Moving America Forward

State and Federal Leadership Is Producing Results in the Fight against Global Warming

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Executive Summary

American leadership in the fight against global warming is crucial. America is the world's largest economy, the second-largest emitter of global warming pollution, and the nation responsible for more of the human-caused carbon dioxide pollution in the atmosphere than any other. Without prompt action by the United States and others to reduce global warming pollution, catastrophic impacts – from coastal flooding to food system disruptions – could become unavoidable.

Fortunately, even in the absence of a comprehensive response from the U.S. Congress, local and state governments and the Obama administration have taken leadership on global warming.

State and federal leadership on global warming is already having a significant impact. A set of clean energy policies adopted by states and the federal government and in effect from 2007 to 2012 reduced U.S. carbon dioxide pollution by 162 million metric tons in 2012. (See Figure ES-1.) That is equal to annual emissions from 34 million vehicles, or all the passenger cars and trucks in Pennsylvania, Michigan, Illinois and Colorado combined. Those emission savings will grow in future years as the policies mature and more ambitious clean energy targets come into effect.

America is moving forward. But science tells us that we will need to do much more to prevent the worst impacts of global warming. Leaders at all levels of government should build on existing momentum to use energy more efficiently, ramp up production of energy from renewable sources, and scale back the use of dirty sources of energy with negative impacts on the climate.

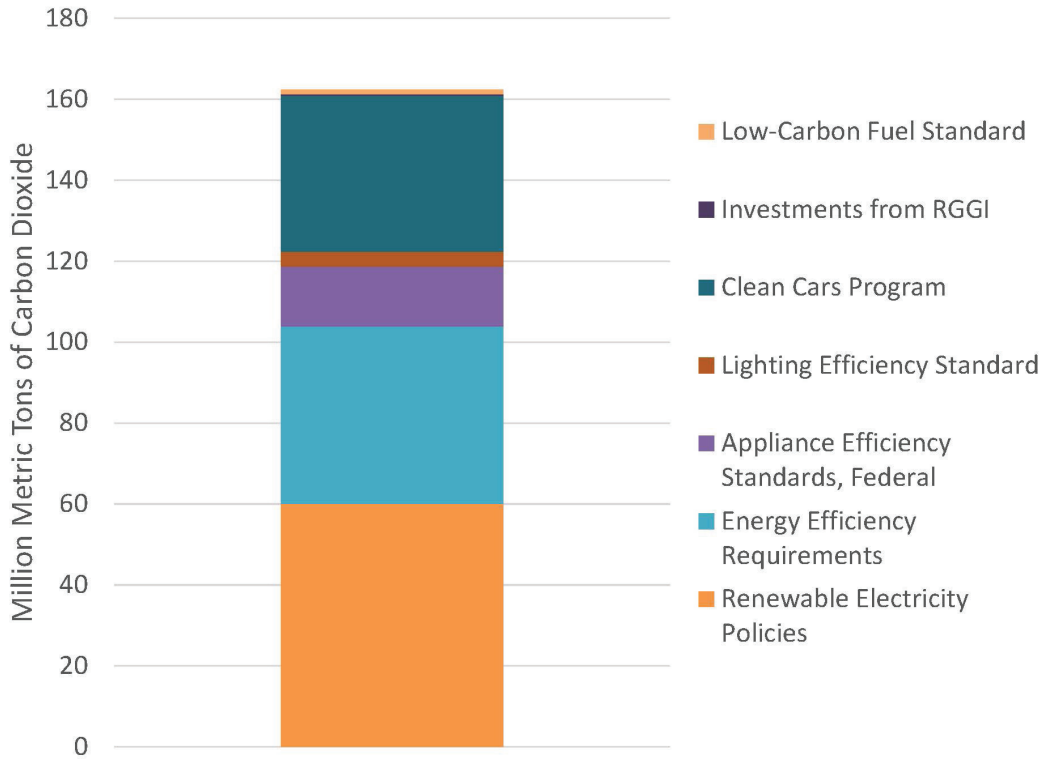
State and federal action has led to a dramatic increase in clean, renewable energy.

- Twenty-nine states have adopted renewable electricity standards (RES) – requiring utilities to secure a portion of their power from renewable energy sources like the wind and the sun – contributing to a major expansion of renewable energy across the country, both in those states and beyond.
- The federal government has supported wind and solar energy through tax credits and through direct purchases of renewable energy. In 2012-2013, the federal government obtained 7 percent of its electricity from sources such as wind and solar energy.
- The amount of electricity generated from wind and solar energy increased four-fold from 2007 to 2012. This helped avert **60 million metric tons of global warming pollution** in 2012, equal to annual emissions from 13 million cars.

State and federal action has cut significant amounts of energy waste in homes, businesses and factories.

- Half of the states have adopted energy efficiency resource standards, requiring that a share of energy demand be met with energy efficiency

Figure ES-1. Estimated Carbon Dioxide Emission Reductions in 2012 from Policies Adopted or Implemented from 2007 to 2012



improvements, and many other states have established energy efficiency programs supported by utility ratepayers. State and local energy efficiency programs from 2007 to 2012 reduced global warming emissions by **44 million metric tons** in 2012. In addition, the federal government has cut energy use in its buildings by 9 percent per square foot since 2007-2008.

- Efficiency standards for common residential and commercial appliances cut an estimated **15 million metric tons of carbon dioxide emissions** in 2012 compared to a scenario without these policies. New or updated federal standards have been issued since 2009 that affect appliances responsible for 90 percent of residential energy use.
- New federal lighting standards cut electricity use and helped to avert **3.6 million metric tons of carbon dioxide pollution** in 2012, the first year the standards were in effect. Savings will rise in coming years.

The Clean Cars Program has improved fuel efficiency and cut global warming pollution from cars, trucks and SUVs.

- Long before the Obama administration took office, California and 13 other states were developing and implementing their own state-level clean car standards, which set limits on tailpipe emissions of smog-forming pollutants and pollutants that cause global warming.

- This state leadership paved the way for the Obama administration to set the first-ever federal carbon pollution standards for vehicles, which began with model-year 2012 cars.
- In 2012, the Clean Cars Program helped reduce vehicle carbon dioxide pollution by **39 million metric tons**, equal to taking 8 million vehicles off the road for a year.

Other policies adopted by pioneering states have yielded additional emission benefits, while providing a foundation for achieving bigger savings in the future.

- California, Connecticut, Hawaii, Massachusetts, Maryland and New Jersey each have adopted statewide limits on global warming pollution, and by 2020 these caps could cut emissions by 270 million metric tons of carbon dioxide.
- Nine Northeastern states have banded together to create the Regional Greenhouse Gas Initiative (RGGI), which reduces global warming pollution from electricity generation by capping emissions, making carbon emitters pay for each ton of pollution, and investing in additional measures to help reduce pollution. In 2012, RGGI-funded energy efficiency and renewable energy programs reduced carbon dioxide emissions by about half a million metric tons.
- California's low carbon fuel standard requires the use of less polluting transportation fuels through the replacement of gasoline and diesel with electricity, biofuels and other cleaner fuels. The low carbon fuel standard saved the equivalent of 1.2 million metric tons of carbon dioxide in 2012.

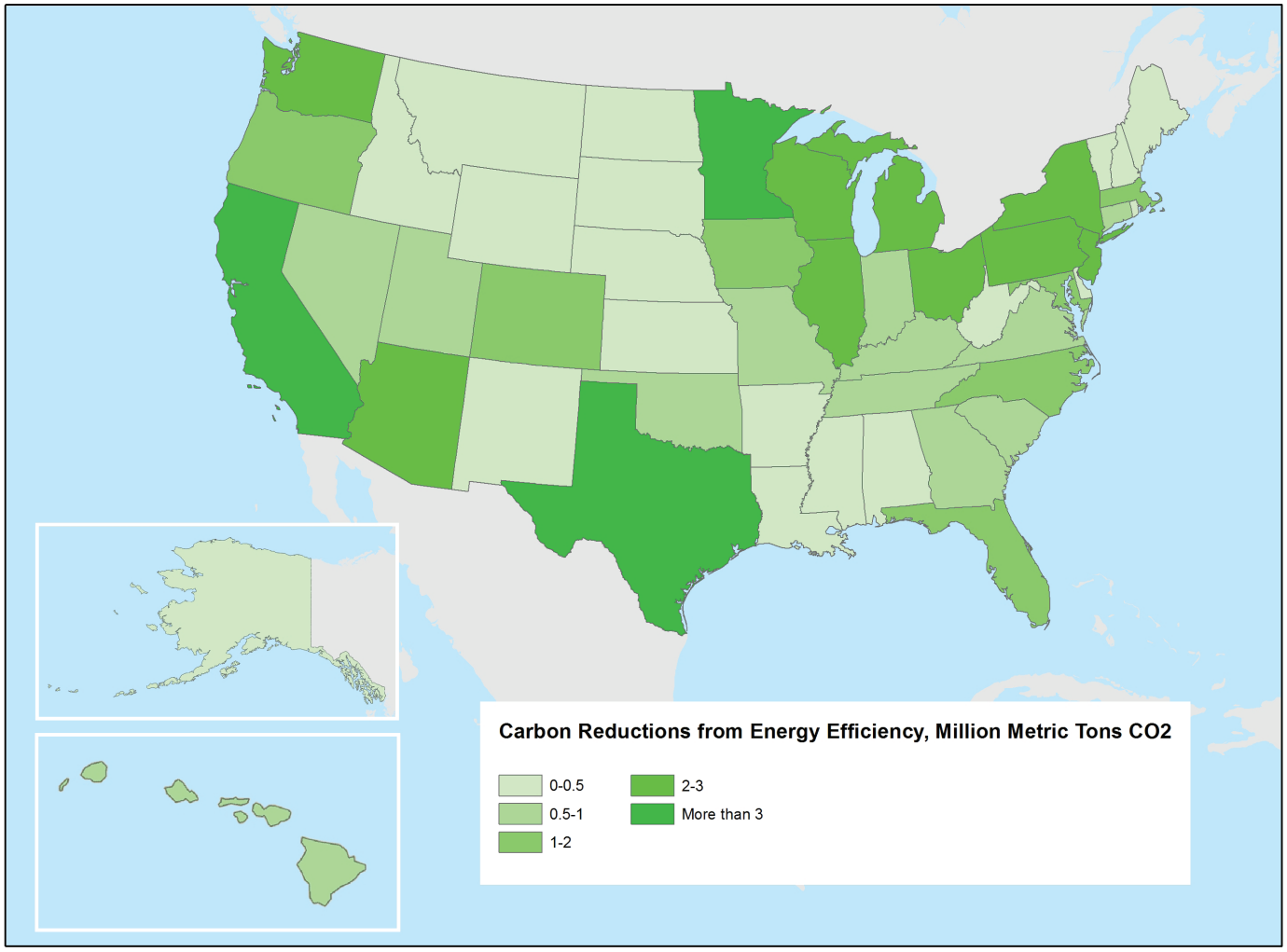
The United States can further cut carbon pollution and achieve its emission goals with increased deployment of clean energy and further efforts to limit carbon pollution.

- In combination, the set of policies to improve energy efficiency, expand renewable energy and curb the use of dirty fossil fuels listed above prevented 162 million metric tons of climate-altering carbon dioxide pollution in 2012.
- The impact of these policies will increase over time as clean energy generation expands, as more buildings are renovated to be efficient, and as efficient vehicles replace more polluting ones. By 2020, these policies will annually prevent more than 500 million metric tons of carbon dioxide pollution – about 9 percent of 2005 emissions.
- Additional policy measures, such as limiting carbon pollution from new and existing power plants, can increase deployment of clean energy, further reduce pollution, and steer the U.S. economy away from fossil fuels and toward a clean energy future.

Achieving America's commitment to reduce global warming pollution will require action at all levels of government.

In 2009, America pledged to the international community that we would reduce our global warming pollution to 17 percent below 2005 levels by 2020. The clean energy policies in this report have already delivered one-sixth of the emission reductions needed to achieve the nation's Climate Action Plan 2020 emission target, and will deliver an even greater share of savings as those policies mature and build momentum over time. Additional leadership at the federal, state and local level will be needed to help the nation meet this target.

Figure ES-2. Implementation of energy efficiency policies from 2007 to 2012 cut 62 million metric tons of carbon dioxide pollution in 2012, with benefits accumulating in every state across the country.



- The Obama administration should move forward with the National Climate Action Plan, including cleaning up carbon pollution from new and existing power plants and leading the development of an international climate treaty capable of preventing the worst impacts of global warming.
- Every state should begin developing a plan to meet or exceed federal standards to limit carbon pollution from power plants. States should draw on the significant experience they have amassed to date with energy efficiency and the generation of electricity from renewable sources of energy.
- States and local governments should continue to shift toward a clean energy economy and aggressively reduce global warming pollution at every available opportunity. For example, every state should create or strengthen renewable electricity and energy efficiency resource standards, and local governments should push toward net-zero energy building codes.

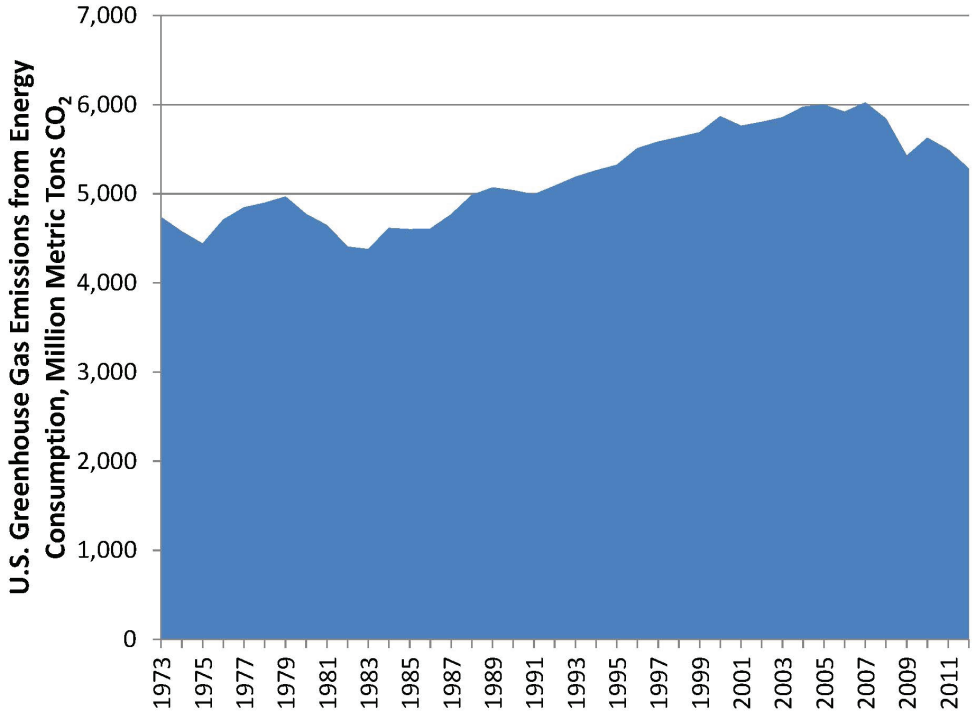
Introduction

Global warming emissions in the United States in 2012 were at their lowest level since 1994 – more than 12 percent below their 2007 peak.[1] Emissions dropped from 2007 to 2012, a remarkable reversal of a decades-long trend of rising climate pollution. (See Figure 1.) Even as the worst effects of the 2008 recession have softened and as the economy has begun to improve, emissions continued to drop, enabling total global warming pollution in 2012 to reach a level not seen since Bill Clinton's first term in office.

The decline stems in large part from deliberate policy decisions and from clean energy programs implemented by states and by President Obama. Smart energy policies that reduce the amount of energy we waste and expand the share of our energy we get from clean, renewable sources have played a major role in "bending the curve" of U.S. global warming emissions.

The change in America's trajectory of global warming pollution has come not a moment too soon.

Figure 1. Annual Carbon Dioxide Emissions from Energy Use Declined 2007-2012[2]



Smart energy policies that reduce the amount of energy we waste and expand the share of our energy we get from clean, renewable sources have played a major role in "bending the curve" of U.S. global warming emissions.

The latest report from the Intergovernmental Panel on Climate Change reinforces the urgent need to act on global warming, warning that the world has only 15 years in which to dramatically curtail global warming pollution or risk environmentally and economically catastrophic damage.[3] Science warns us that industrialized countries, including the United States, will need to reduce climate-altering emissions 80 to 95 percent by mid-century in order to avert the worst impacts of global warming.[4]

Clean energy policies such as those highlighted in this report are critical components of any strategy to protect our children and future generations from the impacts of global warming. Unlike the economic recession, which contributed to the recent decline in emissions, clean energy policies deliver emission reductions in both good economic times and bad.

And unlike the switch from coal-fired power plants to natural gas, clean energy policies contribute to achieving a future free of dependence on fossil fuels and the pollution they produce.[5]

In this report, we tell the story of state and federal clean energy policies and programs – many of them only a few years old – that are already delivering significant reductions in global warming pollution. To avert irreversible and catastrophic damage to our communities – and to reassert American global leadership – policymakers must build on the foundation laid by those policies and speed the nation's transition to a clean energy system with dramatically reduced impacts on the global climate.

America is truly moving forward in the fight against global warming. It is up to leaders at all levels of government to build upon and accelerate that momentum in the years to come.

The Threat of Global Warming Requires Urgent Action

The world must take action now to avert the worst impacts of global warming. The threats global warming poses to natural ecosystems, coastal infrastructure and human health are increasingly serious, and the dangers of catastrophic impacts grow with every passing year that the world fails to reduce its emissions of climate-altering pollution.

The Dangers of Global Warming

Science tells us that global warming is already here. Humans have released more than half a trillion metric tons of carbon dioxide into the atmosphere, and this has contributed to rising temperatures.[6] According to the Intergovernmental Panel on Climate Change, greenhouse gases likely caused global surface warming of between 0.5° and 1.3°C between 1951 and 2010.[7] Without a rapid and sharp drop in emissions, the world faces extreme and irreversible changes in the global climate.

The world's glaciers are losing ice at a rate unprecedented in modern history – and as a result, sea level is rising.

- Worldwide, glaciers have lost an average of approximately 275 billion tons of ice annually since 1993 – enough to cover the entire state of California in more than two feet of water.[8]
- Ice loss has contributed significantly to ocean level rise; the seas have risen about 2.2 inches since 1992, and the rate of sea level rise since the 19th century has been higher than the average rate over the past 2,000 years.[9] From 1901 to 2010, global average sea level rose by more than half a foot.[10]
- The Intergovernmental Panel on Climate Change observed that "over the past three decades, Arctic summer sea ice retreat was unprecedented and sea surface temperatures were anomalously high."[11]

Warming temperatures have also fueled extreme weather patterns, which are already occurring with greater frequency and force.

- Heat waves are striking more often and more powerfully, with particularly devastating consequences for areas already prone to drought.[12] In 2012, a catastrophic drought, exacerbated by near-record heat, withered crops across the country; economists estimated losses at $77 billion.[13]
- The Rim Fire in Yosemite in fall 2013, the third-largest such fire in California history, spread to an area the size of Dallas.[14] The U.S. Forest Service spent $600 million that summer to fight 50 out-of-control fires in Alaska, Arizona, California, Idaho, Montana, Nevada, Oregon, Utah, Washington and Wyoming.[15] According to the head of the U.S. Forest Service, global warming has already lengthened the fire season by two months and has made it easier for large fires to spread more quickly and be more destructive.[16]

- In the United States, extreme weather events like Hurricanes Sandy and Katrina have already killed thousands of people and caused more than $100 billion in damage.
- In September 2013, devastating floods swept through cities and towns across Colorado, causing an estimated $2 billion in damages, damaging more than 17,000 homes and destroying more than 1,600, and killing at least eight people.[17]

If significant steps are not taken to reduce global warming pollution, sea level rise will flood more land, and the frequency and intensity of extreme weather events will only get worse.

- Scientists estimate that continued global warming will make extreme storm surges like that from Hurricane Katrina up to seven times more likely – meaning that by the end of the century, such a storm could occur every other year.[18]
- Without change to current climate policies, University of Illinois climate experts predict that the annual acreage lost to wildfires may double by 2043. "You might get to the point where in some parts of the West, there are no more forests," warns Professor Don Wuebbles, coordinating lead author of the Intergovernmental Panel on Climate Change's Fifth Assessment Report.[19]
- By the end of the century, climate models predict that the planet may warm by up to 11° Fahrenheit and face a sea level rise of between two and six feet, submerging thousands of miles of coastline and wreaking havoc on coastal communities around the world.[20]
- According to a study led by World Bank Senior Economist Stephane Hallegatte, five of the world's 10 cities most endangered by continued sea level rise are in the United States. Miami, New York, New Orleans, Tampa and Boston stand to be hit the hardest of U.S. cities, and global flood losses are expected to rise tenfold, to over $60 billion annually, by 2050.[21]
- The ecological consequences of unchecked global warming could include the extinction of as much as 70 percent of all species on earth and the loss of unique ecosystems like the Amazon.[22]

Some of these climate impacts, given the tremendous amount of global warming pollution already emitted and the accumulation of carbon dioxide in the atmosphere, are inevitable. The world's glaciers will continue to melt, and the oceans will likely continue to acidify due to high levels of carbon dioxide, killing or drastically altering valuable undersea ecosystems from the Florida Keys to Australia's Great Barrier Reef.[23]

But if policymakers take action now to reduce climate-altering pollution, there is still time to prevent the worst impacts of global warming.

The United States Has an Obligation to Act

As the world's largest economy, the nation responsible for more of the carbon pollution in the atmosphere than any other, and a center for clean energy technology and research, the United States has a responsibility to lead the world in tackling the problem of global warming.

The United States is the second-largest current emitter of global warming pollution. Our nation emits more than five billion metric tons of carbon dioxide each year – about one-fifth of the world total – meaning that there is no solution to global warming that does not require United States involvement and leadership.[24]

In order to lead, the United States needs to reduce its own emissions of climate-altering pollution, and then show the world how to transition from dirty energy sources to the efficient use of clean energy. Thanks to clean energy policies adopted and implemented over the last decade, the United States is already beginning to rise to that challenge. In 2009, President Obama established a goal of reducing global warming pollution in the United States by 17 percent below 2005 levels by 2020 and has pursued policies to cut emissions – including from power plants, the nation's biggest source of pollution.[25] States across the nation have also adopted a variety of policies to cut emissions.

As the following section of this report shows, these actions are working. America is moving forward. Local, state and federal leaders are building momentum around reducing emissions of global warming pollution.

State and Federal Leadership on Global Warming Is Already Having a Significant Impact

Many of the most important and long-lasting developments in the fight against global warming have come from policies adopted by states and the federal government to cut down on global warming pollution, save energy, and produce electricity from less-polluting sources.

Three categories of clean energy policy stand out as particularly effective in reducing carbon emissions. First, the increased use of clean renewable electricity is reducing carbon emissions per unit of energy produced. Second, energy efficiency programs are resulting in more efficient appliances and energy grids, cutting down on energy waste and lowering the energy intensity of the economy. And third, policies that lead to reductions in our fossil fuel consumption are cleaning up our economy, lowering emissions and helping America transition to a more efficient future.

In this report, we examine the benefits of the most important of these policies, focusing on policies in effect in the five years since U.S. global warming emissions peaked in 2007. We examine the benefits of these policies on a national and state-by-state basis, providing insight into the ways in which these programs are helping cut emissions. The policies and programs we examine in this report – just a subset of the many clean energy policies adopted by local, state and federal governments in recent years – saved an estimated 162 million metric tons of carbon dioxide in 2012, equal to the annual emissions of 34 million passenger vehicles, or all the passenger cars and trucks in Pennsylvania, Michigan, Illinois and Colorado combined.[26] This means that in 2012, just three years after announcement of the National Climate Action Plan, we have already achieved one-sixth of the emission reductions needed to achieve the 2020 emission target.

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Policies to Increase Renewable Electricity Generation Prevented 60 Million Metric Tons of Carbon Dioxide

Electricity generation from wind and solar energy increased four-fold from 2007 to 2012, slashing carbon dioxide emissions by 62 million metric tons in 2012.[29] This growth in renewable electricity generation largely occurred in response to state renewable electricity standards, with a boost from federal policies supporting wind energy.

Renewable electricity generation has grown by leaps and bounds since 2007. The amount of electricity generated from wind increased four-fold from 2007 to 2012.[30] (See Figure 2.) Solar energy generation increased at least seven-fold, and even more if rooftop solar energy installations are included. (See Figure 3.)

State and local governments have boosted renewable electricity production and helped build cleaner electricity grids through the adoption of renewable electricity standards, or RES policies. These require utilities to source a percentage of their energy from renewable sources, such as the sun and wind, usually in increasing percentages over time. Wind and solar power emit essentially no global warming pollution, resulting in lower overall emissions from electricity generation and consumption.

The state of Ohio, for instance, passed its Clean Energy Law in 2008, including provisions establishing an RES. In 2012, the law required that utilities source 1.5 percent of their energy from renewables, and by 2025 utilities will need to develop or purchase 12.5 percent of their energy from renewable sources.[33] In a state that in 2010 ranked fourth in the nation for carbon dioxide emissions from power plants, Ohio's Clean Energy Law is helping to cut large amounts of pollution.[34]

Carbon Dioxide and Other Global Warming Pollutants

There are many kinds of global warming pollution, and even more sources. This report focuses solely on carbon dioxide emissions from combustion of fossil fuels.

Carbon dioxide (CO_2) emissions comprised 79 percent of U.S. global warming emissions in 2011.[27] Other global warming pollutants include methane, nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6). These pollutants are released from agricultural practices, oil and gas production, landfills, air conditioners, insulation around electrical equipment, and other sources.

Some gases have a greater ability to trap heat and warm the atmosphere. Over a 20-year timeframe, a pound of methane has 84 times the heat-trapping effect of a pound of carbon dioxide.[28] Nitrous oxide is 264 times more powerful, HFCs have up to 10,800 times more heating potential than carbon dioxide, and SF_6 can hold 17,500 times more heat. While this report focuses on measuring carbon dioxide because it is the largest source of pollution, addressing all global warming pollutants is important.

Figure 2. Net Generation of Electricity from Wind Increased Four-Fold from 2007 to 2012[31]

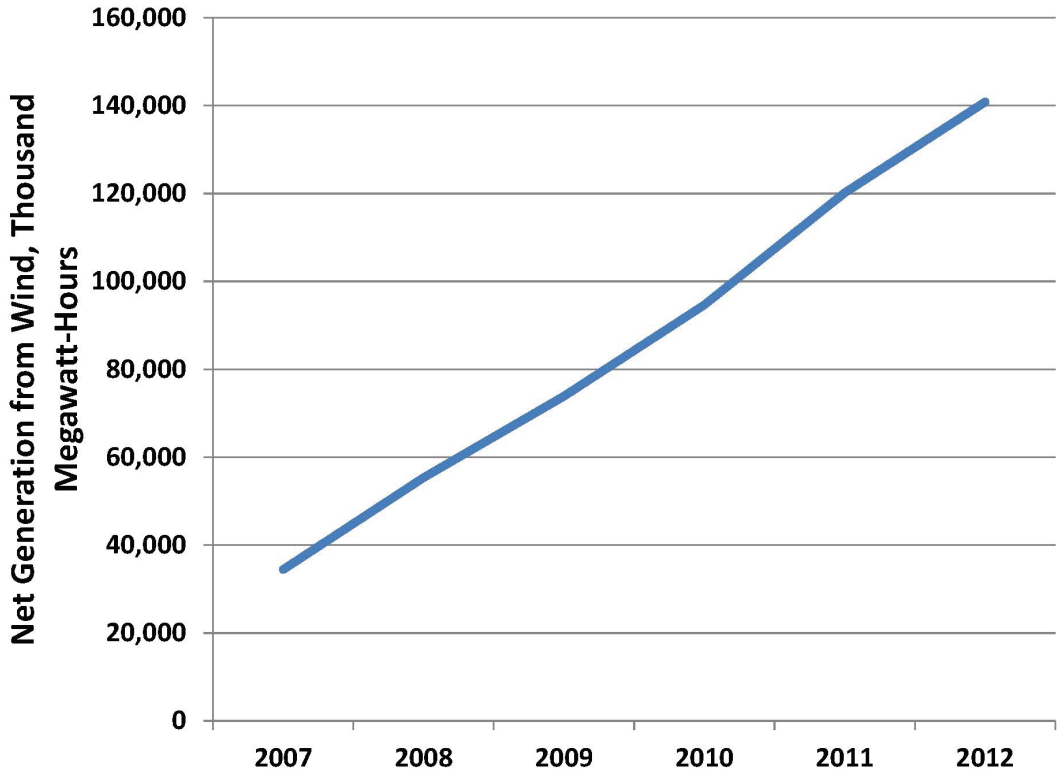


Figure 3. Net Generation of Electricity from Utility-Scale Solar Energy Increased Seven-Fold from 2007 to 2012[32]

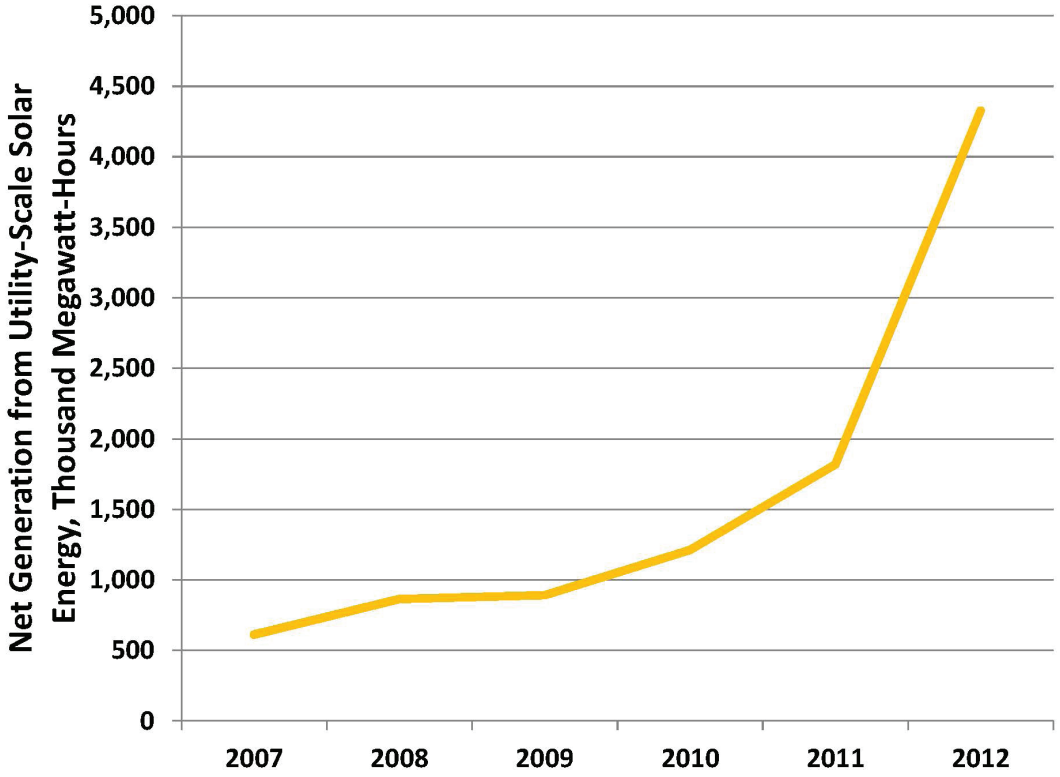
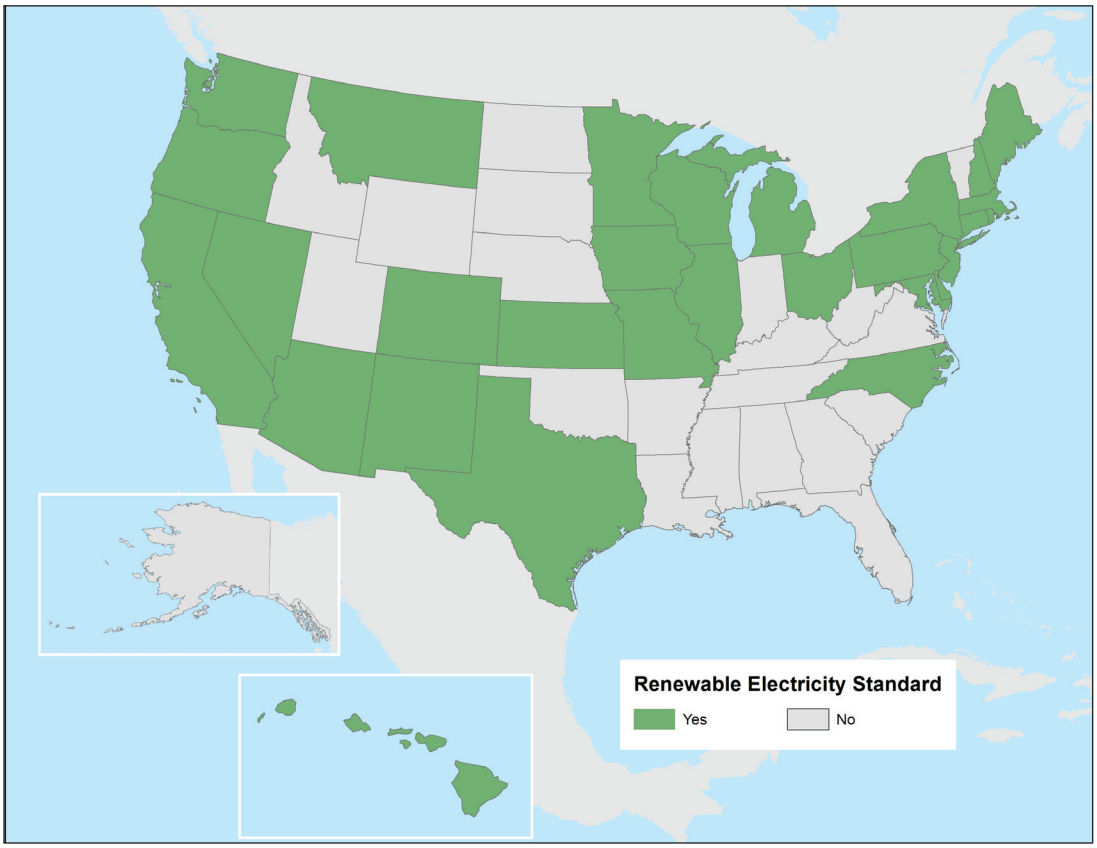


Figure 4. A Majority of States Have Adopted a Renewable Electricity Standard[38]



In Minnesota, the state legislature passed an RES in 2007 that set a standard of 31.5 percent renewable energy by 2025 for Xcel Energy, the largest energy utility in the state, and 26.5 percent for all other investor-owned utilities in the state. Minnesota has emerged as one of the Midwest's clean energy leaders, and has expanded its commitments to both renewable power and energy efficiency.[35]

Across the United States, 29 states and the District of Columbia have implemented binding renewable electricity standards, ranging from 40 percent in Hawaii by 2030 to 20 percent in Kansas by 2020 to 12.5 percent in Ohio by 2024.[36] (See Figure 4.) These renewable electricity standards are responsible for approximately 75 percent of the growth in renewable electricity generation in recent years.[37]

The federal government has also played a role in increasing generation from clean, renewable sources of energy and reducing global warming pollution. The production tax credit helps support construction of new wind farms, while a tax credit for solar energy supports the installation of solar panels on homes.[39] Federal policies have also facilitated the siting of renewable energy projects on public land.[40] In 2012-2013, the federal government obtained 7 percent of its electricity from sources such as wind and solar energy.

Measures to Improve Energy Efficiency in Buildings Prevented 62 Million Metric Tons of Carbon Dioxide

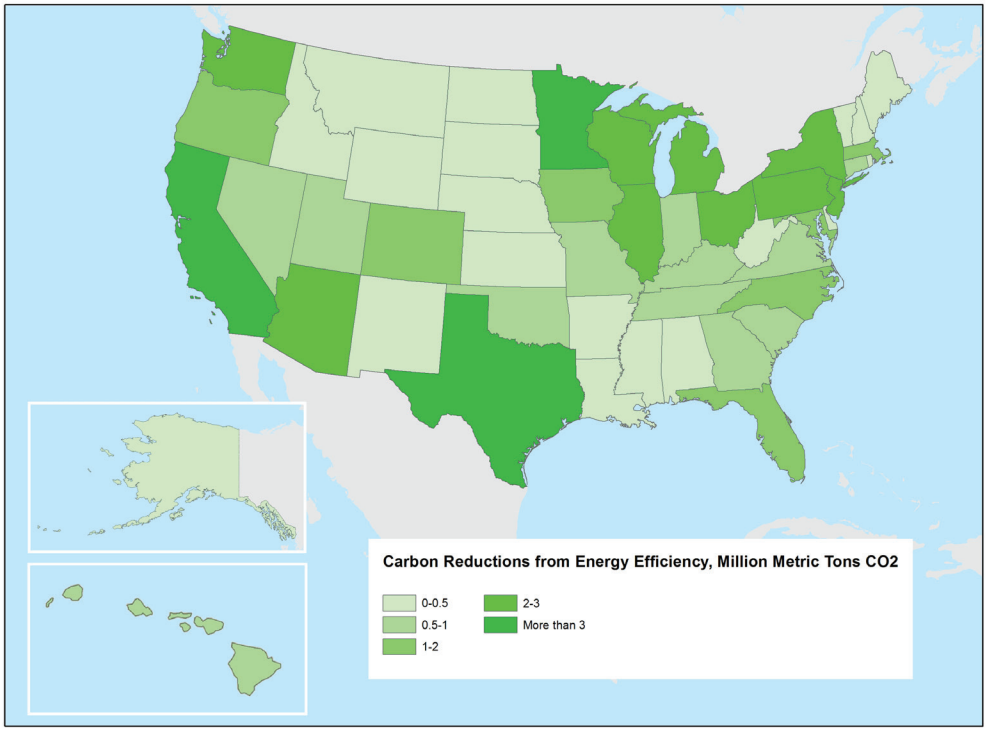
One of the most cost-effective and simplest ways to reduce energy consumption, and therefore dangerous global warming pollution, is to improve energy efficiency. By removing old and inefficient appliances from the power grid, upgrading to energy-efficient technologies, encouraging innovation in energy-efficient product design, and requiring utilities to reduce energy waste, policymakers can save consumers money, use our natural resources more effectively, and reduce emissions that contribute to global warming.

Retail electricity sales declined 1.9 percent from 2007 to 2012, a change driven in part by energy efficiency programs.[41] A variety of policies promote energy efficiency and reduce global warming pollution. Energy efficiency resource standards and other broad energy efficiency requirements target energy waste across the economy, while appliance and lighting efficiency standards target specific areas of energy consumption. Implementation of energy efficiency policies from 2007 to 2012 cut 62 million metric tons of carbon dioxide pollution in 2012, with benefits accumulating in every state across the country. (See Figure 5.)

State Energy Efficiency Requirements

A number of states have developed statewide energy efficiency goals or adopted regulatory policies that promote efficiency investments by utilities, saving millions of megawatt-hours of electricity per year.

Figure 5. Energy Efficiency Benefits Accrued in Every State in 2012



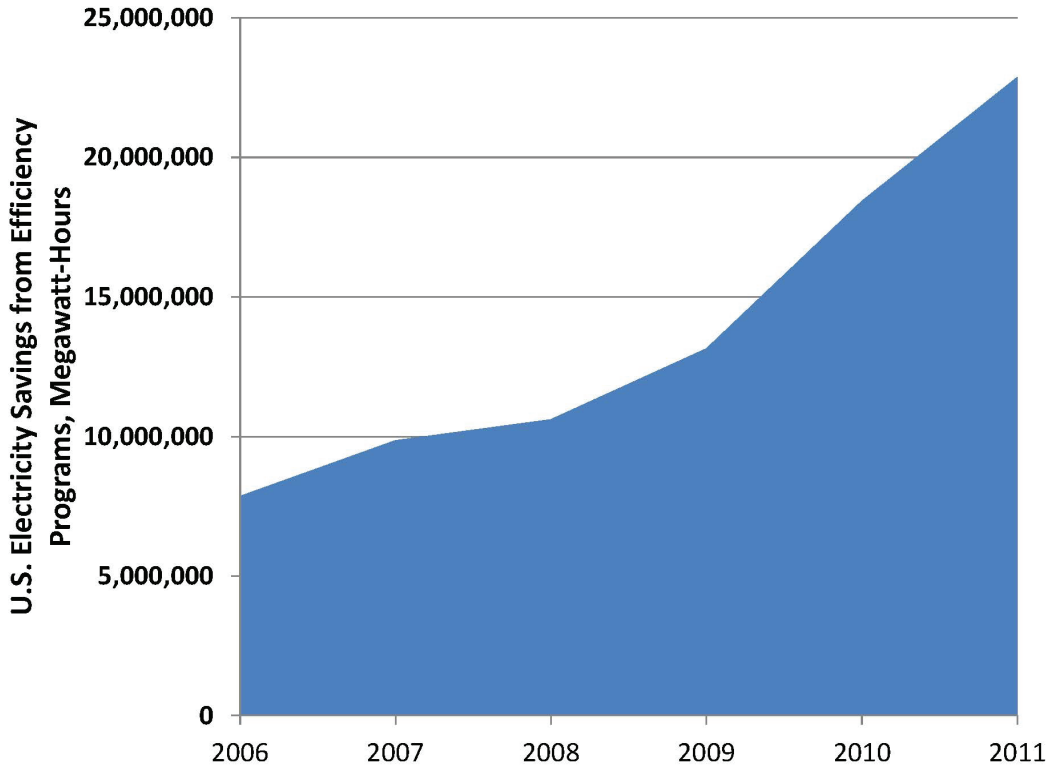
Broad energy efficiency programs cut energy waste by:

- helping manufacturers identify inefficiencies in their processes and replace old, inefficient equipment;
- providing energy audits of homes and helping homeowners seal air leaks;
- offering design advice to enable commercial buildings to install more efficient heating and cooling systems;
- subsidizing the cost of efficient lighting; and
- offering technical support wherever energy is consumed.

Certain states have been particularly effective in reducing energy consumption and avoiding global warming pollution. Vermont, a national leader in energy efficiency, saved over 2 percent of retail electricity sales through efficiency investments made during 2011 alone. Massachusetts saved about 1.4 percent of its electricity from investments made in 2011, and California 1.35 percent.[42]

Savings from energy efficiency programs have been increasing every year, as previous investments continue to deliver energy savings and new investments contribute additional savings. Second, states have been strengthening their energy efficiency requirements and increasing their investments in efficiency. The American Council for an Energy-Efficient Econo-

Figure 6. First-Year Energy Efficiency Savings Increased from 2006 to 2011[45]



my (ACEEE) annually collects information from each state on its energy efficiency savings. ACEEE's data show that, as a result of rising investment, first-year energy savings due to state energy efficiency programs increased from 7.8 million megawatt-hours in 2006 to 13.1 million in 2009 to 22.9 million in 2011.[43] (See Figure 6.) Cumulatively, all state investments in energy efficiency from 2007 to 2012 produced savings of 90 million megawatt-hours in 2012 – as much electricity as was consumed by the entire state of Washington in 2010.[44]

The federal government has also invested in reducing energy waste in its operations. Since 2007-2008, energy use has declined by 9 percent per square foot of federal building space.[46]

Appliance and Lighting Efficiency Standards

Until the 1980s, individual states were the only entities setting efficiency standards for appliances.[47] California was the first state to do so, beginning in the 1970s. Various other states – including Washington, New York and Maryland – soon joined California. According to the U.S. Environmental Protection Agency, these state-level actions "helped create the consensus for new federal legislation," including the National Appliance Energy Conservation Act (NAECA), enacted under President Reagan in 1987.[48]

Federal standards now form the basis for efficiency requirements for 55 common household and commercial appliances, including air conditioners, furnaces, ceiling fans, light fixtures, traffic signals and commercial ice makers.[49] As old appliances break or are retired, replacement equipment will meet higher efficiency standards, ensuring savings for years to come. Since 2009, standards have been issued or updated for 17 products, influencing appliances that account for 90 percent of residential electricity use and 60 percent of commercial energy use.[50] In 2012, appliance standards adopted in 2005 and 2007 reduced national carbon dioxide emissions by about 15 million metric tons.[51]

Cumulatively, all state investments in energy efficiency from 2007 to 2012 produced savings of 90 million megawatt-hours in 2012 – as much electricity as was consumed by the entire state of Washington in 2010.

Building Energy Codes

Another key policy for reducing energy waste and improving energy efficiency is adoption of building energy codes, which improve the efficiency of long-lived sources of energy consumption. Buildings codes are typically adopted and enforced by state and local bodies, creating wide variation in energy savings, even within individual states.

Building codes are the construction standards to which new and heavily remodeled buildings are held, including standards for energy efficiency. Residential and commercial buildings are responsible for about 41 percent of the nation's total energy consumption, and about 35 percent of the country's annual global warming pollution.[54] Because buildings last for decades, initial energy efficiency improvements during construction can have a long-lasting impact, reducing energy waste, saving money, and cutting pollution for decades to come.[55]

While state and local governments have wide latitude to establish their own building codes, they also have a variety of standard model codes available for them to choose from. The most commonly implemented model codes are the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 90.1 code for commercial construction and the International Code Council's International Energy Conservation Code (IECC), for both residential and commercial construction. These model codes are updated, and generally become more energy efficient, every three years. The most recent ASHRAE code is 2010 and the most recent IECC code is 2012. States may implement these model codes as they are, modify them to suit local conditions, or implement a unique state code.

The federal American Reinvestment and Recovery Act, passed in 2009, contained significant incentives for states to invest in improved building efficiency. The Act granted additional funds to states that upgraded to the most modern building energy codes, and all 50 states accepted funds to do so.[56] However, many states have been slow to adopt the latest code.

As of October 2013, 38 states and the District of Columbia had adopted a code as efficient as or more efficient than the commercial ASHRAE 90.1 2007 standards. For residential buildings, 32 states and D.C. have adopted codes equal to or better than the IECC 2009 code.[57] States with strong building codes tend to adopt both a strong commercial and strong residential code; Oregon, Massachusetts, Maryland, Rhode Island, Illinois and California, for instance, have all adopted both the IECC 2012 code or better and the ASHRAE 2010 code or better.

Even more improvements in building code efficiency are in the works. By 2015, the U.S. Department of Energy estimates that 18 additional states will have updated to the most efficient commercial model code currently available – the 2012 IECC – or better, while 16 will have adopted the 2012 IECC residential code.[60]

These improvements in building efficiency promise to result in significant global warming pollution reductions. The Building Codes Assistance Project estimates that if states upgrade to recommended model codes beginning in 2013, annual reductions of 32.4 million metric tons of carbon dioxide would be achieved by 2020 – eliminating as much global warming pollution as is produced annually by nine coal-fired power plants.[61]

Building Energy Codes (continued)

Emission reductions from building energy codes are not quantified in this report, due to the absence of data sources that account for the many variations in state building code adoption and enforcement. Strong building energy codes can, however, make a significant contribution toward reducing global warming pollution, particularly if they are used to drive the adoption of cutting-edge energy efficiency technologies and practices in American homes and businesses.

Figure 7. Residential Building Codes[58]

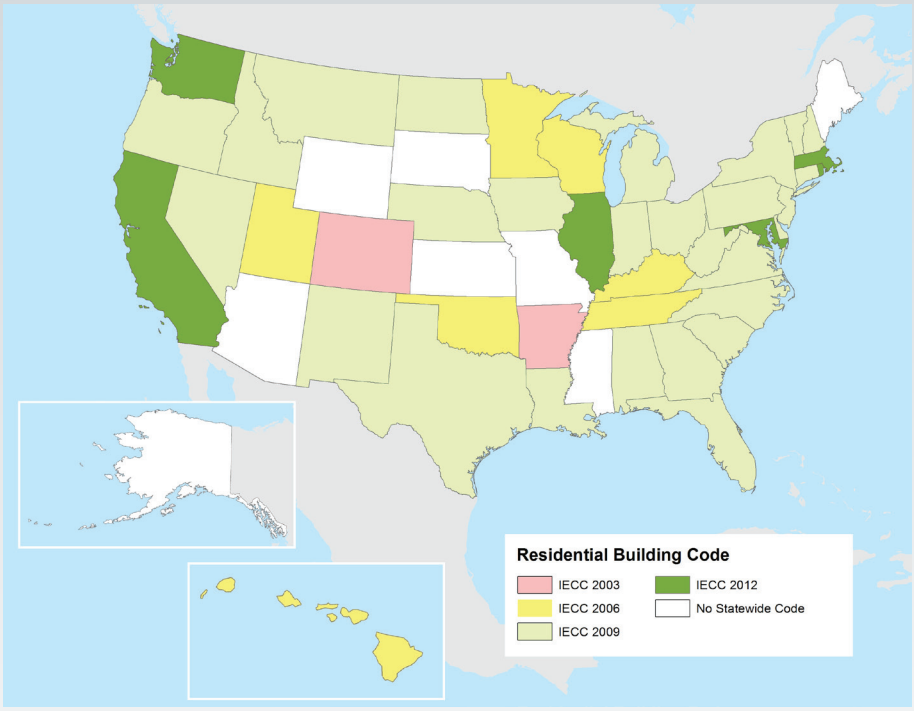
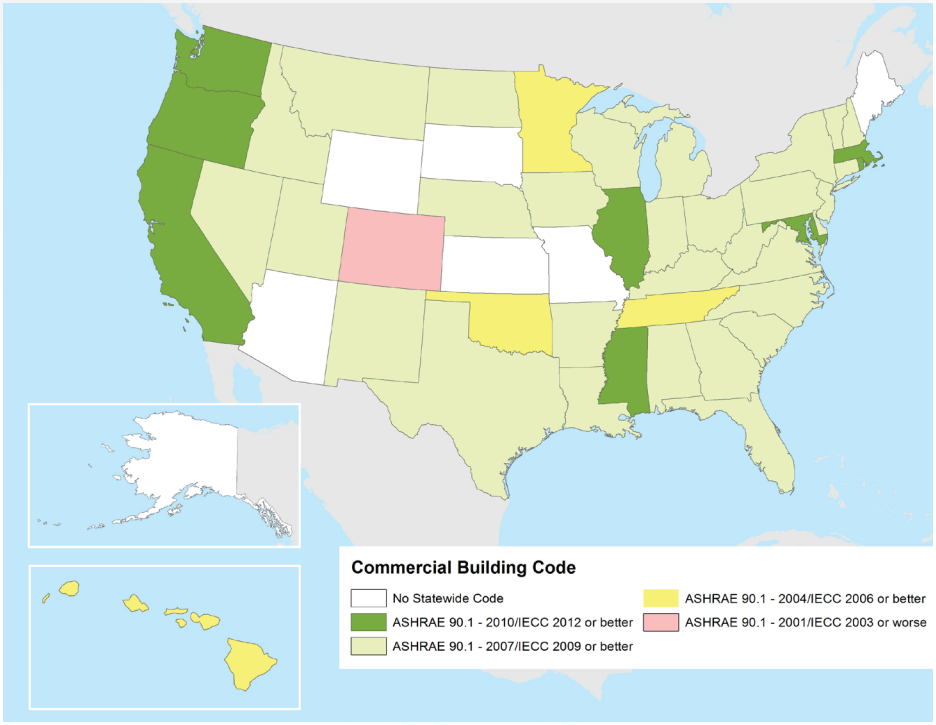


Figure 8. Commercial Building Codes[59]



In July 2012, new energy efficiency rules for fluorescent and incandescent lamps took effect, building on a history of state-level lighting efficiency standards.[52] The new rules cover both general service fluorescent lamps and incandescent reflector lamps, saving an estimated 3.6 million metric tons of global warming pollution in the last six months of 2012.[53]

The Clean Cars Program Prevented 39 Million Metric Tons of Carbon Dioxide

Due to a combination of state and federal policy, vehicle fuel efficiency standards have improved more in the past few years than in the previous two decades. As automakers have begun producing more efficient vehicles to meet higher fuel efficiency standards, carbon pollution from cars and light trucks has started to fall.

After 20 years of no improvement in fuel efficiency for passenger cars, federal standards rose from 27.5 miles per gallon in 2010 to 32.7 MPG in 2012.[62] Standards for light-duty trucks, which were stagnant for nearly a decade, rose from 20.7 miles per gallon in 2004 to 25.2 MPG in 2012.[63] Thanks in part to these higher standards for cars and light trucks, light-duty vehicles produced 3.8 percent less global warming pollution in 2012 than would have been the case if fuel efficiency standards had remained at 2007 levels.[64] Nationally, this reduced carbon dioxide pollution by 39 million metric tons in 2012, equal to taking 8 million vehicles off the road for a year.

Improvements in vehicle fuel efficiency have been driven by both state and federal policy. Under the federal Clean Air Act, California has the right to impose its own, more stringent standards for air pollution from vehicle tailpipes. States with severe air pollution problems may choose to follow California's standards in lieu of the more lenient federal rules.

Historically, California's emission standards targeted air pollutants that contribute to the formation of smog and soot. But that changed in 2002, when California adopted the nation's first law regulating global warming pollution from automobiles. The law requires California to achieve the maximum cost-effective reductions in global warming pollution from tailpipes – a level later established at a 34 percent reduction in per-mile emissions from cars by 2016 and a 25 percent reduction in emissions from light trucks.[65]

Thirteen other states and the District of Columbia – accounting for 40 percent of the United States market for new cars and light trucks – ultimately followed California in adopting the rules.[66] In late 2007, the U.S. Congress followed the states' lead by requiring stronger federal corporate average fuel economy (CAFE) standards for automobiles. It was the first increase in the standards since 1990 and set 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 for the model years 2009-2016, 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.

Fuel efficiency standards – and emission savings – will rise even further in the coming years. The Obama administration has announced that fuel economy standards will increase 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, the new fuel economy standards are expected to have reduced global warming pollution by a cumulative 6 billion metric tons – more carbon dioxide than was emitted by the entire United States in 2010.[67] New efficiency standards for medium- and heavy-duty vehicles, to be finalized in 2016, will help further reduce emissions from transportation.

Other Policies Are Helping to Prevent Emissions of Climate-Altering Pollution

States have adopted a number of additional policies to cut global warming pollution. Some of these policies have delivered significant emission reductions to date, while others establish a regulatory framework that will help cut emissions in the years to come.

State Caps on Global Warming Pollution

Six U.S. states have adopted comprehensive, multi-sector caps on global warming pollution that by 2020 could cut emissions by 270 million metric tons of carbon dioxide. Those states – California, Connecticut, Hawaii, Maryland, Massachusetts and New Jersey – represent 23 percent of U.S. gross domestic product.[68] Internationally, they would rank as the world's fifth-largest economy, behind the United States as a whole, China, Japan and Germany.[69] These six states also emit 12 percent of America's fossil-fuel related carbon dioxide emissions.[70] 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.[71]

California became the first 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. AB 32 required the California Air Resources Board, or CARB, to formulate a plan for reducing California's global warming pollution to 1990 levels by 2020 – an approximately 17 percent reduction from business-as-usual projections – and reducing emissions 80 percent below 1990 levels by 2050.[72] CARB will enforce increasingly strict compliance periods for the law, with allowable global warming pollution decreasing incrementally in three-year periods.

The centerpiece of California's greenhouse gas 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 will cover fuel distributors beginning in 2015. California's cap-and-trade program incentivizes businesses to implement the most cost-effective means of reducing global warming emissions. Compared to the state's forecast 2020 business-as-usual projection of 509 million metric tons CO_2 equivalent, California is expected to reduce its global warming pollution by 78 million metric tons, to 431 million, with 23 million metric tons of those savings expected to come from cap-and-trade measures.[73]

California estimates that policies pursued to implement the statewide cap cut 18 million metric tons of global warming pollution in 2011, the most recent year for which data are available.[74] The savings came from the Clean Cars Program, a diesel vehicle anti-idling program, proper inflation of vehicle tires by automobile service stations, better control of climate-damaging refrigerants, a low-carbon fuel standard, appliance and building energy standards, broad energy efficiency programs and the state's renewable electricity standard.

Regional Greenhouse Gas Initiative

States in the Northeast have joined together to develop a regional approach to reducing global warming pollution from electricity generation.

The Regional Greenhouse Gas Initiative (RGGI) aims to reduce carbon dioxide pollution from power plants in nine northeastern states. Massachusetts adopted its own limit on carbon dioxide pollution from power plants in 2001, spurring a regional conversation about limiting power plant pollution. When RGGI was implemented in 2008, it became the first mandatory cap-and-trade program for carbon dioxide emissions anywhere in the United States.[75] The nine RGGI participating states, as of 2013, were Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island and

Vermont. (New Jersey also participated until 2011.[76]) In 2011, these states accounted for 13.1 percent of the U.S. population, 7 percent of U.S. carbon dioxide emissions, and 16 percent of U.S. gross domestic product.[77]

The states agreed to a regional cap on global warming pollution from electricity generation. Power generators in each state are required to hold emissions allowances corresponding to the amount of pollution they emit. Most states participating in RGGI distribute pollution allowances by auction, in which power generators purchase allowances, yielding funds that states can use to promote energy efficiency and renewable energy. This investment reduces global warming emissions and produces significant reinvestment in the economy.

Through 2012, RGGI-funded energy efficiency and renewable energy programs reduced carbon dioxide emissions by more than 400,000 metric tons – the equivalent of removing about 90,000 cars from the road for a year – and saved ratepayers $240 million in energy bills thanks to investments in energy efficiency.[78]

A November 2011 report from economic consulting firm Analysis Group found that "RGGI generates greater economic growth in every one of the 10 states that participate in RGGI than would occur without a carbon price," fueling $1.6 billion in economic growth, keeping $765 million in the local economy from reduced use of fossil fuels, and creating 16,000 jobs across the region.[79] These benefits hold true even after accounting for power plant owner losses due to allowance expenditures and reductions in energy sales.

The RGGI states recently took the important step of further tightening the region's emissions cap to match the region's current emissions, correcting for an earlier overestimate in emissions. Beginning in 2015, RGGI will reduce the carbon dioxide emissions budget by 2.5 percent per year, driving down emissions and raising the cost of allowances. This will help level the playing field for cleaner sources of electricity and increase funds available for clean energy and energy efficiency programs, enabling further emission cuts.

Low Carbon Fuel Standards

In 2007, California Governor Arnold Schwarzenegger issued an executive order directing oil refiners and distributors doing business in California to reduce the carbon intensity of their fuels by 10 percent by 2020.[80] Implementation of the resulting Low Carbon Fuel Standard (LCFS) – the nation's first – was placed under the direction of the California Air Resources Board.[81]

California's low carbon fuel standard has helped to boost the inclusion of carbon-reduced fuels in the state's overall fuel mix, including electricity, hydrogen fuel cells, biodiesel and natural gas. Under the LCFS, transportation fuels consumed in California are measured for their carbon intensity – the amount of global warming pollution they emit per unit of energy consumed, including all pollution emitted during extraction, transportation, refining, distribution and consumption – and must be replaced by less carbon-intense fuels in increasing percentages over time. In 2011, petroleum companies first began to comply with the standard, which required a 0.25 percent reduction in carbon intensity that year.[82]

California's LCFS operates by distributing low carbon fuel credits to companies that exceed their requirement for low carbon fuel production, importation, or refinement, which can then be sold to companies that have not met their low carbon fuel requirements – establishing a market for low-carbon fuels that incentivizes companies to adopt the most cost-effective means of carbon intensity reduction.

Researchers at the University of California, Davis, estimate that by the end of 2012, California's low carbon fuel standard had resulted in the displacement of approximately 2.1 billion gallons of gasoline

and 77 million gasoline gallon equivalents of diesel.[83] In 2012, the displacement of high-carbon fuels by lower-carbon counterparts has reduced global warming pollution in California by 1.2 million metric tons – equivalent to taking about 250,000 cars off the state's roads.[84]

A number of states in the Northeast and Mid-Atlantic regions are investigating adoption of a regional low-carbon fuel standard.

Generation Performance Standards

Generation performance standards require power plants to limit the amount of global warming pollution they emit per unit of energy produced. Generation performance standards also often bar the importation of dirty out-of-state energy, holding out-of-state power plants to the same standards of energy production as facilities located in-state. A generation performance standard complements a renewable electricity standard: as one promotes clean, renewable energy, the other helps curtail reliance on dirty power sources.

As Northeastern states established RGGI to limit carbon dioxide pollution from power plants, the West Coast states of Oregon, Washington and California adopted generation performance standards. Oregon was the first state to limit global warming pollution from power plants through a generation performance standard.[85]

California was the next state to act. Governor Arnold Schwarzenegger signed Senate Bill 1368 in September 2006, which required the California Energy Commission (CEC) and California Public Utilities Commission (CPUC) to implement an improved performance standard for California power plants. The CEC and CPUC agreed upon a performance standard of no more than 1,100 pounds of carbon dioxide per megawatt-hour, which applied to generation owned by or under long-term contract with California investor-owned utilities.[86]

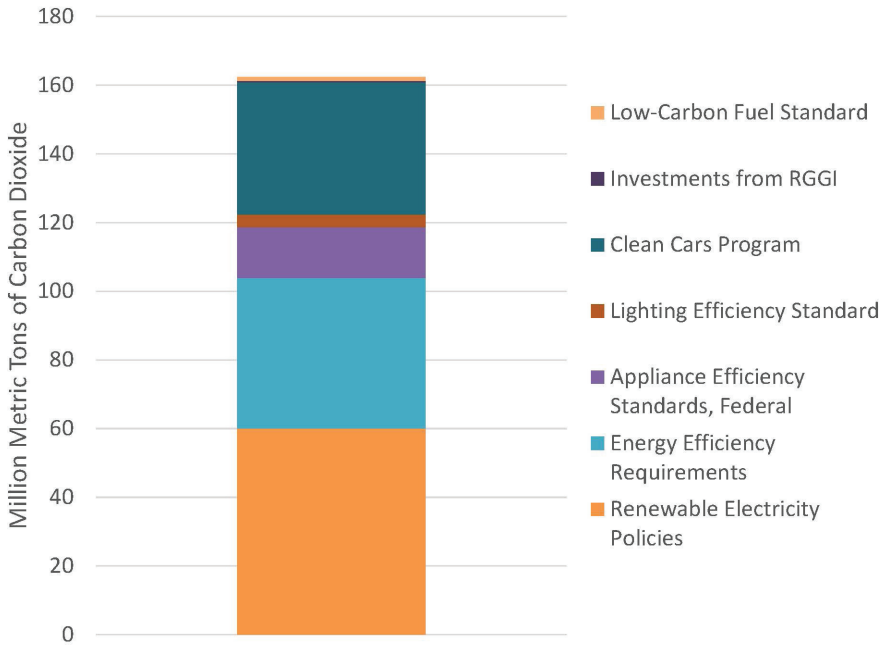
Washington state followed suit in May 2007, when Governor Christine Gregoire signed legislation establishing the same performance standard as California's and applying the standard to electric generation located in Washington, regardless of whether the electricity is consumed in-state. Oregon subsequently updated its pollution standard to match Washington and California, and applied this standard to both energy produced in-state and energy imported from out-of-state, barring utilities from signing long-term purchase agreements with non-Oregon companies whose energy production is too dirty to meet the standard.[87]

The state of Montana has also adopted a generation performance standard, but Montana's law is shaped differently from its counterparts on the coast. Governor Brian Schweitzer approved House Bill 25 in 2007, which barred the state's Public Utilities Commission from allowing new power plants constructed after 2006 that are "primarily fueled by coal" unless the facility "captures and sequesters at least 50 percent of its carbon dioxide."[88]

Total Emission Savings from Clean Energy Policies

The selected policies and programs we examine in this report have had a significant cumulative impact on global warming emissions. Actions to implement these policies during the 5-year period from 2007 through 2012 saved an estimated 162 million metric tons of carbon dioxide in 2012, which is equal to 22 percent of the total decline that has occurred in U.S. carbon dioxide emissions since 2007.[89] This estimate likely understates the contribution of clean energy policies overall as it does not include some policies whose impacts are difficult to quantify (such as building energy codes) as well as other clean energy efforts implemented at the local, state and federal levels.

Figure 9. Estimated Carbon Dioxide Emission Reductions in 2012 from Policies Adopted or Implemented from 2007 to 2012



The policies evaluated in this report will provide greater emission reductions in the years to come. A 2009 analysis of the benefits of these same policies estimates that they will deliver savings of 536 million metric tons of carbon dioxide in 2020.[90] That represents nearly 9 percent of U.S. global warming pollution in 2005.

Through the National Climate Action Plan, America has set a goal of reducing emissions of global warming pollution by 17 percent below 2005 levels by 2020.[91] The clean energy policies examined in this report have gotten America one sixth of the way there so far, and will deliver an even greater share of savings as those policies mature and build momentum over time.[92] With adoption of additional policies to curb emissions, the nation can achieve even greater emission reductions. With redoubled commitment, we can protect our children and future generations from the worst impacts of global warming.

Policy Recommendations: Keep America Moving Forward in the Fight Against Global Warming

America is moving forward in the fight against global warming. State and federal clean energy policies are significantly reducing global warming pollution. These actions will continue to deliver benefits into the future with ongoing implementation. Moreover, emission reductions achieved as a result of clean energy policies will be stable and enduring, unlikely to disappear even as the economy strengthens and natural gas prices shift.

The United States has all of the tools necessary to do its part to provide a stable and healthy climate for future generations, and prevent the worst impacts of global warming. The challenge now is to bring those solutions to a much greater scale.

To make further progress, the United States should implement the National Climate Action Plan and ensure the cleanup of dirty power plants. Internationally, the administration should lead the development of a binding global agreement capable of protecting future generations.

Leaders at all levels of government can contribute to the effort by building on existing momentum to ramp up production of energy from renewable sources, to use energy more efficiently, and to scale back the use of dirty sources of energy with negative impacts on the climate.

Reduce Global Warming Pollution from New and Existing Power Plants

Currently we protect public health from mercury, arsenic, soot and other air pollution from power plants, but there are no federal limits on carbon pollution. That must change. Power plants produce roughly 40 percent of all carbon dioxide emissions from energy use in the United States.[93]

Under the National Climate Action Plan, the Environmental Protection Agency (EPA) has initiated the first-ever federal rules to cut carbon pollution from new and existing power plants. The EPA should finalize strong rules on schedule, and all states should develop effective plans to clean up power plants within their borders.

EPA Should Finalize Rules to Cut Carbon Pollution from New Power Plants

The EPA has drafted rules to reduce global warming pollution from new power plants. The agency's proposal builds on the policies developed by states participating in RGGI and those that have adopted generation performance standards. EPA Administrator Gina McCarthy announced rules in September

2013 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.[94] The EPA should finalize these rules as soon as possible.

EPA Should Develop Strong Rules to Cut Carbon Pollution from Existing Power Plants

The EPA is also developing the first-ever federal rules to cut carbon pollution from existing power plants, under the authority of the Clean Air Act.[95]

The World Resources Institute finds that through swift enactment of a strong policy, the nation could reduce global warming pollution from existing power plants by 38 percent below 2012 levels by 2020.[96] This level of action on pollution from power plants is essential to meeting the National Climate Action Plan goal of cutting global warming pollution 17 percent below 2005 levels by 2020.[97]

The EPA should publish draft rules on schedule in June 2014 and finalize them by June 2015.

States Should Craft Effective Plans to Cut Carbon Pollution from Power Plants

All states will be responsible for developing plans to comply with the forthcoming EPA rules to cut carbon pollution from existing power plants. Every state should begin developing a plan to meet or exceed federal standards, building on the substantial experience states have accumulated with cutting carbon pollution through energy efficiency and renewable sources of energy. States that have already made substantial progress should work with neighboring states to help ensure efficient cleanup of power plants nationwide.

States that fail to develop sufficiently effective plans will cede that authority to the EPA, which will apply a federal plan.

Increase Renewable Energy Production

In conjunction with policies to reduce emissions from power plants, the nation needs policies to increase our use of clean, renewable energy. Expanded renewable electricity standards can promote widespread adoption of renewable energy, while policies targeting solar energy and offshore wind power will help develop technologies that have the potential to meet a large share of our future power needs.

Strengthen Renewable Electricity Goals

The nation should seek to obtain 25 percent of its electricity from renewable sources such as wind, solar and geothermal energy by 2025, a stepping stone on our way to generating all of our electricity from renewable energy.

States with existing renewable electricity standards should strengthen their goals and establish high targets beyond 2025. States without an RES should adopt a policy, as should the federal government.

Adopt Other Policies Supportive of Renewable Energy

Renewable electricity standards will be more effective and the nation's ability to develop renewable energy sources will be greater with the support of additional policies.

Federal tax credits – Two of the most important tools that have helped grow the renewable energy industry in the United States are the federal renewable electricity production tax credit (PTC) and the investment tax credit (ITC). Policies such as the PTC and ITC help investors consider capital-intensive investments in renewable energy projects with long-term

benefits for the nation. The PTC provides an income tax credit of 2.3 cents per kilowatt-hour for utility-scale wind energy producers for 10 years, while the ITC covers up to 30 percent of the capital cost of new renewable energy investments.

The effectiveness of federal renewable energy tax credits, however, has been hamstrung by their "here today, gone tomorrow" inconsistency. The United States should make a long-term commitment to renewable energy with a long-term renewal of the PTC and ITC.

Solar energy policies – Solar power is on a dramatic upswing nationally. America has more than three times as much solar photovoltaic capacity today as it did in 2010, and in the first three months of 2013, solar power accounted for nearly half the new electricity generating capacity in the United States.[98] The price of solar is falling rapidly, and each year tens of thousands of additional Americans begin to reap the benefits of clean energy from the sun, generated right on the rooftops of their homes or places of business.[99]

Strong solar energy policies, particularly at the state and local level, have helped unlock America's solar potential. To continue the nation's solar energy momentum, federal and state policymakers can:

- Set goals within an RES for how much power should come from solar energy.
- Adopt policies such as net metering that help level the financial playing field for solar energy.
- Adopt lead-by-example measures such as sourcing energy for government facilities from solar generation, placing solar panels on the rooftops of large public buildings, and opening appropriate federal land for the placement of environmentally friendly solar installations.

Taking advantage of new opportunities – To ensure continued growth of renewable electricity generation in the decades to come, the United States needs to support new technologies, including offshore wind energy, a smart electricity grid and electricity storage.

Offshore wind: American coastlines offer significant potential for building one of the cleanest, safest, and most stable sources of power: offshore wind. The United States has the technical potential to install up to 4,200 gigawatts of offshore wind capacity. That could produce 17 million gigawatt-hours of electricity annually – more than four times the amount of electricity generated in the United States in 2012.[100]

Development of offshore wind resources is just beginning. In Massachusetts, the 468 MW Cape Wind facility, located on Horseshoe Shoal in Nantucket Sound, is under construction.[101] Maryland passed the Offshore Wind Energy Act in 2013, which aims to construct a 200-MW offshore wind power generation facility to complement the state's existing renewable energy standard.[102] New Jersey has required, as a set-aside from its overall state renewable electricity standard, a portion of its renewable electricity generation to come from offshore wind.[103] As state governments forge ahead in harnessing this clean energy windfall, the federal government should follow their lead and establish enhanced targets for offshore wind generation, and support research and development of offshore wind technologies.

Smart grid and energy storage: The electricity grid of the future will need to be able to accept power from tens of thousands of solar energy installations, wind farms and other distributed generation facilities. The nation should begin investing today in smart grid technology that will accommodate 100 percent renewable electricity and integrate new technologies such as electric cars. State governments and utility regulators must recognize the value that on-site renewable and distributed generation provides to the grid, in addition to environmental and societal benefits, and adopt policies that facilitate their seamless integration into the electric power system.

In addition, because electricity demand does not always coincide with when energy is produced by renewable sources, better energy storage technology and capacity will eventually be needed if the nation is to rely on renewable power for a large share of its electricity. For example, solar electricity systems can be integrated with battery storage to collect electricity during the day and feed it back into the grid at night, or the batteries in electric vehicles could be used to store excess power and release it back into the grid when needed. Investing in research and development for energy storage technologies and building a smart grid that can handle distributed generation are essential if the United States is to achieve high levels of renewable electricity use.

Improve Energy Efficiency

The U.S. has improved energy efficiency throughout the economy, cutting energy waste in homes, businesses and factories by improving the efficiency of appliances, lighting, heating and cooling. The next step is to address all sources of energy use in a building as a package. The U.S., along with state and local governments, should establish goals for all new homes to be net zero-energy by no later than 2030.

Zero-energy buildings are designed to be highly energy efficient and to produce their own energy. By evaluating the building as a single unit, architects and contractors can identify more opportunities for efficiency and for capturing renewable energy potential. A number of net zero-energy buildings have already been constructed in the United States, both in mild-weather states like California and Oregon, and in states with heating or cooling challenges such as Minnesota and Florida.[104]

Current efforts to cut energy use and emissions should also continue. The federal Department of Energy should stick to its schedule for issuing new or updated standards for dozens of appliances, including refrigerators, furnaces, small motors, vending machines, boilers and clothes dryers.[105]

The nation also could tap the potential of new technologies to monitor energy use and identify opportunities for cutting waste. Continuous electronic monitoring of heating and cooling systems can identify spikes in energy use or changes in consumption patterns, and also allow for remote adjustments by building managers or homeowners. Public policy should encourage the spread of these technologies – empowering more Americans to take control over their energy use.

Improve the Efficiency of the Transportation System

New technologies and services are making it easier for Americans to drive less – reducing the number of vehicle-miles traveled and gallons of gasoline purchased while simultaneously expanding the range of transportation options available to consumers. Americans have already been reducing the number of miles they drive, traveling as many miles per capita in 2013 as they did in 1996.[106]

Public transit ridership increased to 10.5 billion rides in 2012, and more than 16 public transit systems reported all-time high ridership numbers that year.[107] By investing in expanded public transportation options and restoring transit service cuts made during the Great Recession, local, state and federal governments can encourage more Americans to leave their cars behind when traveling for work or other purposes.

Transit and real-time planning apps are also making it simpler for consumers to more effectively make use of existing services, like trains and buses. At the same time, the emergence of new technology-enabled transportation tools such as carsharing and bikesharing has encouraged a growing number of Americans to reduce their level of car ownership, a step that

usually results in reductions in driving. The total reduction in driving as a result of carsharing alone has been estimated at 1.1 billion miles as of early 2013 – saving about 359,000 metric tons carbon dioxide.[108]

Policymakers at the state and federal level should embrace the benefits of public transportation and new transportation options by reducing barriers to innovative transportation services, integrating multimodal transportation planning into new transportation policies, and continuing to make transit data openly and transparently available to the public.

Local government officials also affect the efficiency of our transportation system through land-use and zoning decisions. Policies that encourage construction of compact, walkable neighborhoods, and redevelopment of urban areas reduce the need for driving and give residents more transportation options.

Promote Electric Vehicles

Electric vehicles powered by renewable electricity have the potential to slash emissions from transportation. To fulfill policy requirements for zero-emission vehicles (ZEVs) and build on more than a decade's worth of experience with hybrid-electric vehicles, automakers have begun selling battery-electric vehicles. From 2012 to 2013, sales of fully electric cars increased by 147 percent to 11,392.[109] Barriers to growth in the electric car market remain, including access to charging stations in rental housing and availability of non-residential charging infrastructure.

Looking to create more opportunities for expansion in the electric car market, state governments are currently enacting policies designed to smooth the transition to the cleaner and more fuel-efficient cars of the future. Nine states are currently participating in the Zero Emission Vehicle (ZEV) program, which requires automakers to accelerate the market penetration of advanced technology cars. These states are California, Maine, Vermont, Massachusetts, Rhode Island, Connecticut, New York, Maryland and Oregon. Additional states, including Delaware and Washington, should adopt this program.

In October 2013, eight states (all ZEV states but Maine) announced plans to achieve collective sales of 3.3 million ZEVs by 2025.[110] Accompanying the vehicle sales target are programs to grow and standardize their networks of electric charging stations, purchase all-electric vehicles for their state fleets, allow electric vehicles to use high-occupancy vehicle lanes (HOVs) and pay reduced tolls on toll roads and bridges. Additional states should join this effort.

In October 2013, the governors of Washington, Oregon, and California, along with the premier of British Columbia, jointly signed the Pacific Coast Action Plan on Climate and Energy, pledging to work towards having 10 percent of new public vehicle purchases be ZEVs by 2016.[111]

As the electric and hybrid car market continues to expand, the federal government should learn from the example of early-adopting states that clean cars can save consumers money, cut down on oil dependence, and dramatically reduce our global warming pollution. Requirements that cars achieve an average fuel efficiency of 54.5 miles per gallon by 2025 are a positive start. The federal government should continue to encourage the growth of electric and plug-in hybrid car sales by facilitating the development of charging infrastructure, boosting incentives for clean car purchases, and investing in basic energy research to help build the transportation network of the future.

Take Leadership in International Efforts

Ultimately, international action on a significant scale will be necessary to fully avert the catastrophic effects of global warming in the long term. As the Intergovernmental Panel on Climate Change has repeatedly emphasized, global warming is a challenge

that confronts all of us – and a problem that the world's nations must ultimately face together.

As one of the biggest emitters of global warming pollution, the United States will have to play a key role by reducing its emissions dramatically. Though the country has not made an economy-wide national commitment to slashing emissions, global warming pollution has begun to decline, thanks to a variety of state and federal clean energy policies.

The United States should play a leadership role in international discussions on reducing global warming pollution, driving the development of an international climate treaty capable of preventing the worst impacts of global warming. We have begun to reduce our own emissions, we know what additional steps will yield future emission reductions, and we can encourage the world's nations to join us in making a strong commitment to cutting climate pollution.

Methodology

The analysis in this report looks at the impact in 2012 of selected policies adopted or implemented by states and the federal government from 2007 to 2012, and in effect during some or all of those years. It includes key policies that have helped reduce emissions, but is not a complete assessment of all clean energy policies that states and the federal government have adopted in recent years.

Cross-Cutting Issues

Electricity Emission Factors

To estimate carbon dioxide emission reductions from changes in electricity generation and consumption, we assumed that renewable energy added to the grid as a result of state policies or electricity saved through energy efficiency policies would offset carbon dioxide at the average emission rate of power plants in the region in which the state resides. To obtain region-specific emission factors for electricity generation, we relied on U.S. Energy Information Administration *AEO 2014 Early Release, Tables 73-94,* for data on 2012 electricity generation and power plant emissions for each EIA electricity market module (EMM) region.

We assigned each EMM region to one of the interconnection regions identified by the North American Electric Reliability Corporation (NERC), using maps of EMM regions and NERC regions.[112] We estimated an emissions factor for each NERC region, using the generation and emissions data for the constituent EMM regions.

To arrive at an emissions factor for each state, we determined the percentage of electricity sales in each state that come from within each NERC region, using data from U.S. Department of Energy, Energy Information Administration, *Electric Power Sales, Revenue, and Energy Efficiency Form EIA-861*, 29 October 2013. NERC regions could not be identified for utilities responsible for a total of 1.5 percent of electricity sales nationally. The majority of those sales were in Texas. State emission factors were created by multiplying each state's percent of sales per NERC region by each region's emission factor.

For Alaska and Hawaii, which are not included in the NERC regions, we calculated an emissions factor using 2011 data on total electricity generation and total carbon dioxide emissions from electricity generation in each state. Generation data came from U.S. Department of Energy, Energy Information Administration, *Net Generation by State by Type of Producer by Energy Source (EIA-906, EIA-920, and EIA-923)*, December 2013. Emissions data came from U.S. Department of Energy, Energy Information Administration, *U.S. Electric Power Industry Estimated Emissions by State, Back to 1990 (EIA-767 and EIA-906), February 2013.*

The use of a constant emission factor for each state masks hourly variations in the carbon intensity of electricity on the grid, meaning that the estimates in this report do not fully reflect the ways in which energy efficiency and renewable energy policies affect hourly dispatch of different electricity generators in each region of the country.

Tallying Total Emission Savings

To calculate total emission savings in each state, we added up total savings from each policy, with a few exceptions to avoid double-counting.

States that participate in RGGI: RGGI savings potentially overlap with other energy efficiency savings, per Annie Downs, et al., American Council for an Energy-Efficient Economy, *The 2013 State Energy Efficiency Scorecard*, November 2013. Therefore, to avoid overlap but still give states credit for savings from their policies, we included savings either from RGGI or from energy efficiency programs in the estimate of total emission reductions, whichever was greater.

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Renewable Electricity Increases

The calculation of savings from renewable sources of electricity is based on Energy Information Administration, *Electricity Data Browser: Net Generation for Electric Power*, accessed from www.eia.gov/electricity/data/browser/, 25 February 2014. Growth in net generation from wind and solar sources was calculated for each state. Avoided emissions from electricity generation were estimated as described in "Electricity Emission Factors," above.

Broad Energy Efficiency Standards

Energy efficiency savings were calculated using data from Annie Downs, et al., American Council for an Energy-Efficient Economy, *The 2013 State Energy Efficiency Scorecard*, November 2013, and previous versions of ACEEE's energy efficiency scorecard back to 2007. Savings from energy efficiency in 2012 are the sum of the net incremental savings in each year from 2007 to 2011 or 2012 from ratepayer-funded energy efficiency efforts. The total includes 2012 data for states included in Appendix H of *The 2013 State Energy Efficiency Scorecard*, which lists preliminary 2012 energy efficiency savings as provided by some states to ACEEE. For states that did not provide 2012 data, we used 2011 figures. We included natural gas efficiency savings for 2011 only, the first year for which ACEEE began collecting and presenting the data.

Data for some states from earlier years may have been gross rather than net savings, but the error introduced by this is small (less than 10 percent for that state for that year). Avoided emissions from electricity were calculated as described in "Electricity Emission Factors," above. Avoided emissions from natural gas were calculated using U.S. Energy Information Administration, *Carbon Dioxide Emissions Coefficients,* 14 February 2013.

Appliance Efficiency Standards

National savings from federal appliance efficiency standards are based on standards passed into federal law in 2005 and 2007. Estimated savings from the Energy Policy Act of 2005 came from Steven Nadel, American Council for an Energy-Efficient Economy, *The Federal Energy Policy Act of 2005 and its Implications for Energy Efficiency Program Efforts*, September 2005. Estimated savings from the Energy Independence and Security Act of 2007 came from American Council for an Energy-Efficient Economy, *Energy Bill Savings Estimates as Passed by the Senate*, 14 December 2007. For both 2005 and 2007, we included data for appliances only. We then apportioned savings to the states based on estimated annual electricity usage, sourced from the U.S. Department of Energy, Energy Information Administration, *State Energy Data System (SEDS)*, as of 28 June 2013. We calculated the carbon dioxide savings from avoided

electricity consumption as described in the "Electricity Emission Factors" section. Avoided emissions from natural gas were calculated using U.S. Energy Information Administration, *Carbon Dioxide Emissions Coefficients,* 14 February 2013.

The estimated savings are national projections for 2010 at the time the laws were passed. To the extent that implementation has been slower than expected; standards were set higher or lower than anticipated; or economic growth was slower or faster than projected, these projected savings may be higher or lower than actual savings.

Federal Lighting Efficiency Standards

Total national savings from lighting efficiency standards that came into force in July 2012 were estimated based on annualized forecasts of energy savings sourced from the Federal Register, Vol. 74, No. 133, 14 July 2009, and produced by the U.S. Department of Energy. Out of three estimates for climate emissions reduction produced by the Department of Energy – a high, low, and primary (intermediate) estimate – we chose the low estimate, on the theory that in the first year of the program some of the biggest savings might not yet be implemented, and then summed estimated annualized savings for general service fluorescent lamps and incandescent reflector lamps, the two types of lights regulated. Since standards only took effect in July 2012, we halved estimated annualized savings from the "low" estimate of savings. We then apportioned estimated federal lighting standard savings by state based on state population data from the U.S. Census, 2010. (We chose to allocate the savings based on state population instead of state electricity consumption, because the latter is so heavily influenced by air conditioning use.)

Clean Cars

To estimate the impact of improved vehicle fuel economy in 2012, we compared actual motor gasoline consumption in 2012 to a counterfactual scenario of motor gasoline consumption based on 2007 vehicle fuel economy levels. Actual motor gasoline consumption in 2012 was calculated from U.S. Department of Energy, Energy Information Administration, *State Energy Data System (SEDS)*, as of 20 December 2013. State-level transportation-sector motor gasoline consumption was adjusted to include just motor gasoline consumed in light-duty vehicles, using national data from U.S. Department of Energy, Energy Information Administration, *Annual Energy Outlook 2014 Early Release (AEO2014 Early Release)*, 16 December 2013, which shows that 95 percent of transportation-sector motor gasoline use occurs in light-duty vehicles. To calculate global warming pollution from motor gasoline consumption, we removed ethanol consumption from each state's motor gasoline consumption figure. Ethanol consumption figures were obtained from *SEDS*.

To create an alternative scenario for 2012 in which fuel economy levels remained at 2007 levels, we calculated Btu per mile for light-duty vehicles in 2007, using data from U.S. Department of Energy, Energy Information Administration, *Annual Energy Outlook 2010*, December 2009, and multiplied that by miles driven in light-duty vehicles in 2012, from *AEO2014 Early Release*. Total Btu consumed in light-duty vehicles in this alternative scenario was 3.8 percent higher than actually was the case in 2012. We assumed this is the amount of motor gasoline savings produced by improved fuel economy in 2012. This estimate of improved vehicle economy also includes the effects of recent changes in the mix of new vehicle sales toward cars and away from SUVs and light-duty trucks.

Global warming pollution savings were calculated assuming 19.64 pounds of carbon dioxide per gallon of gasoline, per U.S. Department of Energy, Energy Information Administration, *Frequently Asked Ques-*

tions: How Much Carbon Dioxide Is Produced by Burning Gasoline and Diesel Fuel?, 18 April 2013. The inclusion of upstream emissions from the production and refining of oil would increase emissions.

State Global Warming Caps

California has catalogued emission reductions from programs conducted as part of the state's effort to reduce global warming pollution. Savings are presented in California Environmental Protection Agency, *State Agency Greenhouse Gas Reduction Report Card*, January 2013. We summed all energy-related emission savings from 2011, the latest date for which data are available, not including programs with savings less than 100,000 metric tons and therefore not precisely reported. Actual California savings are therefore higher than our estimate.

Connecticut's last Greenhouse Gas Inventory was conducted in 2009, with data through only 2007. In the absence of more recent data, we do not estimate any savings for Connecticut.

As the state of Hawaii only finalized its global warming pollution rules in 2013, we do not estimate any savings to date.

Massachusetts emissions reductions were based upon Massachusetts Executive Office of Energy and Environmental Affairs, *GWSA Strategies for Reducing GHG Emissions by 2020*, accessed at www.mass.gov/eea/air-water-climate-change/climate-change/massachusetts-global-warming-solutions-act/progress-on-2020-plan/, 15 January 2014. We summed reductions for "More Stringent Power Plant Rules" and "All Cost-Effective Energy Efficiency," both with data from 2012, "GHG Emissions Reduction at State Facilities" (data from 2011), and "Transportation" (data from 2010).

Given that Maryland was still finalizing its global warming pollution plan in 2012, we do not estimate any savings directly from the state's global warming emissions cap.

New Jersey released a plan for reducing its global warming pollution in 2009 but has not published updates on savings directly resulting from that plan.

Investments Made Through the Regional Greenhouse Gas Initiative

We estimated emission savings from RGGI based on the benefits of investments made by RGGI states using funds from allowance auctions. Megawatt-hour and Btu savings were reported in Regional Greenhouse Gas Initiative, *Regional Investment of RGGI CO_2 Allowance Proceeds, 2012*, February 2014. We apportioned savings to the states based on each state's share of cumulative investment in energy efficiency, clean and renewable energy, and greenhouse gas abatement and climate change adaptation, excluding spending for direct bill assistance. We converted avoided electricity consumption into carbon dioxide savings as described in "Electricity Emission Factors." To ensure a conservative savings estimate, we assumed that Btu savings came from natural gas rather than a mix of natural gas and heating oil, and calculated carbon dioxide savings using U.S. Energy Information Administration, *Carbon Dioxide Emissions Coefficients,* 14 February 2013.

Appendix: Estimated Impact of Policies on Global Warming Emissions, 2012

Global warming pollution savings in million metric tons of carbon dioxide.

		Energy Efficiency Policies								
State	Renewable Electricity Policies	Energy Efficiency Require-ments	Appliance Efficiency Standards, Federal	Lighting Efficiency Standard	*Energy Efficien-cy Total*	Clean Cars Program	Invest-ments from RGGI	Low Carbon Fuel Standard	Generation Performance Standard (b)	Total Emission Savings (a)
Alaska	0.02	0.00	0.04	0.01	*0.05*	0.08				0.2
Alabama	0.00	0.10	0.23	0.06	*0.39*	0.76				1.1
Arkansas	0.00	0.22	0.16	0.03	*0.41*	0.41				0.8
Arizona	0.63	1.84	0.27	0.08	*2.18*	0.72				3.5
California (c)	2.13	8.38	1.59	0.44	*10.41*	4.22		1.20	Yes	18.0
Colorado	2.06	0.75	0.21	0.06	*1.02*	0.62				3.7
Connecticut	0.00	0.56	0.11	0.04	*0.71*	0.41	0.04			1.1
District of Columbia	0.00	0.07	0.04	0.01	*0.11*	0.03				0.1
Delaware	0.01	0.03	0.05	0.01	*0.09*	0.12	0.02			0.2
Florida	0.09	0.91	0.83	0.22	*1.96*	2.34				4.4
Georgia	0.00	0.16	0.47	0.11	*0.74*	1.34				2.1
Hawaii	0.11	0.52	0.09	0.02	*0.63*	0.12				0.9
Iowa	7.39	1.34	0.18	0.04	*1.56*	0.45				9.4
Idaho	0.72	0.37	0.07	0.02	*0.46*	0.20				1.4
Illinois	3.99	2.03	0.68	0.15	*2.86*	1.31			Yes	8.2
Indiana	1.92	0.48	0.36	0.08	*0.92*	0.84				3.7
Kansas	3.04	0.11	0.19	0.03	*0.33*	0.35				3.7
Kentucky	0.00	0.36	0.22	0.05	*0.63*	0.62				1.2
Louisiana	0.00	0.01	0.24	0.05	*0.30*	0.63				0.9
Massachusetts	0.03	1.04	0.19	0.08	*1.31*	0.80	0.11			2.1
Maryland	0.21	1.11	0.33	0.07	*1.51*	0.79	0.08			2.5
Maine	0.20	0.17	0.04	0.02	*0.22*	0.18	0.02			0.6
Michigan	0.68	2.17	0.55	0.12	*2.84*	1.28				4.8
Minnesota	3.24	2.82	0.32	0.06	*3.20*	0.72				7.2
Missouri	0.72	0.49	0.33	0.07	*0.89*	0.91				2.5

		Energy Efficiency Policies								
State	Renewable Electricity Policies	Energy Efficiency Require-ments	Appliance Efficiency Standards, Federal	Lighting Efficiency Standard	*Energy Efficien-cy Total*	Clean Cars Program	Invest-ments from RGGI	Low Carbon Fuel Standard	Generation Performance Standard (b)	Total Emission Savings (a)
Mississippi	0.00	0.07	0.14	0.03	*0.25*	0.47				0.7
Montana	0.34	0.19	0.04	0.01	*0.25*	0.14			Yes	0.7
North Carolina	0.07	0.89	0.46	0.11	*1.46*	1.20				2.7
North Dakota	3.08	0.03	0.04	0.01	*0.07*	0.12				3.3
Nebraska	0.71	0.21	0.11	0.02	*0.35*	0.24				1.3
New Hampshire	0.05	0.11	0.04	0.02	*0.17*	0.20	0.02			0.3
New Jersey	0.15	1.53	0.49	0.10	*2.12*	1.15				3.4
New Mexico	0.61	0.17	0.10	0.02	*0.30*	0.28				1.2
Nevada	0.23	0.73	0.12	0.03	*0.88*	0.31				1.4
New York	0.57	1.69	0.57	0.23	*2.49*	1.53	0.11			4.6
Ohio	0.60	1.94	0.65	0.14	*2.72*	1.41				4.7
Oklahoma	4.74	0.28	0.25	0.04	*0.57*	0.56				5.9
Oregon	2.20	1.10	0.16	0.05	*1.31*	0.41			Yes	3.9
Pennsylvania	1.02	1.32	0.71	0.15	*2.18*	1.46				4.7
Rhode Island	0.00	0.14	0.03	0.01	*0.18*	0.10	0.01			0.3
South Carolina	0.00	0.44	0.22	0.05	*0.71*	0.76				1.5
South Dakota	1.73	0.07	0.05	0.01	*0.13*	0.13				2.0
Tennessee	0.00	0.54	0.31	0.07	*0.92*	0.90				1.8
Texas	11.44	1.64	1.19	0.30	*3.14*	3.56				18.1
Utah	0.30	0.48	0.12	0.03	*0.63*	0.31				1.2
Virginia	0.00	0.06	0.40	0.09	*0.55*	1.13				1.7
Vermont	0.03	0.18	0.02	0.01	*0.21*	0.09	0.01			0.3
Washington	1.79	1.90	0.29	0.08	*2.27*	0.74			Yes	4.8
Wisconsin	0.92	2.09	0.33	0.07	*2.49*	0.71				4.1
West Virginia	0.68	0.01	0.10	0.02	*0.13*	0.23				1.0
Wyoming	1.55	0.02	0.02	0.01	*0.05*	0.10				1.7
Total	60.02	43.87	14.76	3.64	*62.26*	38.51	0.42	1.20		161.9

(a) Total savings do not add up to the sum of the columns due to overlap between energy efficiency policies and savings from investments in RGGI.

(b) Emission reductions from generation performance standards were not included in this analysis.

(c) Total emission reductions listed for California are based on savings from the state's global warming cap rather than the sum of savings from individual policies listed here.

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