollution by more than 500 million metric tons ($MMTCO_2$) by 2025, assuring the achievement of nearly one-third of the emission reductions needed to meet the president's climate reduction pledge.
- As a result of this policy, wasteful electricity consumption will decline, power plants will operate more efficiently, and more electricity will come from clean, renewable sources.

A number of policies already in place to reduce emissions from electricity (discussed below) will help states comply with the Clean Power Plan.

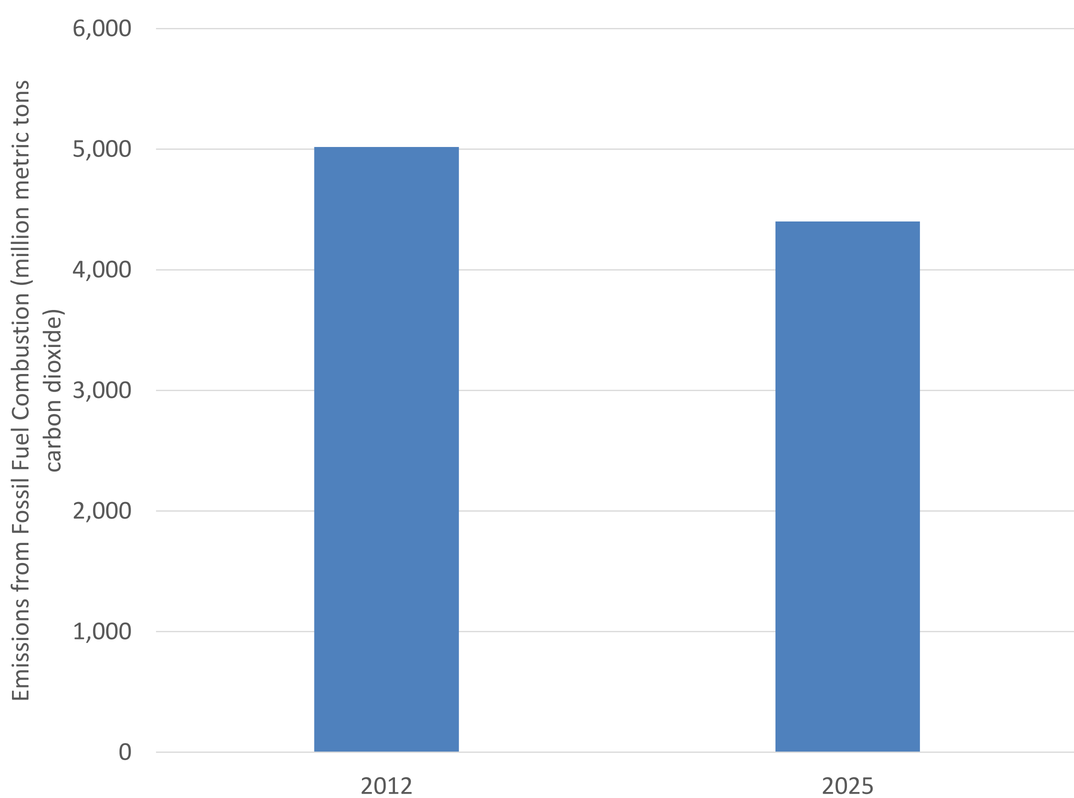
Economy-wide caps on global warming pollution adopted by seven states reduce emissions from a wide range of sources.

- California, Connecticut, Hawaii, Massachusetts, Maryland, New Jersey and Rhode Island have adopted broad caps on emissions that, when implemented fully, will reduce pollution by 242 $MMTCO_2$ in 2025.
- California's cap, for example, calls for cutting global warming pollution to 1990 levels by 2020 and to 40 percent below 1990 levels by 2030. The state will achieve these savings by improving the efficiency of vehicles, increasing energy efficiency, and boosting renewable energy generation, among other measures.
- More than 80 percent of the savings from the state caps come from California's actions, both because the state is large, and because it has pledged to make the deepest cuts in emissions.

State and federal policies will reduce wasteful energy use.

- As a result of current policy commitments, by 2025, new homes and businesses will use less energy, and many existing buildings will have been renovated to cut energy use. Appliances will provide the same functions as today while consuming less electricity and natural gas. Less energy will be needed to provide lighting.
- Federal appliance efficiency standards and state ratepayer-funded programs to reduce energy waste in homes and businesses will reduce pollution by 235 $MMTCO_2$ in 2025 compared to emissions without these programs.

Figure ES-1. Estimated Carbon Dioxide Emissions in 2025 with Adopted and Proposed Clean Energy Policies



Emissions from cars, SUVs and light-duty trucks – which together represent the biggest source of pollution from transportation – will be 10 percent lower in 2025 due to improved vehicle fuel economy and emission standards.

- As a result of national and state policy, a typical new car in 2025 will go nearly 17 miles farther on a gallon of gas than a typical new car in 2015.
- National adoption of the global warming pollution standards in the Clean Cars Program, a policy originally developed by California and 13 other states, means that passenger vehicles will produce 179 $MMTCO_2$ less in 2025 than would otherwise have been the case.

More wind, solar and other clean energy generation will reduce the nation's reliance on electricity from coal and natural gas.

- Wind energy production tripled from 2008 to 2014, while solar generation grew by an average of 65 percent per year from 2010 to 2013. With the right policy support, this growth in renewable energy will continue.
- Twenty-eight states and Washington, D.C., currently have renewable energy requirements driving growth in wind and solar energy, with many benefits and little to no cost to consumers. These policies will reduce emissions by 57 $MMTCO_2$ in 2025.

The Regional Greenhouse Gas Initiative (RGGI) will produce nationally significant reductions in power plant emissions.

- Nine Northeastern states have adopted a regional cap on emissions from power plants. By requiring power plant operators to purchase pollution permits, RGGI creates a financial incentive for electricity generators to cut pollution. Funds from the sale of permits support investment in energy efficiency and clean energy technology.
- RGGI will cut global warming pollution by 55 $MMTCO_2$ in 2025 compared to a scenario without the policy. Like other policies that reduce emissions from electricity consumption, RGGI will help participating states comply with the Clean Power Plan.

Heavy duty vehicles – such as tractor-trailers, buses and delivery trucks – will use fuel more efficiently.

- Until recently, there were no standards for fuel efficiency in medium- and heavy-duty vehicles. As a result, tractor-trailers currently travel only about 6 miles for every gallon of fuel burned.
- Federal requirements for improved fuel efficiency in heavy-duty vehicles will reduce emissions by 29 $MMTCO_2$ in 2025 compared to a scenario without the standards.
- An expected second phase of efficiency improvements will deliver even greater reductions than estimated here.

The combined effect of these policies (excluding overlapping policies) will be to reduce U.S. carbon dioxide emissions by 1.1 billion metric tons per year in 2025, compared to a scenario in which those policies did not exist. The greatest emission reductions occur in states that that have adopted economy-wide caps on global warming pollution or that have carbon-intensive electricity sources.

The actions the United States has taken to date are necessary – but not yet sufficient – to prevent a catastrophic rise in global temperatures. In order to keep global temperatures from rising more than 2°C (3.6°F) – the international consensus target for preventing the worst consequences of warming – the U.S. must cut emissions at least 80 percent below 1990 levels by mid-century. Other nations around the world must also take action.

Leaders at all levels of government across the United States must follow through with existing commitments to reduce pollution.

- The Obama administration should finalize the strongest possible Clean Power Plan to limit global warming pollution from power plants. States should then implement the policy with plans that maximize the use of energy efficiency, wind energy, solar energy, and other zero-emission technologies, in order to ensure a sustainable, low-carbon trajectory for the nation's electricity system beyond the 2030 compliance deadline.
- States with global warming pollution caps should ensure the effective and timely implementation of those policies. California, for example, incorporated transportation fuels into its cap and auction program this year, enabling the state to advance its investments in zero-emission mobility solutions.
- Elected officials should stand up to any and all attacks on clean energy policies.

Leaders at all levels of government should identify and pursue new policies to cut pollution.

- The nation should increase the amount of electricity that it obtains from renewable sources, aiming for 100 percent clean energy by mid-century.
- The United States should ensure that all new vehicles achieve zero-emissions performance within the next 25 years.
- The nation should reduce wasteful energy use by adopting stronger energy efficiency policies.
- The U.S. also must curb emissions of other climate pollutants, including methane and HFCs.

The United States must play a leadership role at the Paris conference.

- Building on the foundation of actions taken to date, the United States should push for an international agreement in Paris this December sufficient to keep global temperatures from rising by more than 2°C.

Introduction

The United States is rebuilding its economy on a new foundation: one that is less reliant on fossil fuels and produces less climate pollution. Policies to reduce wasteful energy use and boost clean, renewable electricity production are already having an impact, helping to drive down carbon dioxide emissions every year from 2007 to 2012.[1]

The shift to a clean energy economy is increasingly visible in our homes, on our roads and in our communities. In Lancaster, California, residents and public officials have embraced solar energy, installing enough solar panels to power many of the city's schools, businesses, churches and municipal buildings, and even the local minor league baseball stadium.[2] Lancaster's goal is to meet all of its electricity needs with clean energy.

In Boston, residents, businesses and the city government have made a bold commitment to energy efficiency. The city has an ambitious plan for reducing energy use, and has adopted a program to ensure that owners of large buildings are doing everything they can to cut energy use and improve efficiency.[3] Meanwhile, like many other cities, Boston is expanding bike lanes and building new, walkable neighborhoods that reduce people's need to drive.

In Greensburg, Kansas, the town is rebuilding after a tornado on a renewable foundation.[4] Municipal and commercial buildings have been rebuilt to use far less energy than typical buildings. Many also produce renewable energy on-site, with some buildings meeting half their electricity need with wind, solar or geothermal energy. A new wind farm provides zero-emission electricity for the entire community.

On streets and highways in those cities and beyond, electric vehicles with zero tailpipe emissions are becoming a common sight, while almost every new car on the road – even big trucks – increasingly incorporates technology designed to improve fuel efficiency.

If the United States is to lead the world in responding to global warming, those changes must be only the beginning. America has vast renewable energy potential and great opportunities to use energy more efficiently. We have tremendous technical know-how and a citizenry that increasingly recognizes the dire threat posed by global warming and wants to do something about it.

With world leaders gathering in Paris later this year to discuss next steps to prevent catastrophic global warming, it is time for the United States to take stock of the progress it has made to date, and to make a bold commitment to further action.

This report shows that the United States has already taken important steps toward a clean energy future, adopting public policies that are helping to reduce the impacts of global warming. Much, of course, remains to be done. But the progress made to date provides hope that the nation can rise to the challenge and lead the world in meeting the defining global threat of our time.

The U.S. Role in Global Warming

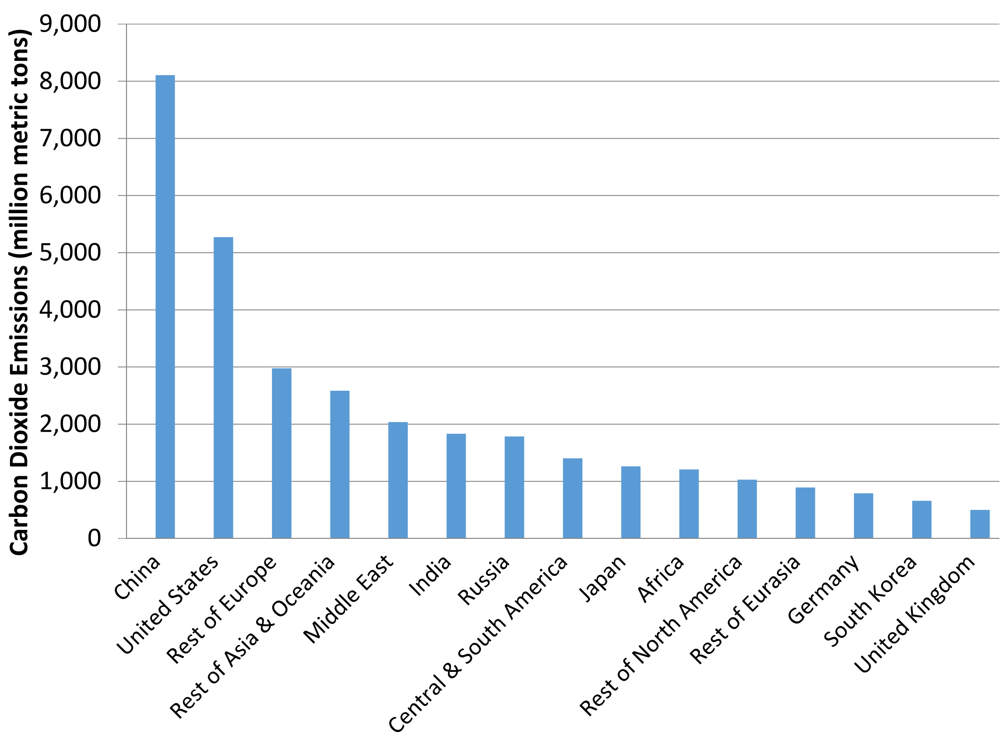
As the largest source of the global warming pollution now in the atmosphere, the United States has a moral obligation to lead the way in preventing further pollution, both by cutting emissions at home and urging other countries around the world to join us.

The United States Is a Leading Source of Pollution

No country has produced more total global warming pollution since the Industrial Revolution than the United States.[5] In terms of annual emissions, the U.S. remains the second-largest polluter today, surpassed only by China.[6] (See Figure 1.)

U.S. global warming emissions have declined since their peak in 2007, the result of policies to improve energy efficiency and boost renewable energy production and a decline in coal-fired electricity generation.[8] However, the federal government anticipates that carbon dioxide emissions will begin to climb again, unless the nation implements new policies to reduce emissions. Assuming that energy

Figure 1. The U.S. Was the World's Second-Largest Global Warming Polluter in 2012[7]



consumption in regions across the country increases as forecast by the U.S. Department of Energy, carbon dioxide emissions in the United States could increase slowly over the course of the next decade and beyond. (See Figure 2.)

The U.S. Has Pledged to Cut Carbon Pollution

As a leading source of global warming pollution, the United States must dramatically reduce its emissions if the world is to avoid the worst impacts of global warming.

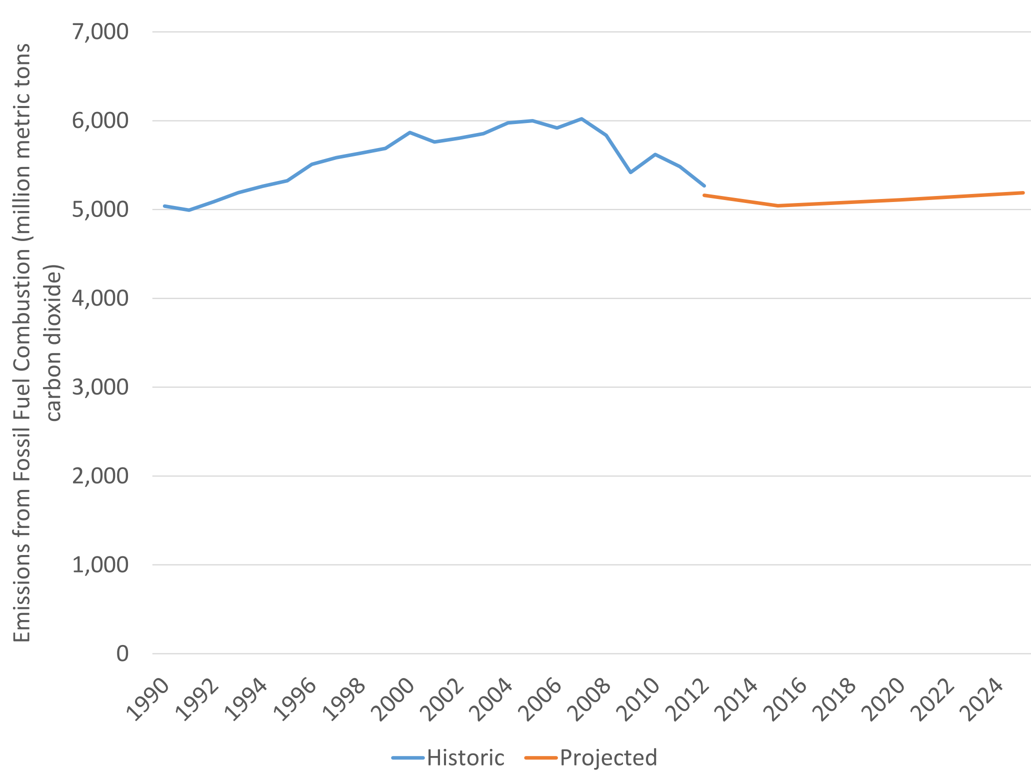
The nation's leaders have begun to take steps in the right direction. President Obama's Climate Action Plan set a course to reduce emissions to 17 percent below 2005 levels by 2017. In November 2014, the Obama administration announced an agreement with China, pledging to reduce U.S. climate pollution by 26 to 28 percent below 2005 levels by 2025.[10] This is also the nation's pledge in advance of the Paris climate conference.

The 2015 Paris climate negotiations offer an opportunity for the U.S. to push for a strong global agreement to help keep total global warming pollution to the level that scientists say is needed to avoid the worst impacts of warming. With the nation's strong public commitments to reducing emissions, backed by a broad range of policies that are already having an impact, the U.S. is in a clear position to encourage strong international action.

Further Pollution Reductions Are Necessary

To have a reasonable hope of keeping global temperatures within 2°C (3.6°F) of pre-industrial levels, global warming pollution must drop dramati-

Figure 2. Historic and Projected U.S. Carbon Dioxide Pollution from Fossil Fuel Combustion[9]



cally. Emissions must fall at least 80 percent below 1990 levels by 2050. For the U.S., that means carbon dioxide emissions from fossil fuel combustion would need to fall to roughly 1,000 million metric tons per year by mid-century, and likely much lower.[11]

Cutting emissions to this degree will require action at all levels of government. Local governments will need to change land use laws and planning; state governments will need to support energy efficiency and greater use of clean energy technology; and the federal government will have to promote renewable energy; discourage coal, oil and gas consumption; and lead international efforts to achieve global emission reductions.

The range of needed actions goes far beyond what the nation has already initiated. However, thanks to action by states and the federal government, the U.S. is heading in the right direction.

The United States Is Cutting Carbon Pollution

State governments and the federal government have adopted a wide range of policies to reduce carbon dioxide pollution from burning fossil fuels. These policies address emissions from transportation; residential, commercial and industrial energy use; and electricity generation.

Clean Power Plan

542 Million Metric Tons

America has dozens of dirty, aging power plants that make a disproportionate contribution to global warming and spew pollution that makes Americans sick. The nation's 50 dirtiest power plants produce 2 percent of the *world's* carbon dioxide emissions from energy use.[12] All in all, power plants produce about 38 percent of all carbon dioxide emissions from energy use in the United States.[13]

To clean up these polluting power plants, the U.S. EPA has initiated the first ever federal rules to cut carbon pollution from new and existing power plants. In 2013, the agency announced proposed rules that would limit new power plants to emissions of no more than 1,100 pounds of carbon dioxide per megawatt-hour – significantly less than the average coal-fired plant, which emits 1,800 pounds of carbon dioxide per megawatt-hour.[14]

More recently, the EPA proposed the first-ever federal rules to cut carbon pollution from existing power plants.[15] The Clean Power Plan, as proposed, will help reduce global warming emissions from electricity generation by 30 percent from 2005 levels by 2030.[16] EPA expects to finalize these rules during the summer of 2015.

States will be responsible for developing their own approaches to comply with the Clean Power Plan, and have wide latitude in determining how they will meet their goals. States that fail to develop sufficient plans will cede that authority to EPA, which will then apply a federal plan.

The Clean Power Plan has the potential to be the single most significant action taken by the United States to address global warming, and one of the most significant actions in the world. The rules could reduce carbon dioxide emissions by 542 $MMTCO_2$ in 2025.

State Caps on Global Warming Pollution

242 Million Metric Tons

The U.S. federal government has thus far failed to set enforceable, economy-wide limits on emissions of global warming pollution. But seven U.S. states have. Together, these states – California, Connecticut, Hawaii, Maryland, Massachusetts, New Jersey and Rhode Island – could cut global warming pollution by as much as 242 million metric tons.

The seven U.S. states with enforceable limits on global warming pollution, taken together, represent nearly a quarter of U.S. gross domestic product and produce 13 percent of America's fossil-fuel related carbon dioxide emissions.[17] Collectively, they would represent the world's seventh-largest emitter of carbon dioxide, behind China, the United States as a whole, Russia, India, Japan and Germany.[18]

California became the first (and largest) U.S. state to cap global warming pollution with the adoption of Assembly Bill 32, also known as the Global Warming Solutions Act, in 2006. The law required the California Air Resources Board, or CARB, to formulate a plan to reduce California's global warming pollution to 1990 levels by 2020 – an approximately 17 percent reduction from business-as-usual projections – and 80 percent below 1990 levels by 2050.[19]

The centerpiece of California's pollution reduction plan is the state's cap-and-trade program, which has covered all major industrial and electricity-generation sources since the beginning of 2013 and, as of early 2015, now covers transportation fuel distributors. California's cap-and-trade program creates a financial incentive for businesses to implement the most cost-effective means of reducing global warming emissions.

California estimates that policies pursued to implement the statewide cap reduced global warming pollution by 18 million metric tons in 2011, the most recent year for which data are available.[20] California Gov. Jerry Brown has tightened the cap on global warming pollution with an executive order signed in spring 2015 that calls for reducing emissions 40 percent below 1990 levels by 2030.[21]

Efforts by other states to obtain economy-wide pollution reductions are similar in concept and design, though none have set such strong goals as California, which accounts for 80 percent of the savings. Implementation and enforcement of the caps in other states have varied in effectiveness.

Using Energy More Wisely in Our Homes and Businesses

235 Million Metric Tons

Nearly two-thirds of all carbon dioxide emissions in America come from the use of energy in our homes, businesses and factories.[22] Much of that energy is wasted through air leaks and the use of outdated, inefficient equipment.

Improving the efficiency of buildings and appliances is one of the quickest, cheapest ways to reduce global warming pollution. Over the last decade, states and the federal government have adopted a variety of policies to promote energy efficiency.

Many of these policies have overlapping impacts. Combined, they will help reduce emissions by 235 $MMTCO_2$ in 2025.

State Energy Efficiency Requirements

Wasting energy doesn't just hurt the environment; it also costs consumers money, both individually, through higher energy consumption, and collectively, through the need to pay for more power plants, transmission lines and pipelines on their energy bills.

To save energy, 24 states have adopted statewide energy efficiency requirements for utilities or have created programs through which ratepayers fund investments in energy efficiency improvements that benefit consumers and the environment. (See Table 1.) These programs help consumers to reduce energy waste by:

- helping homeowners identify and address sources of energy waste such as inefficient lighting and air leaks;
- helping commercial building owners to install more efficient heating and cooling systems;
- helping manufacturers identify inefficiencies in their processes and replace old equipment.

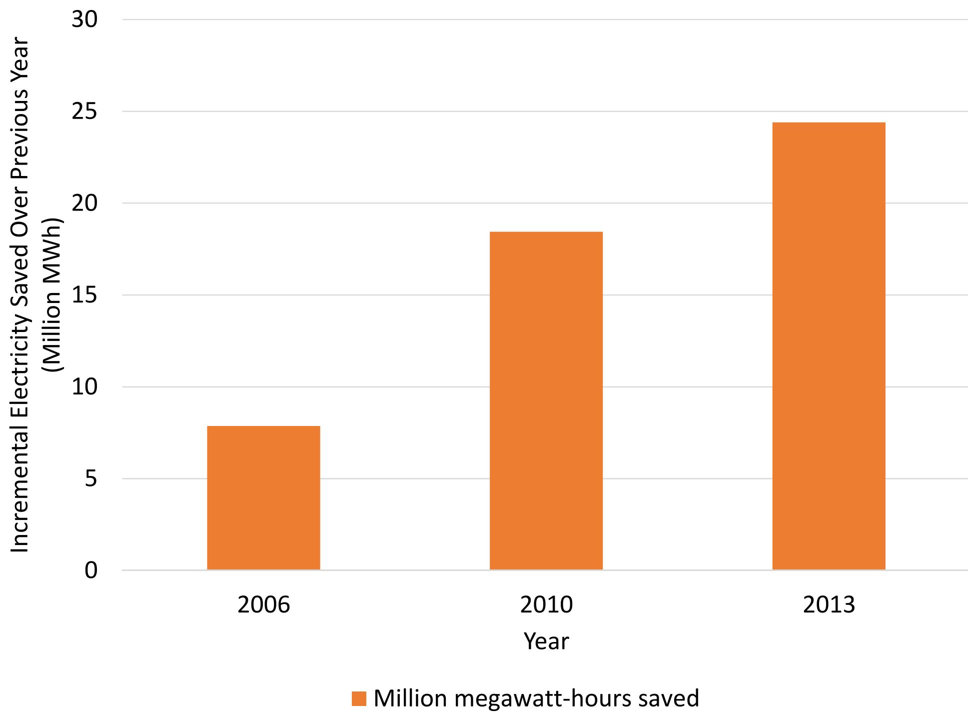
Table 1. States with Binding, Long-Term Energy Efficiency Requirements[23]

State	Electricity Efficiency Requirement?	Natural Gas Efficiency Requirement?
Arizona	Y	Y
Arkansas	Y	Y
California	Y	Y
Colorado	Y	Y
Connecticut	Y	Y
Hawaii	Y	N
Illinois	Y	Y
Iowa	Y	Y
Maine	Y	Y
Maryland	Y	N
Massachusetts	Y	N
Michigan	Y	Y
Minnesota	Y	Y
Nevada	Y	N
New Mexico	Y	N
New York	Y	Y
North Carolina	Y	N
Oregon	Y	Y
Pennsylvania	Y	N
Rhode Island	Y	Y
Texas	Y	N
Vermont	Y	N
Washington	Y	N
Wisconsin	Y	Y

Leading states, such as Massachusetts, have taken energy efficiency efforts to the next level, saving just over 2 percent of retail electricity sales through efficiency investments made during 2013 alone.[24] Those savings should continue to mount over the years, as previous investments continue to deliver energy savings and new investments contribute additional savings. Many states are also ramping up investments in efficiency: year-over-year energy savings due to state energy efficiency programs increased from 7.8 million megawatt-hours in 2006 to 24.3 million in 2013.[25] (See Figure 3.)

Cumulative state investments in energy efficiency from 2006 to 2013 produced savings of 130 million megawatt-hours in 2013 – as much electricity as was consumed by the entire state of North Carolina in 2012.[26]

Figure 3. Year-over-Year Energy Efficiency Savings Increased from 2006 to 2013[27]



Appliance and Lighting Efficiency Standards

Starting in the 1970s, states have adopted minimum energy efficiency standards for appliances, including notorious household energy hogs such as refrigerators.[28] As first California, and then other states, joined in the adoption of those standards, there emerged, according to the U.S. Environmental Protection Agency, a "consensus for new federal legislation."[29]

There are currently federal minimum efficiency requirements for 55 common household and commercial appliances, including air conditioners, furnaces, ceiling fans, light fixtures, traffic signals and commercial ice-makers.[30] As old appliances break or are retired, they are replaced by newer, more efficient equipment, ensuring energy savings for years to come.

The effort to improve appliance energy efficiency has accelerated in the last decade, as first the states and then the federal government moved to create new efficiency standards or tighten old ones. Since 2009, standards have been issued or updated for 29 products that account for 90 percent of residential electricity use, 60 percent of commercial building energy use and 30 percent of industrial energy use.[31] Among the most important of those new standards are those for lighting, which accounts for at least 11 percent of U.S. electricity use.[32]

Building Energy Codes

Building codes are the construction standards to which new and heavily remodeled buildings are held, including standards for energy efficiency. Because buildings last for decades, initial energy efficiency improvements made during construction can have a long-lasting impact, reducing energy waste, saving money, and cutting pollution for decades to come.[33]

State and local governments have wide latitude to establish their own building codes, but they often follow national model codes established by organizations such as the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) and the International Code Council. These model codes are updated, and usually strengthened, every three years.

The federal American Reinvestment and Recovery Act, passed in 2009, granted additional funds to states that upgraded to the most modern building energy codes, and all 50 states accepted funds to do so.[34] As of March 2015, 17 states and the District of Columbia had adopted a code as efficient as or more efficient than the commercial codes in place in the early 2010s.[35] For residential buildings, 10 states and the District of Columbia have adopted codes equal to or better than the relevant 2012 code.[36] Leading states such as Washington, Massachusetts, Maryland, Rhode Island, Illinois and California have adopted both updated residential and commercial energy codes.[37]

The latest codes bring with them the potential for big savings. The 2012 residential energy code, for example, was projected to improve energy efficiency by 30 percent relative to the 2006 version of the code.[38] The 2015 version of the code will deliver further savings.[39]

More Fuel Efficient Cars

179 Million Metric Tons

By 2025, Americans will be driving cars that go more than twice as far on a gallon of gas as the cars made a generation earlier – cutting per-mile carbon dioxide emissions in half – thanks to clean car standards adopted by the Obama administration after years of work at the state level.

For more than a decade, from 1990 through the mid-2000s, the federal government refused to strengthen vehicle fuel economy standards for cars, leaving Americans increasingly vulnerable to gas price increases and contributing to a sharp increase in carbon dioxide pollution from transportation. In the early 2000s, California adopted the nation's first law regulating global warming pollution from automobiles, a move that was followed by 13 other states and the District of Columbia – accounting for 40 percent of the United States market for new cars and light trucks.[40]

In late 2007, the U.S. Congress followed the states' lead by requiring stronger federal corporate average fuel economy (CAFE) standards for automobiles, setting a fuel economy target of 35 miles per gallon by 2020.

Then, in 2009, the Obama administration committed to national adoption of a modified version of the California standards. In spring 2010, the EPA and the National Highway Traffic Safety Administration (NHTSA) adopted rules establishing a nationwide vehicle global warming pollution program, starting with model year 2012 vehicles. The rules set a national average fuel efficiency standard equivalent to 35.5 mpg for cars and light trucks.

In 2012, the Obama administration finalized another improvement to fuel economy standards, increasing them to the equivalent of 54.5 mpg for cars and light-duty trucks by 2025, nearly doubling those vehicles' fuel efficiency compared to vehicles in 2012 production.

By 2025, cars, light trucks and SUVs will produce 179 $MMTCO_2$ less pollution compared to maintaining standards at 2015 levels. If standards are tightened again after 2025, savings could be even greater.

Increasing Production of Clean, Renewable Energy

57 Million Metric Tons

Renewable energy is on the rise across the United States. Wind energy production tripled from 2008 to 2014, providing enough power for nearly 17 million homes.[41] Nationally, solar generation grew by an average of 65 percent per year between 2010 and 2013.[42] By 2025, growth in renewable electricity generation above 2015 levels due to renewable electricity requirements is projected to eliminate 57 $MMTCO_2$ of carbon dioxide emissions.

The recent increase in renewable electricity generation has been driven by both state and federal policies. Twenty-eight states and Washington, D.C., have adopted renewable electricity standards setting minimum requirements for the share of their electricity that will come from renewable sources.[43] The most ambitious of these policies call for targets in the range of 30 percent renewable energy by 2020 (Colorado), 33 percent renewable energy by 2020 (California), and 100 percent by 2045 (Hawaii).[44] California is considering raising its standard to 50 percent by 2030. These policies have increased renewable electricity generation and reduced emissions, typically at little to no cost to consumers.[45]

At the federal level, the renewable electricity production tax credit (PTC) and the investment tax credit (ITC) have also spurred growth in renewable energy. The PTC provided an income tax credit of 2.3 cents per kilowatt-hour (kWh) for utility-scale wind, geothermal and some biomass energy producers for 10 years, but was allowed to expire in 2014. The ITC covers up to 30 percent of the capital cost of new renewable energy investments, though that amount is scheduled to drop to 10 percent starting in 2016.[46]

America has great potential to generate far more electricity using clean, renewable sources of energy. The nation's technical potential for wind power and solar energy far exceeds the amount of electricity consumed in the United States each year.[47] Other renewable energy sources, including geothermal energy, wave and tidal power, and sustainably grown biomass can also play a role in boosting clean electricity production.[48]

State renewable electricity standards will continue to drive additional renewable energy development in the years to come, achieving more than would occur with just economically motivated clean energy construction, but as states begin to meet their renewable energy targets – and especially if federal tax incentives for renewable energy disappear – there is a risk that the momentum toward clean energy will slow. Strong public policies can enable America to tap a greater share of its renewable energy potential, and deliver greenhouse gas emission reductions far greater than are estimated here.

Regional Greenhouse Gas Initiative (RGGI)

55 Million Metric Tons

In 2008, Northeastern and Mid-Atlantic states implemented the nation's first mandatory cap-and-trade program for carbon dioxide emissions, launching the Regional Greenhouse Gas Initiative (RGGI). The program limits emissions of carbon dioxide from power plants, and requires power plants to pay for each unit of pollution they emit, with proceeds devoted largely toward clean energy programs in participating states. By 2025, as the emissions cap for power plants declines, the program will eliminate as much as 55 million metric tons of carbon dioxide pollution annually.

The nine participating states are Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island and Vermont. (New Jersey also participated until 2011.[49]) These states account for 13 percent of the United States population, 5 percent of U.S. carbon dioxide emissions, and 16 percent of U.S. gross domestic product.[50]

In the early years of the RGGI program, emissions were well below the cap, meaning that the majority of the program's impact came from the reinvestment of polluters' payments for emission allowances in energy efficiency and renewable energy programs. Through 2013, RGGI-funded energy efficiency and clean energy investments reduced carbon dioxide emissions by more than 1.1 million metric tons – the equivalent of removing about 238,000 cars from the road for a year – and saved ratepayers $254 million in energy bills.[51]

The RGGI states recently took the important step of further tightening the region's emissions cap to account for the fact that power plant emissions fell faster than anyone had anticipated when the program was designed.[52] A tighter cap will help promote cleaner sources of electricity and increase funds available for clean energy and energy efficiency programs, enabling further emission cuts.

Cleaning Up Pollution from Heavy Trucks

29 Million Metric Tons

Since the mid-1970s, American cars and light trucks have been subject to minimum fuel economy standards – standards that have reduced the nation's dependence on oil while benefiting our environment. Those standards, however, were never applied to tractor-trailers, buses, delivery trucks or other large vehicles, some of which, like tractor-trailers, travel less than 6 miles on every gallon of fuel.[53]

In 2011, the Obama administration took the common-sense step of implementing the nation's first-ever fuel consumption and global warming pollution standards for the on-road medium- and heavy-duty vehicles that produce nearly a quarter of all carbon dioxide emissions from transportation.[54]

The first phase of the standards applies to vehicles in model years 2014 through 2018, and sets limits on fuel use and total global warming emissions from fuel combustion and air conditioning systems. New tractor-trailers sold under the standards will use 20 percent less fuel and reduce their global warming pollution by 20 percent.[55] Smaller heavy-duty vehicles and medium-duty vehicles will be 10 to 15 percent more energy efficient.

By 2025, the standards will reduce pollution from medium- and heavy-duty trucks by 29 $MMTCO_2$. The program will also reduce particulate matter and ozone-forming pollution. Vehicle owners will save $50 billion in fuel costs over the life of the vehicles compared with just $8 billion in costs for technology upgrades.[56]

The EPA and NHTSA are currently developing a second phase of the program that will apply to vehicles produced after model year 2018. Those standards should deliver further emission reductions beyond those estimated here.

Current Policies Will Drive Large Reductions in Carbon Pollution

By implementing current and proposed state and federal policies, the U.S. can be expected to cut carbon dioxide pollution from burning fossil fuels by 27 percent below 2005 levels by 2025. By fully implementing these policies and reducing other types of global warming pollution, the nation will be on its way to achieving its pledge, made in advance of the Paris climate conference, to reduce global warming pollution by between 26 and 28 percent below 2005 levels by 2025.[57]

When compared with a scenario without clean energy policies, the United States' progress in reducing carbon pollution appears even more profound. By 2025, U.S. carbon dioxide pollution will likely be 1,135 $MMTCO_2$ lower than if the policies described in this report were all to end in 2015. Those avoided emissions are greater than the total annual carbon dioxide emissions of Germany, the world's sixth largest polluter.[58]

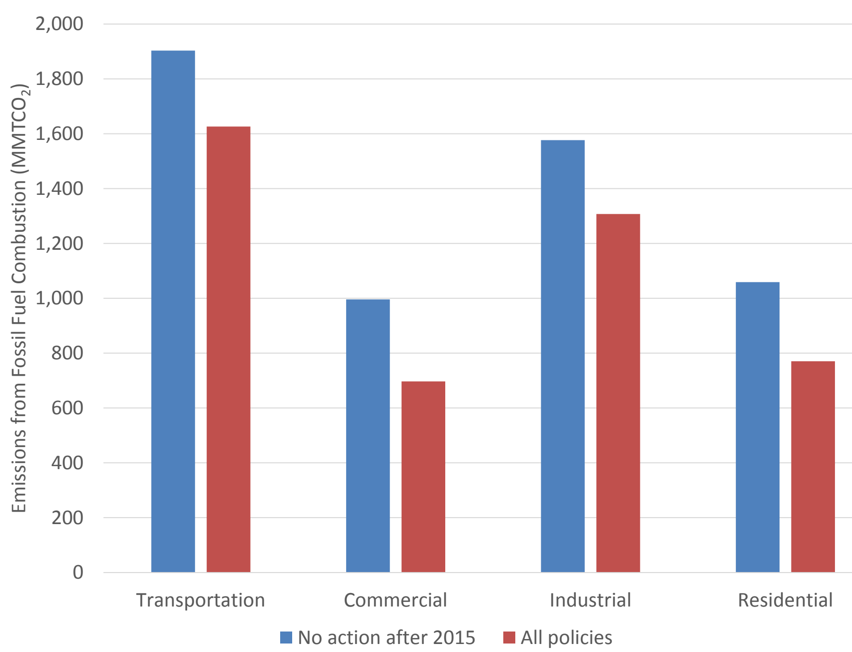
In addition, this estimate does not include the emission reductions that will occur in the future thanks to actions taken under these and other clean energy policies prior to 2015. For example, policies promoting renewable energy tripled wind energy production from 2008 to 2014, while investments in energy efficiency programs will save energy for years into the future.[59] The effects of these emission reduction efforts – which appear to have helped "bend the curve" of U.S. carbon dioxide emissions over the last decade – are not incorporated in the emission reduction estimates in this report.

Finally, this estimate does not include savings from policies for which emission reductions are a secondary effect, such as standards limiting mercury pollution from power plants.

Emission Reductions by Source of Energy Use

The greatest percentage reduction in pollution will come from commercial and residential energy use.

Figure 4. Carbon Dioxide Emissions in 2025 by Source of Energy Use (Including Electricity Consumption)



Declining emissions from electricity consumed in those sectors is the biggest reason for the drop. These savings are the result of comparing emissions that would occur with all policies in place, to emissions that would occur if existing policies were frozen at their 2015 level and no new policies were adopted. This calculation avoids double-counting the savings from policies that may overlap, such as clean energy policies that will help states comply with the Clean Power Plan.

Emission Reductions by State

States that have adopted economy-wide caps on global warming pollution are likely to achieve the biggest percentage reductions in emissions. California is projected to have the greatest decline in emissions because of the state's strong 2030 goals for cutting global warming pollution. (See Table 2.)

Table 2. Top 10 States with Biggest Percentage Reductions in Carbon Dioxide Emissions in 2025 Compared to No Action after 2015

State	% Emission Reduction	Rank
California	40%	1
Delaware	36%	2
New York	36%	3
New Jersey	33%	4
Maryland	31%	5
Arizona	28%	6
Washington, D.C.	27%	7
Massachusetts	26%	8
Nevada	25%	9
Minnesota	22%	10

(As with all data in this report, these savings figures are based on emissions from energy consumed in each state. This means that if a state improves energy efficiency and reduces the need for electricity generation in a neighboring state, the emission reduction is credited to the state that invested in energy efficiency, not the state that produced the electricity.)

Table 3. Top 10 States with Biggest Absolute Reductions in Emissions in 2025 Compared to No Action after 2015

State	Emission Reduction ($MMTCO_2$)	Rank
California	200	1
Texas	105	2
New York	88	3
Illinois	47	4
Ohio	42	5
New Jersey	42	6
Florida	42	7
Pennsylvania	35	8
Michigan	33	9
Indiana	28	10

In terms of absolute emission reductions, large states and those with high electricity consumption from relatively dirty sources have the largest projected declines in emissions. (See Table 3.) California tops the list again because of its large size and the aggressiveness of its emission reduction goals. Texas' size propels it to second. New York is third because its size means it consumes large amounts of electricity and its participation in RGGI helps drive down emissions.

Addressing Other Global Warming Pollutants

In this report, we focus on carbon dioxide emissions from fossil fuel combustion, because that is the largest source of global warming pollution in the United States. Carbon dioxide accounted for 82 percent of U.S. global warming pollution in 2012.[60]

Addressing the remaining 18 percent of U.S. emissions, however, is essential if the nation is to do its part to prevent the worst impacts of global warming. Of particular concern are emissions of methane and HFCs, which are projected to rise to 25 percent above 2005 levels by 2025 even as carbon dioxide emissions are expected to decline.[61]

Methane

Methane accounts for at least 9 percent of total U.S. global warming pollution.[62] Over the course of 20 years, methane is 84 times more powerful a global warming pollutant than carbon dioxide.[63] U.S. methane emissions reportedly declined between 1990 and 2012, though emissions from oil and gas drilling are projected to increase by 25 percent by 2025.[64] In January 2015, the EPA announced new draft rules to reduce new, known sources of methane emissions from the oil and gas industry.[65] Further action to reduce methane pollution will be required to curtail emissions from existing sources.

Nitrous Oxide

Nitrous oxide is 264 times more potent a global warming pollutant than carbon dioxide and accounts for 6 percent of total U.S. emissions of greenhouse gases.[66] Three-quarters of these emissions come from applying nitrogen-enriching fertilizers to croplands.[67] About 15 percent of U.S. nitrous oxide emissions come from industrial uses, transportation and fossil fuel-powered electricity generators.[68] Emissions increased about 3 percent a year between 1990 and 2012, and are projected to climb 5 percent annually through 2020.[69]

Improving fertilizer application efficiency and improving manure treatment can reduce nitrous oxide emissions, as can improving fuel efficiency in vehicles and industrial uses.[70] The U.S. Department of Agriculture announced new voluntary programs in April 2015 to help curb agricultural emissions of nitrous oxide and other climate pollutants.[71]

Fluorinated Gases

Fluorinated gases – 3 percent of total U.S. greenhouse gas emissions – are potent global warming pollutants that are used in industrial processes and electrical equipment, and as refrigerants and aerosol propellants. Some, such as chlorofluorocarbons (CFCs), were banned globally in the 1980s as part of efforts to reverse destruction of the ozone layer.[72] Others, such as hydrofluorocarbons (HFCs), remain in use.[73] HFCs are powerful greenhouse gases: for example, HFC-134a is 3,700 times more potent a global warming pollutant as carbon dioxide over a 20-year period.[74]

At the September 2014 climate summit in New York, a broad range of countries and organizations – including the United States – agreed to create a process for eliminating HFC emissions under the same treaty that has eliminated CFC use.[75]

Black Carbon

Another significant contributor to global warming is black carbon, which is not a gas but fine particles suspended in air. Also known as soot, it is a powerful but short-lived global warming pollutant.[76]

Black carbon is produced when fossil fuels and other organic materials are burned, such as in older diesel vehicles, coal-fired power plants, and industrial facilities.[77] Black carbon absorbs solar energy while it's in the air, heating the atmosphere, and affects cloud formation in ways that can boost global warming.[78] When it settles on the ground, it also reduces the reflectivity of snow and ice, boosting heat absorption and speeding melting.[79]

Pollution control measures reduced U.S. black carbon emissions 25 percent from 1990 to 2004, with stricter rules in California credited with reducing that state's emissions by as much as half over the same period.[80]

Continued efforts in the U.S. to reduce pollution from diesel and coal will continue to drive down American black carbon emissions.[81] The EPA's existing regulations, including on diesel engines and industrial pollution, are expected to reduce black carbon emissions by as much as 86 percent by 2030.[82]

Policy Recommendations

The United States has a clear path forward to dramatically reducing carbon dioxide pollution, helping to reduce the severity of global warming. By fully implementing the policies described in this report, plus taking additional action to cut carbon dioxide emissions and address other types of climate pollution (such as methane and HFCs), the nation can achieve – or even exceed – President Obama's pledge of reducing greenhouse gas pollution by 26 to 28 percent below 2005 levels by 2025.

But more must be done. Climate science indicates that developed nations such as the United States need to reduce emissions of all global warming pollutants by at least 80 percent by 2050 if we hope to avert global warming's worst impacts. Other nations must do their share as well, with the 2015 international climate conference in Paris representing a key opportunity to forge a global agreement for accelerated action.

To take advantage of that opportunity, the United States must take the following the steps.

1. The U.S. must fully implement policies that have been proposed or enacted to reduce fossil fuel use and curb global warming pollution.

States and the federal government should work together to obtain large reductions in global warming pollution from power plants. The Obama administration should finalize the strongest possible Clean Power Plan – new rules limiting global warming pollution from new and existing power plants. Specifically:

- EPA should finalize stringent standards limiting carbon pollution from new power plants. New plants represent huge investments that will operate for years to come. Once a plant is built, cutting emissions will be far more difficult than if the plant is as clean as possible to start with.
- EPA should also finalize rules limiting global warming pollution from existing power plants.
- States should maximize the use of zero-emission technologies when planning how to clean up power plants within their borders, including energy efficiency measures and renewable energy technologies like wind and solar power.
- The new EPA standards are a floor – and not a ceiling – for action. Every state should plan to exceed the minimum standards of the Clean Power Plan. Every additional pound of pollution prevented will help America and the world avoid the worst consequences of global warming.

States that have adopted economy-wide caps on global warming pollution must implement plans to reach their emission targets. California has an extensive array of programs in place to reduce emissions, and regularly monitors progress towards the state's goals. Other states need to establish similarly rigorous implementation plans.

States and the federal government should regularly update appliance and building efficiency standards.

- The federal government should continue to strengthen energy efficiency standards for appliances. Standards for more than 40 appliances that are under review should be completed promptly. Existing standards should be reviewed for possible updates at least every six years.[83]

- State and municipal governments should adopt updated building energy codes as they become available, and enforce compliance with the codes. All new buildings should be net zero energy by 2030.

The federal government should continue to implement strong emission standards for cars and light trucks. To meet long-term climate protection goals the nation must continue to make vehicles cleaner. By 2040 at the latest, all new vehicles should have zero emissions.

2. The U.S. must go beyond its current policies and commitments to achieve greater emission reductions.

The nation should increase the amount of electricity that it obtains from renewable sources.

- States with existing renewable electricity standards should strengthen their goals and establish high targets beyond the current expiration date of their laws, many of which lack higher goals beyond 2020.
- States without a renewable electricity standard should adopt such a policy, as should the federal government. The nationwide goal should be to obtain at least 40 percent of electricity from renewable sources such as wind, solar and geothermal energy by 2030, a stepping stone on our way to generating 100 percent of our electricity from zero-emission energy sources.
- Federal renewable energy tax credits should be renewed. Long-term reinstatement of the Production Tax Credit and renewal of the Investment Tax Credit would signal that the U.S. is committed to increasing renewable electricity generation.

States can tap the extensive opportunities for reducing wasteful energy use with stronger energy efficiency policies. States with energy efficiency resource standards should strengthen those standards, while states without established programs should adopt one of the successful model programs operated by states in a variety of climates.

The U.S. should continue to cut emissions from heavy trucks. The second phase of standards governing emissions from medium- and heavy-duty trucks produced in model year 2018 and later should be as strong as possible. Experts estimate that manufacturers could improve the efficiency of medium- and heavy-duty vehicles by 40 percent by 2025 relative to 2010 levels.[84]

The nation must move swiftly to reduce emissions of methane, HFCs and other non-carbon dioxide global warming pollutants. Many of these pollutants are more powerful than carbon dioxide and limiting their release into the atmosphere is critical for stabilizing the climate.

3. The U.S. should lead the nations of the world at the Paris climate conference.

By announcing clear emission reduction goals for the nation, the U.S. has already indicated its intention to seek meaningful pollution cuts from the Paris conference. The United States should encourage other nations to approve the strongest possible binding, long-term agreement that will help reduce emissions now and in the coming decades. The agreement should be sufficient to keep global temperatures from rising by more than 2°C.

Methodology

The analysis in this report looks at the impacts in 2025 of a set of proposed or adopted state and federal policies that reduce global warming pollution.

The estimated emission reductions presented in this report represent the difference between emissions under a "no action after 2015" scenario and an "all policies" scenario that assumes full implementation of the relevant policies. The "no action after 2015" scenario assumes that no further energy efficiency or renewable energy investments under these policies occur after 2015. For example, new cars would be no more efficient in 2025 than they are today, and the amount of renewable energy on the grid would be largely unchanged, due to the elimination of policy supports. In the "no action after 2015" scenario, emissions would rise from current levels because of growth in energy demand. **The "no action after 2015" scenario is not intended as a projection of what might happen; it is simply a tool to better understand the impacts of policies.**

Developing an Initial Estimate of Emissions

The starting point for our analysis was two sources of data from the Energy Information Administration: the *Annual Energy Outlook 2014* (*AEO 2014*), which forecasts future energy consumption at the national and regional level,[85] and the State Energy Data System (SEDS), which provides historical data (with 2012 being the most recent year) on energy use at the state level.[86] These sources are, respectively, the official U.S. government forecast of future energy use and the only comprehensive database of state energy consumption available in the public domain. Thus, they represent a generally accepted starting point for evaluating the impact of policies that shift America's patterns of energy consumption.

We developed state-level scenarios for future energy use by first combining baseline data on actual 2012 energy consumption by sector, fuel and state from the SEDS with regional forecasts of changes in the use of that fuel in that sector from the *AEO 2014*.

For each category of energy use in the SEDS, we obtained a "regional multiplier" for each census division for 2020 and 2030, representing the amount by which usage of energy in that category is forecast to increase between 2012 and that year. This multiplier was obtained using the forecasts for the corresponding category of energy use in the *AEO 2014*, using the following calculation:

$$Multiplier_{FY} = Usage_{FY} / Usage_{2012}$$

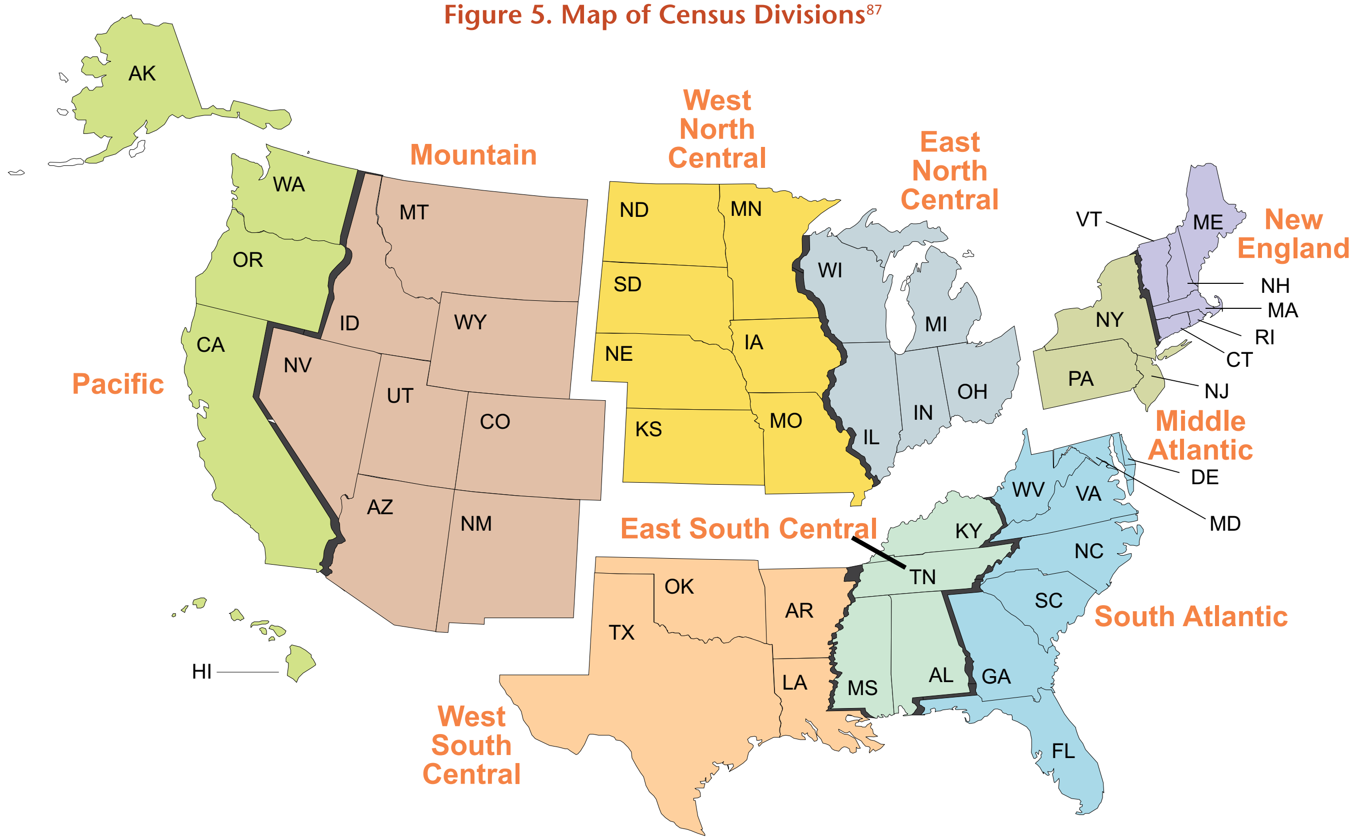
Where:

$Multiplier_{FY}$ is the regional multiplier for a given future year

$Usage_{2012}$ is the amount of energy used in 2012

And $Usage_{FY}$ is the amount of energy forecast to be used in the future year.

Figure 5. Map of Census Divisions[87]



To make this regional multiplier specific to individual states, we adjusted it for the change in the balance of population within each region over time using data from Weldon Cooper Center for Public Service, Demographics & Workforce Group, *Observed and Total Population for the U.S. and the States, 2010-2040*, updated August 2013. We reallocated future energy consumption within the states of the region by assigning a greater share of forecast regional energy consumption to states that are projected to grow faster than the region as a whole, and a lower share to states that are projected to grow more slowly than the region as a whole.

The result of this step was a state-specific projection of energy use by type and by economic sector. Because the *AEO 2014* forecasts on which this projection are based include the effects of several of the policies studied in this report, the effects of those policies had to be "backed out" of the *AEO 2014* forecast number to arrive at the "no action after 2015" case. The procedure for doing this is described below (see page 29).

Translating Fossil Fuel Consumption to Carbon Dioxide Emissions

Having developed a scenario for future energy consumption in each of the states, we next needed to determine what percentage of each fuel was consumed for energy (as opposed to incorporated into consumer products or used for other purposes) and assign a carbon coefficient to each fuel.

Carbon coefficients for all fuels except electricity were drawn from U.S. Environmental Protection Agency, *Emissions Factors for Greenhouse Gas Inventories*, 4 April 2014.

Non-energy Uses

For fuels other than electricity, we determined the share of fossil fuel consumption attributable to non-energy purposes, which are excluded from this analysis. We obtained our figures for the amount of each fuel that was consumed for non-energy purposes from the EPA's inventory of U.S. greenhouse gas emissions.[88] We assumed that the relationship between total fuel consumption and non-energy fuel consumption would remain constant over time and excluded the amount of fossil fuels used for non-energy purposes from our reference case.

Ethanol in Gasoline

To determine a carbon coefficient for motor fuels, we needed to account for the inconsistent treatment of ethanol in EIA publications. *AEO 2014* provides two fuel categories that relate to ethanol: one for standard motor gasoline including ethanol and one for the blend known as E85, which EIA assumes averages 74 percent ethanol when calculated in Btu. SEDS, meanwhile, lists total gallons of ethanol with denaturant, total Btu of ethanol without denaturant, and the amount of motor gasoline (all blends of petroleum gasoline and ethanol included) consumed, in both Btu and gallons.

For the purposes of calculating emissions, we wanted to quantify motor gasoline consumption without ethanol.[89] To reconcile these data sources and develop scenarios for future fuel use, we followed the following steps:

- First, we developed regional multipliers used to estimate the growth in consumption of motor gasoline (which includes ethanol) in *AEO 2014* by comparing consumption of motor gasoline in future years versus the base year of 2012 in *AEO 2014*.
- Second, we applied the regional multipliers to data on motor gasoline consumption (which includes ethanol) from SEDS for the base year of 2012 to arrive at estimated consumption of all motor gasoline blends in future years.
- For E85, we relied upon consumption data from *AEO 2014* because SEDS does not provide data on E85 use. Regional E85 consumption from *AEO 2014* was apportioned out to the states based on each state's share of the regional population each year.
- We then separated ethanol consumption and motor gasoline consumption, starting with E85. Documentation to *AEO 2014* says that E85 varies seasonally and averages 74 percent ethanol and 26 percent gasoline by volume. Documentation to SEDS provides a number for Btu per barrel of un-denatured ethanol and per barrel of motor gasoline, enabling us to calculate Btu consumed of ethanol and gasoline in E85.
- We subtracted total Btu of E85 consumption from total motor gasoline consumption, and then divided the remaining gasoline consumption into ethanol versus gasoline. *AEO 2014* assumes motor gasoline in the transportation sector is mixed with 10 to 15 percent ethanol by volume; the exact blend depends on multiple factors.[90] We chose to use the middle of the range, using a figure of 12.5 percent by volume.
- Finally, we added gasoline from E85 and general gasoline consumption to obtain a figure for consumption of pure petroleum gasoline. We then applied the carbon coefficient of gasoline to this figure to arrive at an estimate of carbon dioxide emissions from gasoline. Our calculation assumes no increase in the volume of ethanol blended into gasoline in the future.

Estimating Emission Reductions from Electricity Generation

For most policies in this report, we use a simplified analysis that attempts to describe how various policy initiatives will affect the composition of the nation's electric power plants. (For the Clean Power Plan and RGGI, we used different approaches, as described in later sections.)

There are two factors in this analysis that result in changes in emissions from electric power plants – changes in electricity demand and changes in the carbon intensity of the nation's fleet of electric power plants. These two factors are interrelated: the elimination of electricity demand results in some existing power plants with particular emission characteristics being shut down or not being built, thereby affecting the carbon intensity of the entire grid. The reverse is also true: when demand goes up, additional power plants come into operation.

Our general approach to estimating the impact of the policy scenarios on emissions from power plants is as follows:

We assumed that reductions in electricity consumption or increases in electricity produced by clean sources of energy would eliminate the need for a specified amount of planned or existing fossil fuel-fired generation. This is represented in this analysis by pulling fossil fuel generation offline in a predetermined order until the demand and supply for fossil fuel-fired electricity within a particular region is brought back into balance. Plants were "pulled offline" in the following order:

New natural gas plants: Natural gas is the most common marginal fuel on the electrical grid, meaning that natural gas power plants are often the first ones to curtail operation when demand for fossil fuel-generated power decreases.[91] In addition, the EIA currently forecasts the development of large new amounts of natural gas capacity (which is relatively inexpensive to construct due to low capital costs). Because of these two factors, we assumed that generation from new natural gas capacity would be the first category to be removed when demand for fossil fuel-generated electricity declines.

To calculate the total amount of electricity generated by plants in this category, we assumed that new gas plants would be utilized at the same capacity factor as all existing gas plants. We then calculated the total amount of electricity to be generated at new plants each year by finding the percentage of natural gas capacity that new plants are anticipated to compose in each region in each year, and removing that percentage of the electricity generated from all gas plants in that region.[92]

We estimated the operating heat rate of plants in this category by assuming that their average operating heat rate would be the same as the average operating heat rate in 2012 of the mix of natural gas plant types constructed in 2013.[93]

New coal plants: The EIA does not forecast the addition of significant coal capacity to the U.S.'s generating stock; we assumed that such new coal capacity as would be built would be the next category for removal in the electric sector reference case.

To estimate the total amount of electricity generated by plants in this category, we assumed that these plants would be operated at the same capacity factor as existing coal plants (a conservative assumption). We then calculated the total amount by which removing these plants would decrease generation in each year.[94]

To estimate the average operating heat rate of plants in this category, we assumed that these plants would have the same average operating heat rate as the coal fleet as a whole in 2012.[95]

Existing natural gas plants: After canceling plans for new capacity construction, we assumed that utilities would match lowered demand for electricity by decreasing generation from their existing natural gas plants, since those are generally the most expensive to fuel and operate.

We calculated the total amount of generation they accounted for in each year by subtracting the amount of electricity generated by new natural gas plants (see above) from the total amount generated by gas plants in each region.[96]

We estimated the average operating heat rate of plants in this category by using the average operating heat rate of existing natural gas plants in 2012.[97]

Existing coal plants: These were our last-ranked category for removal in the electric sector reference case.

We estimated the total amount of electricity generated from plants in this category by assuming that these plants would continue operating as they did in 2012. We also assumed that the average operating heat rate of these plants in each region would remain constant from 2012.[98]

To determine the reduction in fossil fuel consumption that would result from these changes, we calculated the average operating heat rate of plants in that category in each region in the reference case, and held the average operating heat rate constant at 2012 levels for each category. The heat rate figure was used to determine how much fuel would be saved as a result of reductions in fossil fuel electricity generation for each type of plant.

This method yielded estimates of emission reduction impacts of some key policies, such as the Clean Power Plan, similar to those produced by more detailed models of the electricity system. We estimated 2030 savings from the Clean Power Plan of 592 $MMTCO_2$. EIA estimates savings will be 484 to 625 $MMTCO_2$, depending on what plans states adopt to comply.[99]

In some scenarios, such as those that involved "backing out" the impacts of existing policies, more generating capacity was needed. In these cases, additional power was assumed to be supplied by new natural gas plants. We assumed that this additional natural gas capacity would be a mixture of plant types that reflects recent and planned construction of natural gas facilities. We obtained the heat rates for different forms of gas generation from the EIA's *Electric Power Annual*.[100]

Electricity savings from the various states were apportioned to the electricity market module regions based on the share of power that each state receives from each region. Once carbon coefficients for electricity sold in each region were recalculated on the basis of changes in consumption, weighted averages for each state were recreated using the same distribution formula.

Alaska and Hawaii receive somewhat different treatment from other states in the EIA's publications, and accordingly are treated uniquely in our modeling.

The SEDS publishes historical consumption data for Alaska and Hawaii in the same fashion as it does for other states. In the AEO, they are included in the Pacific census division, so we used projections for that census division to generate our consumption baseline for each of those states.

The AEO projects electricity production based on Electricity Market Module (EMM) regions, subdivisions of the nation's electricity grid. Hawaii and Alaska each have their own separate electricity grids, but the AEO does not include projections for electricity production there.

We determined the carbon intensity of existing electricity production in Alaska and Hawaii based on 2012 figures. We assumed that this figure would remain consistent in the future, unless policies affecting the electric sector caused it to change, such as a renewable electricity standard.

For both Alaska and Hawaii, we introduced an additional category of generators representing the plants that compose the bulk of the electricity grid in those states – natural gas plants in Alaska, and fuel oil plants in Hawaii. When policies led to a decline in electricity consumption greater than the amount of electricity in Alaska or Hawaii produced by plants in the other marginal categories, we assumed that any further decreases would be met by reducing the amount of electricity produced by plants in this category.

Estimating the Impacts of Specific Policies

The ongoing effects of a number of policies were already included in *AEO 2014*, and we attempted to remove their post-2015 impact to create a "no action after 2015" scenario. In other words, we attempted to determine what U.S. emissions would look like after 2015 if these existing policies were to deliver no further benefits. The policies whose post-2015 impacts we removed from *AEO 2014* were:

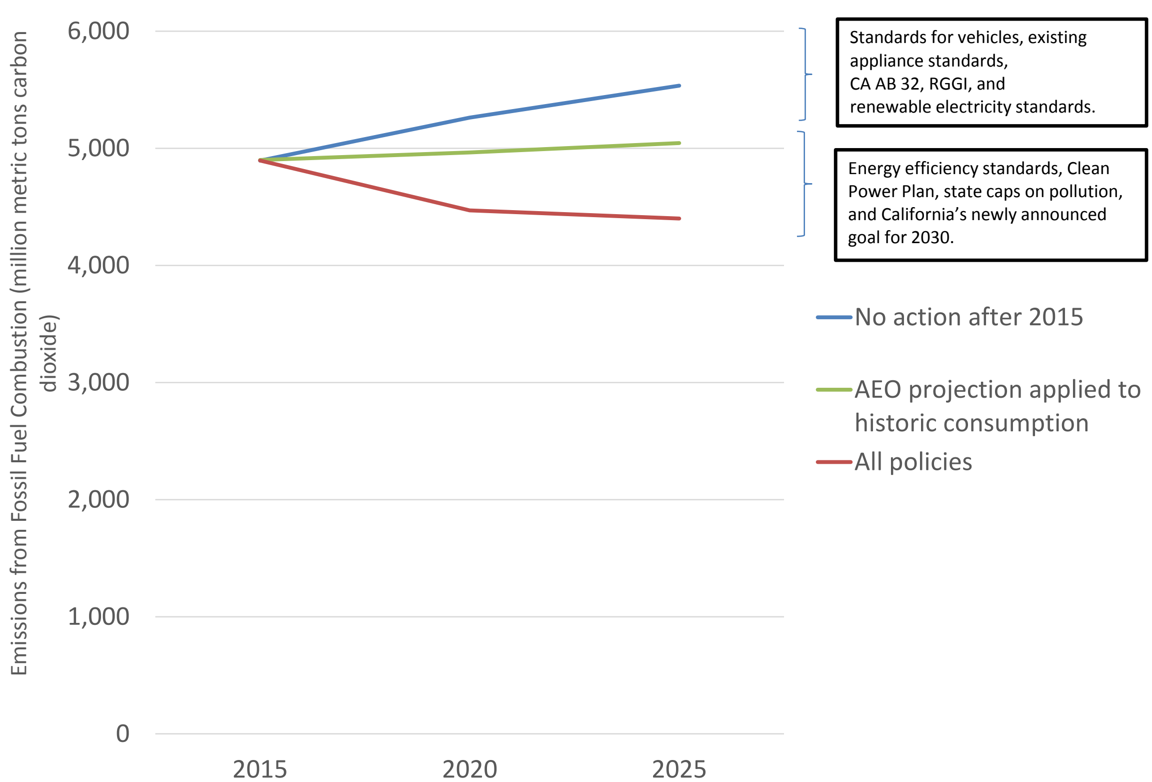
- Standards for light-duty vehicles,
- The first phase of the Heavy Duty National Program for larger vehicles,
- Existing appliance efficiency standards,
- California's statewide cap on emissions to 2020,
- The Regional Greenhouse Gas Initiative, and
- Renewable electricity standards.

These are represented in the top line of Figure 6.

To create an estimate of emissions if the policies above are in effect and additional policies are considered, we applied the effects of additional policies to the baseline forecast created using the *AEO 2014* (middle line of Figure 6), including:

- State energy efficiency standards,
- Limits on pollution from new and existing power plants,
- State caps on global warming pollution, except for California's standards that are already being implemented, and

Figure 6. Development of "No action after 2015" Scenario and "All Policy" Scenario



- California's newly announced carbon dioxide emission cap for 2030.

We estimated the emissions savings from each of these policies independently, and then estimated the savings if all policies are implemented at the same time. This cumulative calculation produced our "all policies" scenario, represented in the bottom line of Figure 6.

Clean Power Plan

We estimated the impact of the Clean Power Plan using data presented in U.S. Energy Information Administration, *Analysis of the Impacts of the Clean Power Plan,* May 2015. Appendix D contains EIA's calculation of state carbon intensity targets into the Electricity Market Module regions used in *AEO 2014*.

The draft rules of the Clean Power Plan include a 2020 to 2029 interim average target rate. We calculated a 2025 target for each EMM region by assuming emissions are higher than the target before 2024 and lower than the target after 2025. The exact rate of decline was calculated as a line passing through the average target rate in 2024 and 2025 and the maximum emissions rate in 2030. From this, we then determined a 2020 emissions rate for each EMM region.

The Clean Power Plan limits emissions based on a maximum emissions rate for power generated in each state, rather than regulating total emissions, and does so based on where power is generated, not where it is consumed. To apply this to our consumption-based model, we did the following:

1. Calculated the percentage by which the Clean Power Plan reduces the generation-based emissions rate in each EMM region compared to the 2012 baseline.
2. Calculated the emissions rate for electricity consumed in each EMM region in our model.
3. Applied the percentage reduction in the emissions rate required by the Clean Power Plan to the emissions rate for each EMM region in our model.
4. Multiplied electricity consumed in each state in our model by this revised emission rate.

This approach – which adapts the mechanisms of the Clean Power Plan to our consumption-based model – produces different state-by-state savings figures than would a generation-based estimate. Total savings from a generation-based estimate would be the result of in-state generation. Total savings from our consumption-based estimate are the result of in-state consumption multiplied by the emissions rate of power plants in a given region that provide that power.

State Caps on Global Warming Pollution

For each state with a cap on greenhouse gas emissions, the use of all fuels in all sectors was assumed to fall by an equal percentage sufficient to comply with the cap.

Estimating the impact of California's state cap on global warming pollution required two separate calculations. First, we needed to determine the impact of AB 32: California Global Warming Solutions Act of 2006, which is incorporated into *AEO 2014* with a cap that sets emissions in 2020 equal to 1990 levels and holds them relatively steady afterward. To ascertain what emissions would have been without AB 32, we calculated the relationship between capped emissions in 2020 and business-as-usual projections for 2020, 2025 and 2030 from CARB.[101] We applied this same ratio to 2020 emissions derived from *AEO 2014* to determine what emissions would have been in the no-policy case.

To evaluate the impact of California's new executive order calling for emissions to be 40 percent below 1990 levels by 2030, we modeled emissions in 2030 as 40 percent below 2020 levels derived from *AEO 2014* because 2020 levels are equal to 1990 levels.

Connecticut and Hawaii do not project what their emissions would be without their respective state emissions caps. With no reference cases against which to measure savings, we do not estimate any savings for Connecticut or Hawaii.

Massachusetts emissions reductions were based upon the projections of business as usual from Massachusetts Executive Office of Energy and Environmental Affairs, *Statewide Greenhouse Gas Emissions Level: 1990 Baseline and 2020 Business As Usual Projection*, 1 July 2009, and establishment of the target for actual reduction from Ian Bowles, Secretary of Energy and Environmental Affairs, *Massachusetts Clean Energy and Climate Plan for 2020*, 29 December 2010. Note that the business-as-usual projections for Massachusetts and the states listed below may be higher than warranted – and the emission reductions attributed to those policies greater – because states created their business-as-usual cases using data from before the Great Recession. The final emission levels estimated under these policies are not affected.

Maryland data, both business-as-usual forecasts and details relating to the carbon cap, were from Maryland Department of Information Technology Open Data Portal, *Greenhouse Gas Emissions Estimates*, accessed at data.maryland.gov/Energy-and-Environment/Greenhouse-Gas-Emissions-Estimates/8cmy-9rim on 4 March 2015. Maryland has established a cap for 2020, but no binding cap for subsequent years. We assume emissions are held steady at 2020 levels. Maryland's cap does not produce emission reductions in our model.

New Jersey's emissions reductions were based on business-as-usual projections and goals from New Jersey Department of Environmental Protection, *Meeting New Jersey's 2020 Greenhouse Gas Limit: New Jersey's Global Warming Response Act Recommendations Report*, December 2009. The goal for 2025 was interpolated linearly from the 2020 and 2050 goals.

Rhode Island's emissions reductions were based on a 1990 emissions baseline and a 2020 business-as-usual projection from Rhode Island Greenhouse Gas Stakeholder Process, *Rhode Island Greenhouse Gas Action Plan*, 15 July 2002, archived at web.archive.org/web/20150406145932/http://righg.raabassociates.org/Articles/GHGPlanBody7-19-02FINAL.pdf. Business-as-usual emissions for 2025 were conservatively assumed to be the same as those in 2020. The goals came from Rhode Island General Assembly, *Resilient Rhode Island Act of 2014 – Climate Change Coordinating Council* (Title 42, Chapter 6.2), enacted 2014, archived at web.archive.org/web/20150406150319/http://webserver.rilin.state.ri.us/Statutes/TITLE42/42-6.2/42-6.2-1.HTM.

Efficient Buildings and Appliances

State Energy Efficiency Requirements

Energy efficiency savings for ratepayer funded efficiency programs, including energy efficiency resource standards (EERS), were calculated using savings rates from Appendix B in Annie Gilleo, et al., American Council for an Energy-Efficient Economy, *The 2014 State Energy Efficiency Scorecard*, October 2014. For states that did not provide 2013 data, ACEEE used 2012 figures.

Savings in each state were assumed to be derived from the residential, commercial and industrial sectors in proportion to their total energy consumption.

We assumed annual savings rates would remain constant at the 2013 level, an assumption that may undercount potential savings for states with energy efficiency goals that increase over time. Data on historic energy efficiency investments show that available efficiency improvements tend to remain unchanged over time. Over the last several years, for example, the cost per unit of energy savings delivered through energy efficiency programs nationwide has remained largely stable, even as the amount of energy efficiency savings delivered by those programs has more than doubled.[102]

Savings from the following policies were included:

- Utility and public benefits programs and policies
- Building energy codes
- Combined heat and power (CHP) policies
- State government-led initiatives around energy efficiency
- Appliance and equipment standards

Appliance and Lighting Efficiency Standards

National savings from federal appliance and lighting efficiency standards are based on standards passed into federal law from 2010 through 2015. We did not ascribe savings to standards created before 2010, though those are significant and date back as far as 1987. Estimated savings for standards adopted from 2010 through 2011 are based on, and were linearly interpolated from, data for 2010, 2025 and 2035 in Amanda Lowenberger et al., American Council for an Energy-Efficient Economy, *The Efficiency Boom: Cashing In on the Savings from Appliance Standards*, March 2012.

That report gave absolute amounts of electricity and natural gas saved as a result of the standards based on projected consumption levels in Energy Information Administration's *2011 Annual Energy Outlook*.

To arrive at a reduction in fuel use from our projection based on *AEO 2014*, we assumed fuel use was reduced by the same percentage as ACEEE's estimate versus *AEO 2011*.

Light-Duty Vehicles

AEO 2014 includes current fuel economy and global warming pollution standards established by EPA and NHTSA in joint rulemakings for model years 2012 through 2025.[103] After 2025, *AEO 2014* holds fuel economy and emissions standards constant at 2025 levels.

To calculate the impact of this program, we reviewed analyses from EPA and NHTSA during rulemaking procedures establishing model year 2012 to 2016 standards and model year 2017 to 2025 standards. Those analyses show that without either the model year 2012 to 2016 standards or the model year 2017 to 2025 standards, light duty vehicle emissions in most states would be governed by the CAFE standards in effect for MY2011. In California and other states that have adopted California's vehicle emission program, standards would have been tighter. By assuming all states revert to federal CAFE standards for model year 2011, we capture the full impact of these state and federal policies.

In our analysis, we assume light-duty vehicle Btu per mile remains constant at the model year 2011 level for internal combustion engine gasoline vehicles, hybrid-electric gasoline vehicles and plug-in hybrid gasoline vehicles. Diesel Btu per mile was held constant at model year 2011 levels for diesel internal combustion engine light-duty vehicles. For these gasoline and diesel vehicles, we assumed that vehicle miles of travel (VMT) changed according to data in Supplemental Table 60 to *AEO 2014*. This may overstate driving and thus emissions in the "no action after 2015" scenario case due to the rebound effect. The VMT figures in *AEO 2014* were developed assuming stronger fuel economy standards that lower the cost of driving and thus encourage more driving than would be the case with the MY 2011 standards.

Light-duty vehicles account for approximately 94 percent of total transportation sector motor gasoline consumption, a share that declines over time in *AEO 2014*, and 1 percent of diesel fuel use, which rises over time.

Regional Greenhouse Gas Initiative

Emission reductions from the Regional Greenhouse Gas Initiative (RGGI) were estimated by comparing business-as-usual figures in RGGI, *2012 Program Review: 2013 IPM Modeling Results* (Excel file), 8 February 2013 to the adjusted cap from RGGI, *Second Control Period Interim Adjustment for Banked Allowances Announcement*, 17 March 2014, archived at web.archive.org/web/20150312180005/http://www.rggi.org/docs/

SCPIABA.pdf. RGGI estimates baseline emissions through 2020 only; we assumed baseline emissions in subsequent years would remain at 2020 levels. RGGI has established a cap through 2020; we assumed that after 2020 the emissions cap is held steady, though it is likely that the RGGI states will agree to lower the cap in that period to achieve compliance with their Clean Power Plan goals.

States' RGGI-capped emissions were calculated based on the states' share of the RGGI participants' total as described in RGGI, *2014 CO_2 Allowance Allocation* (Excel file), 11 December 2014, archived at web.archive.org/web/20150312180145/http://www.rggi.org/docs/CO2AuctionsTrackingOffsets/Allocation/2014_Allowance-Allocation.xls.

For each state, we calculated how much higher emissions would have been with the business-as-usual estimates provided by RGGI versus each state's cap. We then applied that percentage change in emissions to our *AEO 2014*-derived estimate of emissions.

A fundamental challenge in estimating the impact of carbon caps in this analysis is our use of consumption-based accounting for assigning carbon dioxide emissions to various states. In short, our method assigns carbon dioxide emissions from electricity production not to the states in which the power plants are located, but rather to the states where the electricity is consumed. Because RGGI is a production-based cap – with targets set based on emissions from generators located within a specific state – and because some electricity consumed by states in the RGGI region is produced outside the region, this difference in accounting methods creates "apples to oranges" issues.

We used changes in carbon dioxide emissions from electricity consumption as a proxy for RGGI compliance. In other words, if a state's consumption-based electricity emissions declined by the same percent as called for by RGGI's production-based calculation, we assumed that the state met RGGI's production-based targets.

Renewable Electricity Policies

We calculated avoided emissions resulting from state renewable electricity requirements. Though the federal renewable electricity production tax credit (PTC) and the investment tax credit (ITC) are important factors boosting renewable electricity generation, we did not model their effects because we could not clearly disaggregate their impact from that of state RESs.

First, we adjusted the electricity generation mix in *AEO 2014* to fully incorporate the impact of state RESs. Though *AEO 2014* technically includes state renewable electricity requirements, the total volume of renewable energy included in *AEO 2014* by region is not adequate to meet the requirements of all states. We adjusted the *AEO 2014* baseline to correct for this.

Data on RES targets came from the University of North Carolina's Database of State Incentives for Renewable Energy.[104] Some states have policies (often called Advanced Energy Standards or Alternative Energy Standards) that combine mandates for renewable generation with mandates for new types of coal generation or other non-renewable technologies. We counted the portions of these standards as could be met only with renewable generation.

Electricity used to meet a state's RES targets does not have to be generated within the state's borders. Instead, in many states with RESs, utilities are required to demonstrate that they are obtaining a target percentage of their power from renewable sources, which may be located inside or outside of the state's boundaries. We assumed that renewables would be constructed in the region where they were required by policy, without respect to state boundaries.

Second, we determined how much renewable energy was added to the power grid because of renewable electricity requirements. Using 2015 as a baseline, we assumed that 75 percent of renewable electricity added in subsequent years was a result of renewable electricity requirements. Without that wind, solar and other clean energy on the grid, we assumed that generation from natural gas plants would have provided electricity instead. This approach results in a very conservative assumption of savings from renewable electricity requirements.

Medium- and Heavy-Duty Vehicles

To estimate the savings from the Heavy-Duty National Program (HDNP) we needed to know the difference in emissions with the HDNP and without. The HDNP Phase 1 rules from 2011 are incorporated into *AEO 2014*. To calculate emissions without the HDNP, we removed the impacts of the program using EPA and NHTSA's analysis of the program's impact (including changes to vehicle efficiency and the rebound effect).

EPA and NHTSA project that the HDNP will reduce medium- and heavy-duty vehicle gasoline use by 6.5 percent in 2030 and diesel use by 10.4 percent.[105] These savings are assumed to accrue at a consistent annual rate from calendar year 2013 (model year 2014) through 2030. We multiplied the savings by the percent of transportation sector motor gasoline and diesel consumption by commercial light trucks, freight trucks and transit buses (all are vehicle types regulated by the HDNP), per *AEO 2014*, Supplemental Table 46: Transportation Sector Energy Use by Fuel Type within a Mode to obtain the percent of transportation sector motor gasoline and diesel consumption reduced.

We applied this savings rate to our *AEO 2014*-derived baseline to determine fuel consumption in the absence of the HDNP. This scenario without the HDNP treats fuel economy as unchanged to 2025, because EPA assumed that without the Heavy-Duty National Program, medium- and heavy-duty vehicles would continue to comply with the standards that were in effect in 2010.[106] In other words, new vehicles in 2025 would be no more efficient than new vehicles in 2010.

We modeled the impact of the HDNP on carbon dioxide emissions only, which account for 99 percent of the global warming pollution from medium- and heavy-duty on-road vehicles.[107]

Tallying Total Emission Savings

To estimate total emission reductions from the full suite of policies while avoiding double-counting, we used the following procedures.

First, policies included in *AEO 2014* had to be added to the emissions scenario we derived from *AEO 2014* to create the "no action after 2015" scenario. Removing appliance standards, for example, increased electricity consumption. To that higher level of electricity consumption, we applied the increased emissions rate that would result from getting rid of renewable electricity requirements and also the emissions rate as if RGGI did not exist. We assumed those two policies overlapped and for each state selected the higher of the two emission scenarios. California's emissions were determined by removal of the effects of AB 32. Emissions from transportation were calculated as the result of removing the Clean Cars Program and the Heavy Duty National Program, which do not overlap. This created a "no action after 2015" scenario.

Second, policies not already included in *AEO 2014* had to be subtracted from it. To avoid double-counting savings in the electric sector, we started by assuming all states would meet their Clean Power Plan targets, and that all current policies to reduce carbon dioxide emissions from electricity – such as renewable electricity standards, RGGI and energy efficiency programs – would be allowed to count toward those targets.[108] For states with statewide caps on emissions that we could model, we assumed they met their Clean Power Plan goals and reduced emissions from other fuels only as needed to meet their economy-wide cap. In states without economy-wide caps, we assumed residential, commercial and industrial natural gas emissions were reduced by state-level energy efficiency programs.

Appendix I. State-Level Avoided Emissions in 2025 ($MMTCO_2$)

	Federal Policies				State or Regional Policies				
State	**Clean Power Plan**	**Clean Cars**	**Heavy Duty Vehicle Standards**	**Existing Appliance Efficiency Standards**	**State Emission Caps**	**RGGI**	**Renewable Electricity Standards**	**Energy Efficiency**	**All policies**
Alabama	4	3	1	2	0	0	0	0	9
Alaska	0	0	0	0	0	0	0	0	1
Arizona	13	4	1	1	0	0	2	8	21
Arkansas	8	2	0	1	0	0	0	2	12
California	22	20	2	5	201	0	13	15	200
Colorado	10	3	0	1	0	0	2	3	18
Connecticut	2	2	0	0	0	1	1	2	8
Delaware	2	1	0	0	0	3	0	0	7
Florida	26	12	1	4	0	0	0	4	42
Georgia	3	7	1	2	0	0	0	2	12
Hawaii	0	1	0	0	0	0	0	2	1
Idaho	3	1	0	0	0	0	0	1	4
Illinois	27	6	1	3	0	0	8	11	47
Indiana	20	4	1	2	0	0	0	5	28
Iowa	10	2	0	1	0	0	0	4	15
Kansas	6	2	0	1	0	0	0	0	10
Kentucky	12	3	1	2	0	0	0	3	18
Louisiana	13	3	1	2	0	0	0	0	18
Maine	1	1	0	0	0	0	0	1	3
Maryland	9	4	0	1	0	6	2	4	25
Massachusetts	3	3	0	1	7	3	2	8	19
Michigan	21	6	1	2	0	0	0	12	33
Minnesota	16	3	1	1	0	0	2	7	27
Mississippi	4	2	0	1	0	0	0	0	8
Missouri	18	4	1	1	0	0	2	2	26
Montana	2	1	0	0	0	0	0	1	3
Nebraska	7	1	0	1	0	0	0	0	9
Nevada	6	2	0	1	0	0	1	2	10

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	Federal Policies				State or Regional Policies				
State	**Clean Power Plan**	**Clean Cars**	**Heavy Duty Vehicle Standards**	**Existing Appliance Efficiency Standards**	**State Emission Caps**	**RGGI**	**Renewable Electricity Standards**	**Energy Efficiency**	**All policies**
New Hampshire	1	1	0	0	0	0	0	0	3
New Jersey	10	5	1	1	35	0	3	3	42
New Mexico	5	1	0	0	0	0	1	1	7
New York	32	7	1	2	0	41	0	10	88
North Carolina	14	6	1	2	0	0	3	4	25
North Dakota	3	1	0	0	0	0	0	0	4
Ohio	27	6	1	3	0	0	5	8	42
Oklahoma	15	3	1	1	0	0	0	2	20
Oregon	5	2	0	1	0	0	1	4	10
Pennsylvania	21	6	1	3	0	0	4	8	35
Rhode Island	0	0	0	0	0	0	0	1	2
South Carolina	9	4	0	1	0	0	0	2	14
South Dakota	3	1	0	0	0	0	0	0	4
Tennessee	13	4	1	2	0	0	0	2	19
Texas	75	18	4	8	0	0	1	5	105
Utah	3	2	0	1	0	0	0	2	7
Vermont	0	0	0	0	0	0	0	1	1
Virginia	13	5	1	2	0	0	0	0	21
Washington	10	4	1	2	0	0	2	7	19
Washington, D.C.	1	0	0	0	0	0	0	0	2
West Virginia	5	1	0	0	0	0	0	0	7
Wisconsin	10	3	1	1	0	0	0	6	17
Wyoming	2	0	0	0	0	0	0	0	3
U.S.	542	179	29	68	242	55	57	167	1,135

Shading means that the state has adopted that particular policy. States marked as having an energy efficiency requirement have a long-term, binding energy efficiency goal, per American Council for an Energy Efficient Economy, *State Energy Efficiency Resource Standards*, April 2015, available at aceee.org/sites/default/files/eers-04072015.pdf. Some states with listed savings have shorter-term or non-binding programs.

Note that savings in the "all policies" column are not equal to the sum of the individual policies because some savings have been removed to account for overlapping impacts of some policies. Also, in states where RGGI delivers savings, some of the savings attributed to RGGI may actually result from the Clean Power Plan. The two policies overlap extensively and the allocation of savings between the two programs here is a result of how we calculated savings, not necessarily the relative impact of the two policies in reducing pollution.

Appendix II. State Ranking by Total Avoided Emissions in 2025

State	Emission Reduction ($MMTCO_2$)	Rank
California	200	1
Texas	105	2
New York	88	3
Illinois	47	4
Ohio	42	5
New Jersey	42	6
Florida	42	7
Pennsylvania	35	8
Michigan	33	9
Indiana	28	10
Minnesota	27	11
Missouri	26	12
North Carolina	25	13
Maryland	25	14
Arizona	21	15
Virginia	21	16
Oklahoma	20	17
Tennessee	19	18
Massachusetts	19	19
Washington	19	20
Louisiana	18	21
Kentucky	18	22
Colorado	18	23
Wisconsin	17	24
Iowa	15	25
South Carolina	14	26

State	Emission Reduction ($MMTCO_2$)	Rank
Georgia	12	27
Arkansas	12	28
Oregon	10	29
Nevada	10	30
Kansas	10	31
Alabama	9	32
Nebraska	9	33
Connecticut	8	34
Mississippi	8	35
New Mexico	7	36
Delaware	7	37
West Virginia	7	38
Utah	7	39
North Dakota	4	40
Idaho	4	41
South Dakota	4	42
Wyoming	3	43
Montana	3	44
Maine	3	45
New Hampshire	3	46
Rhode Island	2	47
Washington, D.C.	2	48
Hawaii	1	49
Vermont	1	50
Alaska	1	51

Appendix III. State Ranking by Percent Emission Reduction in 2025

State	% Emission Reduction	Rank
California	40%	1
Delaware	36%	2
New York	36%	3
New Jersey	33%	4
Maryland	31%	5
Arizona	28%	6
Washington, D.C.	27%	7
Massachusetts	26%	8
Nevada	25%	9
Minnesota	22%	10
Missouri	22%	11
Rhode Island	22%	12
Michigan	22%	13
Connecticut	21%	14
Oregon	21%	15
Arkansas	21%	16
Illinois	20%	17
North Carolina	20%	18
Oklahoma	20%	19
Iowa	19%	20
Ohio	19%	21
Washington	19%	22
New Mexico	18%	23
South Carolina	18%	24
Nebraska	18%	25
New Hampshire	18%	26

State	% Emission Reduction	Rank
Pennsylvania	18%	27
Indiana	17%	28
Wisconsin	17%	29
Idaho	17%	30
Virginia	17%	31
Florida	17%	32
Colorado	17%	33
West Virginia	17%	34
South Dakota	16%	35
Kentucky	16%	36
Tennessee	15%	37
Texas	15%	38
Utah	15%	39
Maine	14%	40
Montana	14%	41
Vermont	14%	42
North Dakota	13%	43
Kansas	13%	44
Mississippi	11%	45
Wyoming	10%	46
Louisiana	10%	47
Alabama	9%	48
Georgia	8%	49
Hawaii	7%	50
Alaska	2%	51

Notes

To ensure that online materials referenced in this report remain available for public review, those pages have been preserved in the Internet Archive at archive.org.

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