

4

Policies and Measures

At no time in its history has the United States been more engaged—both at home and abroad, at the federal, state, and local levels—in enhancing its efforts to reduce climate change. Since assuming office, President Obama has moved quickly to establish new federal policies and measures designed to reassert American leadership in solving the global climate challenge. President Obama has outlined a comprehensive plan to address global climate change through investments that will save or create many jobs. The plan will:

- Help transform the economy through investments in research, development, demonstration, and deployment of new forms of clean energy and through improvements in energy efficiency.
- Ensure the United States is on a path to reduce its dependence on oil, in part by promoting the next

generation of cars and trucks and the alternative fuels on which they will run.

- Reduce the pollution that causes global warming. By stemming carbon pollution through a market-based cap, the United States will protect the national heritage for generations to come, and address many of the energy challenges the nation faces.

This chapter presents key policies and measures undertaken in these past months to fulfill this vision, including the American Recovery and Reinvestment Act of 2009 (ARRA), a new program to simultaneously promote fuel economy and limit tailpipe emissions of greenhouse gases (GHGs), and other significant actions (Box 4-1). The chapter also outlines significant actions since the most recent *2006 U.S. Climate Action Report* (2006 CAR), as well as ongoing policies and measures at the federal level. In addition, for many



Box 4-1 American Recovery and Reinvestment Act of 2009

On February 17, 2009, President Obama signed the American Recovery and Reinvestment Act of 2009, which provided tax cuts and targeted investments to jump-start the U.S. economy. The bill provides \$787 billion in to multiple sectors of the economy in order to create jobs and stimulate growth. This includes extensive incentives to speed the development and growth of clean energy technologies in the United States. To create jobs today and reduce U.S. dependence on oil, the bill makes investments aimed at doubling renewable energy production and renovating public buildings to make them more energy efficient. Some of the specific investments and incentives targeted at clean energy and energy efficiency that will address climate change include:¹

Modernized Transit—\$17.7 billion for transit and rail to reduce traffic congestion and gas consumption.

Reliable, Efficient Electricity Grid—\$11 billion to modernize the electricity grid, making it more efficient, secure, and reliable, and build new power lines, including lines that transmit clean, renewable energy from sources throughout the nation.

Renewables and Smart Grid Energy Loan Guarantees—\$4 billion to support loan guarantees for up to \$40 billion in loans for renewable energy generation and electric power transmission modernization projects.

GSA Federal Buildings—\$4.5 billion for renovations and repairs to federal buildings, focused on transitioning toward a High-Performance Green Building portfolio.

State and Local Government Energy Efficiency Grants—\$6.3 billion to help state and local governments make investments that make them more energy efficient and reduce carbon emissions.

Energy Efficiency Housing Retrofits—\$250 million for a new program to upgrade U.S. Department of Housing and Urban Development-sponsored low-income housing to increase energy efficiency, including new insulation, windows, and furnaces. Funds will be competitively awarded.

Energy Efficiency and Renewable Energy Research—\$2.5 billion for energy efficiency and renewable energy research, development, demonstration, and deployment activities to foster energy independence, reduce carbon emissions, and cut utility bills. Funds are awarded on a competitive basis to universities, companies, and national laboratories.

Advanced Battery Grants—\$2 billion for the Advanced Battery Grants Program, to support manufacturers of advanced vehicle batteries and battery systems.

Home Weatherization—\$5 billion to help low-income families reduce their energy costs and increase energy efficiency by weatherizing their homes.

Smart Appliances—\$300 million to provide consumers with rebates for buying energy-efficient ENERGY STAR products to replace old appliances, which will lower energy bills.

GSA Federal Fleet—\$300 million to replace older vehicles owned by the federal government with more fuel-efficient vehicles, including alternative-fuel and plug-in hybrid automobiles that will save on fuel costs and reduce carbon emissions.

Electric Transportation—\$400 million for a new grant program to encourage electric vehicle technologies.

Cleaner Fossil Energy—\$3.4 billion for carbon capture and sequestration (CCS) technology demonstration projects. These demonstration projects will provide valuable information needed to advance the deployment of CCS technology, which will be critical to reduce the amount of carbon dioxide emitted into the atmosphere from industrial facilities and fossil fuel power plants.

Training for Green Jobs—\$500 million to prepare workers for careers in energy efficiency and renewable energy fields.

¹ U.S. House of Representatives, Committee on Appropriations. "Summary: American Recovery and Reinvestment Conference Agreement." February 13, 2009. Available at: <http://www.appropriations.house.gov/pdf/PressSummary02-13-09.pdf>.

years, U.S. states and localities have led the way in advancing clean energy climate policies. This chapter does not attempt to cover the broad landscape of U.S. state and local efforts on climate change. Instead, it provides a brief overview and sampling of the many programs that are occurring at the sub-national level.

¹ See http://www.whitehouse.gov/the_press_office/Statement-By-The-President-On-House-Passage-Of-The-American-Clean-Energy-And-Security-Act/.

A cornerstone of the President's platform involves comprehensive new energy and climate legislation, which requires approval by Congress and the executive branch. In February 2009, before a joint session of Congress, President Obama announced his intent to work with Congress to achieve legislation that would reduce GHG emissions through a market-based cap, drive the production of more renewable energy, and invest billions in low-emission technologies, to put the United States on a path to reduce its GHG emissions by more than 80 percent below 2005 levels by 2050.

In June 2009, the U.S. House of Representatives passed the landmark American Clean Energy and Security Act, which includes economy-wide GHG reduction goals of 3 percent below 2005 levels in 2012, 17 percent below 2005 levels in 2020, and 83 percent below 2005 levels in 2050. President Obama praised the passage of the House bill as a "bold and necessary step" in reducing GHGs.¹ Through a cap-and-trade program and other complementary measures, the bill would promote the development and deployment of new clean energy technologies that would fundamentally change the way we produce, deliver, and use energy. The bill would (1) advance energy efficiency and reduce reliance on oil; (2) stimulate innovation in clean coal technology to reduce GHG emissions before they enter the atmosphere; (3) accelerate the use of renewable sources of energy, including biomass, wind, solar, and geothermal; (4) create strong demand for a domestic manufacturing market for these next-generation technologies that will enable American workers to serve in a central role in U.S. clean energy transformation; and (5) play a critical role in the American economic recovery and job growth—from retooling shuttered manufacturing plants to make wind turbines, to using equipment and expertise from oil drilling to develop clean energy from underground geothermal sources, to tapping into American ingenuity to engineer coal-fired power plants that do not contribute to climate change.

This is an exciting and critical time for global climate change in U.S. history. The U.S. Senate is currently considering its own legislation to promote clean energy and reduce GHG emissions. Under the U.S. system, legislation passed by the House and Senate is reconciled, and the resulting bill is passed to the President for signature. As new policies and measures are enacted, existing climate change strategies and investments will continue to be evaluated and adjusted as necessary. Though much remains to be done, this fifth national communication demonstrates new momentum in U.S. efforts to achieve the objective of the United Nations Framework Convention on Climate Change.

FEDERAL POLICIES AND MEASURES

The United States recognizes that a strong set of national policies and measures is critical to achieving the

President’s emissions reduction goal. To reach this goal, a combination of near- and long-term, voluntary and regulatory activities will be needed across the economy, including in the residential, commercial, industrial, transportation, waste, and agricultural sectors. While significant GHG reductions have been made through existing initiatives, the administration recognizes the need to expand upon successful initiatives and introduce new policies and measures. Through the programs outlined sector by sector in this chapter, the federal government will build on its partnerships, invest in the research, development, demonstration, and deployment of emission-reducing technologies, and advance the implementation of critical regulatory policies.

New Initiatives Since the 2006 CAR

In addition to the significant funding for energy efficiency and alternative forms of energy provided through ARRA, the United States has advanced legislation, regulations, and initiatives to reduce GHG emissions since the nation last reported to the United Nations in the 2006 CAR. These efforts constitute a “bottom-up” approach to addressing climate change. They are both distinct from and complementary to the top-down targets described in Chapter 5. These activities are only a sample of U.S. efforts; they do not comprehend all that the United States does to mitigate and adapt to climate change. Most of all, such bottom-up efforts are necessary, tangible evidence of America’s commitment to reducing dangerous GHG emissions. This section and Table 4-1 introduce these initiatives, and the following broader section discusses progress resulting from both recent and ongoing initiatives.

American Recovery and Reinvestment Act

On February 17, 2009, President Obama took an important step toward reaching the administration’s climate change goals with his signing of ARRA. This law provides unprecedented investments in clean energy improvements for the U.S. economy, allocating more than \$90 billion for clean energy programs, such as weatherization assistance for low-income homes, and billions more for science and infrastructure, including the efficient modernization of mass transit systems (EOP/CEA 2010). Key components of the legislation include:

- Appropriating funding for numerous grant programs and tax incentives for clean energy technologies, including solar, wind, biomass, geothermal, marine, hydropower, fuel cells, plug-in electric vehicles, and other technologies that have the potential to reduce U.S. GHG emissions.
- Emphasizing energy-efficient technologies, practices, and policies, including a 30 percent tax credit for residential energy efficiency investments, as well as mandates for improved energy efficiency standards for electric heat pumps, central air condition-

Table 4-1 Recent Initiatives Not Featured in CAR 2006

In addition to the significant funding for energy efficiency and alternative forms of energy provided through the American Recovery and Reinvestment Act of 2009, the United States has advanced legislation, regulations, and initiatives to reduce GHG emissions since the nation last reported to the United Nations in the 2006 *U.S. Climate Action Report*.

Policy/Measure	Agency
Energy: Residential and Commercial	
Energy Efficiency and Conservation Block Grants Net-Zero Energy Commercial Building Initiative	DOE
Energy: Industrial	
Energy-Intensive Industries Program	DOE
Energy: Supply	
Biorefinery Assistance	USDA
Energy Smart Parks	DOI/DOE
Indian Education Renewable Energy Challenge	
University-National Park Energy Partnership Program	
Energy Transmission Infrastructure	
Geothermal Energy Deployment Program	DOI
Solar Energy Deployment Program	
Wind Energy Development Program	
Transportation	
Alternative Transport Systems and Use of Clean Vehicles	DOI
Loan Programs (Advanced Technology Vehicles Manufacturing Incentive)	DOE
Transit Investments for Greenhouse Gas and Energy Reduction (TIGGER)	DOT
Industry (Non-Carbon Dioxide)	
Responsible Appliance Disposal Program	EPA
Forestry	
Enhancing Ecosystems Services on Forest, Grasslands, Parks, and Wildlife Reserves	DOI
Cross-Sectoral	
Carbon Monitoring and Sequestration	DOI
Climate Friendly Parks	
Climate Showcase Communities Grant Program	EPA
National Action Plan for Energy Efficiency	EPA/DOE
Interagency Partnership for Sustainable Communities	DOT/HUD/EPA

DOE = U.S. Department of Energy; DOI = U.S. Department of the Interior; DOT = U.S. Department of Transportation; EPA = U.S. Environmental Protection Agency; HUD = U.S. Department of Housing and Urban Development; USDA = U.S. Department of Agriculture.

ers, water heaters, wood stoves, oil furnaces, and hot-water boilers.

- Increasing the investments allocated to new clean renewable energy bonds and qualified energy conservation bonds.
- Investing in critical energy infrastructure by providing loan guarantees for new or upgraded electric power transmission projects, and by providing funding for the Smart Grid and new Smart Grid technologies.
- Asserting an energy efficiency leadership role for the federal government, investing in the “green” conversion of federal facilities, and purchasing vehicles for government use with higher fuel economy, including hybrid and electric vehicles.

*Executive Order 13514: Federal Leadership in Environmental, Energy, and Economic Performance*²

On October 5, 2009, President Obama signed an Executive Order³ that sets sustainability goals for federal agencies and focuses on improving their environmental, energy, and economic performance. The Executive Order requires federal agencies to set a 2020 GHG emission reduction target within 90 days, increase energy efficiency, reduce fleet petroleum consumption, conserve water, reduce waste, support sustainable communities, and leverage federal purchasing power to promote environmentally responsible products and technologies.

The new Executive Order requires agencies to measure, manage, and reduce GHG emissions toward agency-defined targets. It describes a process by which agency goals will be set and reported to the President by the Chair of the Council on Environmental Quality (CEQ). The Executive Order also requires agencies to meet a number of energy, water, and waste reduction targets, including:

- 30 percent reduction in vehicle fleet petroleum use by 2020, relative to 2005;
- 26 percent improvement in water efficiency by 2020;
- 50 percent recycling and waste diversion by 2015;
- 95 percent of all applicable contracts in compliance with sustainability requirements;
- implementation of the 2030 net-zero-energy building requirement;
- implementation of the stormwater provisions of the Energy Independence and Security Act of 2007 (EISA), section 438; and
- development of guidance for sustainable federal building locations in alignment with the Livability Principles put forward by the U.S. Department of Housing and Urban Development (HUD), the U.S. Department of Transportation (DOT), and the U.S. Environmental Protection Agency (EPA).

Implementation of the Executive Order will focus on integrating achievement of sustainability goals with agency mission and strategic planning to optimize performance and minimize implementation costs. Each agency will develop and carry out an integrated Strategic Sustainability Performance Plan that prioritizes the agency's actions toward the goals of the Executive Order based on life-cycle return on investments. Implementation will be managed through the previously established Office of the Federal Environmental Executive, working in close partnership with the Office of Management and Budget, CEQ, and the federal agencies.

*Energy Independence and Security Act of 2007*⁴

In December 2007, EISA was signed into law. This major energy policy bill enacted numerous key provisions designed to increase energy efficiency and the availability of renewable energy, including:

- *Corporate Average Fuel Economy (CAFE)*—The law set a minimum target of 35 miles per gallon for the combined fleet of cars and light trucks by model year (MY) 2020. In March 2009, DOT issued a final rule increasing fuel economy standards for MY 2011 passenger cars and light trucks. In May 2010, EPA and DOT published a final regulation (FR 2010). This rule is expected to save some 960 million metric tons of carbon dioxide (MMTCO₂) over the life of the regulated vehicles (U.S. EPA/OTAQ 2010).
- *Renewable Fuels Standard (RFS)*⁵—The law established a modified standard that taps the potential of renewable fuels to reduce life-cycle GHG emissions and provide economic growth. The RFS starts at 9 billion gallons in 2008 and increases to 36 billion gallons by 2022, including 21 billion gallons from cellulosic ethanol and other advanced biofuels.
- *Energy Efficiency Equipment Standards*—EISA contains a variety of new standards for reducing energy use in lighting and for residential and commercial appliance equipment, including incandescent and fluorescent lamps, residential refrigerators, freezers, electric motors, and residential boilers.

EISA also established a national goal to achieve zero-net-energy use for new commercial buildings built after 2025, and a goal to retrofit all pre-2025 commercial buildings to zero-net-energy use by 2050. For federal buildings, the law requires total energy use to be reduced by 30 percent by 2015 compared to 2005.

EISA authorized the Energy Efficiency and Conservation Block Grant Program to develop and implement projects that help reduce energy use and emissions at the local and regional levels. Over \$2.7 billion in grants are available through the program, which is funded by ARRA. EISA also established loans, grants, and debentures to help small businesses develop, invest in, and purchase energy-efficient buildings, fixtures, equipment, and technology.

EISA directs U.S. government agencies to support accelerated research, development, and demonstration (RD&D) and commercial application of clean technologies, such as solar, geothermal, marine and hydrokinetic, and energy storage. It also calls for expanded research and development (R&D) for carbon capture and sequestration, including large-scale demonstration projects, and assessment of ecosystem capacities to sequester carbon. It establishes a federal policy to modernize the electric utility transmission and distribution system, including investments in smart grid technologies.

² See http://www.whitehouse.gov/the_press_office/President-Obama-signs-an-Executive-Order-Focused-on-Federal-Leadership-in-Environmental-Energy-and-Economic-Performance/.

³ See http://www.whitehouse.gov/assets/documents/2009fedleader_eo_rel.pdf.

⁴ See http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=110_cong_bills&docid=f:h6ent.txt.pdf.

⁵ See <http://www.epa.gov/otaq/renewablefuels/index.htm>.

Energy Improvement and Extension Act of 2008

Signed into law in October 2008, the Energy Improvement and Extension Act of 2008 offers an array of incentives for U.S. energy production and conservation, including provisions for renewable energy production, clean coal and carbon sequestration, and efficient transportation and end-use standards and incentives (Box 4-2).

Measures to encourage investment in capital-intensive projects with otherwise high financial risk are emphasized, such as incentives for wind, biomass, solar, geothermal, landfill gas, trash combustion, combined heat and power systems, marine and hydropower facilities, fuel cells, microturbines, and advanced coal-based generation technology projects. The legislation provides a new tax credit for investment in qualified energy conservation bonds to reduce energy consumption in public buildings, implement green community programs, and promote mass commuting facilities. Qualifying commercial and residential improvements and provisions for energy-efficient household appliances also are included.

The act also accelerates the deployment of the next generation of vehicles by supporting renewable and alternative fuels and alternative-fuel vehicles. Other low-carbon transportation measures include incentives for bicycle commuting and idling-reduction devices in heavy trucks.

National Policy to Establish Vehicle GHG Emissions and CAFE Standards^{7, 8}

EPA and DOT's National Highway Traffic Safety Administration (NHTSA) signed a joint proposal on September 15, 2009, to establish a national program consisting of new standards for light-duty vehicles that will reduce GHG emissions and improve fuel economy. In May 2010, EPA and DOT published a final regulation (FR 2010). This joint rulemaking implements the National Autos Policy announced by President Obama on May 19, 2009, responding to the country's critical need to address global climate change and reduce oil consumption. For the first time, EPA promulgated federal emission standards for GHGs, using its authority under the Clean Air Act, and NHTSA proposed CAFE standards under the Energy Policy and Conservation Act. These standards apply to passenger cars, light-duty trucks, and medium-duty passenger vehicles, covering MY 2012–2016, and represent a harmonized and consistent national program. Under the program, automobile manufacturers could build a single light-duty national fleet that satisfies all requirements under both standards, while ensuring that consumers still have a full range of vehicle choices.

The new standards, covering MY 2012–2016, require an average fuel economy of 35.5 miles per gallon and an average 250 grams per mile of carbon dioxide

Box 4-2 Energy Improvement and Extension Act of 2008⁶

The Emergency Economic Stabilization Act of 2008 (Public Law 110-343) [4], which was signed into law on October 3, 2008, incorporates the Energy Improvement and Extension Act of 2008 in Division B as follows:

- Extension of the residential and business tax credits for renewable energy as well as for the purchase and production of certain energy-efficient appliances, many of which were originally enacted in the Energy Policy Act of 2005.
- Removal of the cap on the tax credit for purchases of residential solar photovoltaic installations and an increase in the tax credit for residential ground-source heat pumps.
- Addition of a business investment tax credit for combined heat and power, small wind systems, and commercial ground-source heat pumps.
- Provision of a tax credit for the purchase of new, qualified, plug-in electric drive motor vehicles.
- Extension of the income and excise tax credits for biodiesel and renewable diesel to the end of 2009, and an increase in the amount of the tax credit for biodiesel and renewable diesel produced from recycled feedstock.
- Provision of tax credits for the production of liquid petroleum gas, compressed natural gas, and aviation fuels from biomass.
- Provision of an additional tax credit for the elimination of CO₂ that would otherwise be emitted into the atmosphere in enhanced oil recovery and non-enhanced oil recovery operations.
- Extension and modification of key renewable energy tax provisions that were scheduled to expire at the end of 2008, including production tax credits (PTCs) for wind, geothermal, landfill gas, and certain biomass and hydroelectric facilities.
- Expansion of the PTC-eligible technologies to include plants that use energy from offshore, tidal, or river currents (in-stream turbines), ocean waves, or ocean thermal gradients.

(CO₂) in 2016. In turn, they are projected to save 1.8 billion barrels of oil over the life of the program, with a fuel economy gain averaging more than 5 percent per year, and a cumulative reduction of approximately 960 teragrams of carbon dioxide equivalents (Tg CO₂ Eq.) in GHG emissions over the lifetime of the vehicles sold in MY 2012–2016. This substantially accelerates increases in average fuel economy mandated under the CAFE law passed by Congress in 2007.

Mandatory Greenhouse Gas Reporting Rule⁹

In 2009, EPA issued the Mandatory Reporting of Greenhouse Gas Emissions Final Rule. The rule requires reporting of GHG emissions from large U.S. sources, and is intended to collect accurate and timely emissions data to inform future policy decisions. Under the rule, suppliers of fossil fuels or industrial GHGs, manufacturers of vehicles and engines, and facilities that emit 25,000 metric tons or more per year of GHGs are required to submit annual reports to EPA. The gases covered by the proposed rule are CO₂, methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF₆), and other fluorinated gases, including nitrogen trifluoride (NF₃) and hydrofluorinated ethers (HFEs).

This comprehensive national reporting system's accurate and timely GHG emissions data will serve as a cornerstone of the domestic U.S. effort to combat climate change. The reporting program covers about 85 percent of total U.S. emissions from roughly 10,000

⁶ See http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=110_cong_public_laws&docid=f:publ343.110.pdf.

⁷ See <http://www.epa.gov/otaq/climate/regulations.htm>.

⁸ See <http://www.nhtsa.dot.gov/portal/fueleconomy.jsp>.

⁹ See www.epa.gov/climatechange/emissions/ghgrulemaking.html.

facilities. The reporting threshold of 25,000 metric tons per year is roughly equivalent to the annual GHG emissions from just over 4,500 passenger vehicles. Annual reporting will begin in 2011 for calendar year 2010 emissions. Once the system is in place, EPA will make the GHG emissions data freely available to the public.

*Proposed Regulation Facilitating Geologic Sequestration of CO₂*¹⁰

EPA proposed new federal requirements under the Safe Drinking Water Act for the underground injection of CO₂ for the purpose of long-term underground storage, or geologic sequestration. The proposed rule would establish a new class of injection well—Class VI—and technical criteria for geologic site characterization, area of review and corrective action, well construction and operation, mechanical integrity testing and monitoring, well plugging, post-injection site care, and site closure for protecting underground sources of drinking water. Elements of the proposal are based on the existing regulatory framework of EPA's Underground Injection Control Program, while modifications address the unique nature of CO₂ injection for geologic sequestration. EPA is currently evaluating public comments on the proposal, and expects to issue final regulations by 2011.

Department of the Interior Secretarial Order 3289

Under President Obama, the U.S. Department of the Interior (DOI) has taken a key leadership role in the federal government's plans to adapt to the impacts of climate change. To these efforts, DOI brings considerable expertise in climate change and adaptation science, management of U.S. natural landscapes and resources, fish and wildlife, ecosystem services, and biological carbon sequestration.

DOI initiatives will help to address climate change, adapt to a warming planet, and create the new jobs of a clean energy economy. In response to the need for fully integrated information to achieve these objectives, DOI issued Secretarial Order 3285 on March 11, 2009. The order made the production and transmission of renewable energy on public lands a priority and created a new DOI Energy and Climate Change Task Force co-chaired by the Deputy Secretary and Counselor to the Secretary. Building upon this effort, DOI issued Secretarial Order 3289 on September 14, 2009, establishing a Department-wide approach for applying scientific tools to increase understanding of climate change and to coordinate an effective response to its impacts on tribes and on the land, water, ocean, fish and wildlife, and cultural heritage resources that DOI manages.

To fulfill President Obama's vision for a clean energy economy, DOI manages America's public lands and oceans, not just for balanced oil, natural gas, and coal

development, but also to promote environmentally responsible renewable energy development. Sun, wind, biomass, and geothermal energy from U.S. public lands is creating new jobs and will soon power millions of American homes.

Progress and Projections for Reducing U.S. GHG Emissions

The U.S. government is continuing to make important progress toward reducing GHG emissions through energy-related policies and measures that promote increased investment in end-use efficiency, clean energy development, and reductions in GHG emissions in agriculture and through efforts focused on the most potent GHGs. The policies and measures in this chapter highlight the successful U.S. government initiatives focused on reducing GHG emissions. While many of the policies and measures include projections for reducing GHGs, several do not for a variety of reasons, such as double benefit counting and stage of implementation. As a result, the projections presented in this chapter should not be compared to the information presented in Chapter 5. Table 4-3 at the end of this chapter summarizes the current representative U.S. programs and their estimated GHG mitigation impacts through 2020.

In addition, any mitigation levels or projections in this chapter are estimates generated using a range of methods and assumptions. Amounts are subject to change in the future and may have changed relative to amounts presented in past reports due to improvements in calculation methodologies. As noted in Table 4-3, estimates of mitigation impacts for individual policies or measures should not be aggregated to the sectoral level and may not be directly comparable, due to differences in calculation methodologies and possible synergies and interactions among policies and measures that may result in double counting.

Energy: Residential and Commercial Sectors¹¹

The residential and commercial sectors represent approximately 35 percent of U.S. GHG emissions, making them an integral focus of U.S. climate change policies and measures. The use of electricity for such services as lighting, heating, cooling, and running electronic equipment and appliances accounts for the majority of CO₂ emissions in these sectors. Much progress has been made in achieving GHG emission reductions in these sectors, but significant additional potential can be realized through both regulatory and voluntary programs that set standards, provide information, develop measurement tools, and build partnerships. With the use of commercially available energy-efficient products, technologies, and best practices, many commercial buildings and homes could save significantly on energy bills and substantially reduce GHG emissions. These savings are hindered due to a range of pervasive and persistent market barriers.

¹⁰ See http://www.epa.gov/OGWDW/uic/wells_sequestration.html.

¹¹ See <http://www.cere.energy.gov/buildings/>.

Following are descriptions of key policies and measures aimed at addressing these barriers, saving energy, and avoiding GHG emissions in the residential and commercial sectors.

Appliances and Commercial Equipment Standards Program, Appliance Energy Efficiency Standards,¹² Lighting Energy Efficiency Standards

The U.S. Department of Energy's (DOE's) Appliances and Commercial Equipment Standards Program develops test procedures and minimum efficiency standards for residential appliances and commercial equipment. The rules and regulations that are developed apply to products manufactured for sale in, as well as those imported into, the United States. By law, DOE is required to set efficiency standards at levels that achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified. Standards benefit consumers by requiring that appliance manufacturers reduce the energy and water use of their products—and thus the costs to operate them. They are a cost-effective means of saving energy, reducing consumer utility bills, and lowering CO₂ emissions.

Less than three weeks into his term, on February 5, 2009, President Obama issued a memorandum requiring DOE to set more stringent efficiency standards for appliances, consistent with EISA and the Energy Policy Act of 2005 (EPAAct). EPAAct requires DOE to issue semi-annual reports describing its rulemaking schedule and plan for implementing the schedule. DOE published the first report on January 31, 2006. Efficiency and environmental advocates, states, utilities, manufacturers, retailers, and consumers are encouraged to participate in all stages of the rulemaking process. DOE is currently developing standards and test procedures for the following products:

- **Commercial Equipment**—clothes washers, distribution transformers, electric motors, furnaces and boilers, high-intensity discharge lamps, metal halide lamp fixtures, small electric motors, and walk-in coolers and freezers.
- **Residential Products**—battery chargers, external power supplies, central air conditioners and heat pumps, clothes washers and dryers, direct heating equipment, furnaces and boilers, fluorescent lamp ballasts, high-intensity discharge lamps, pool heaters, microwave ovens, refrigerators and freezers, room air conditioners, and water heaters.

In addition, the program shares responsibility with the Federal Trade Commission for labeling commercial equipment.

Building Energy Codes Program¹³

DOE's Building Energy Codes Program is an advocate for and information resource on national model en-

ergy codes, working with other federal government agencies, state and local jurisdictions, national code organizations, and industry to promote stronger model building energy codes and help states adopt, implement, and enforce those codes. The program is involved in three major areas to help improve the energy efficiency of residential and commercial buildings: propose and advocate improvements to national model energy codes; lead DOE's development and promulgation of improved federal energy codes for manufactured housing (mobile homes); and provide financial and technical assistance to help states adopt, implement, and enforce building energy codes. The technical assistance includes development and distribution of easy-to-use compliance tools and materials, and collaboration with stakeholders to address industry needs and provide information on compliance products, Web-based training, and energy code-related news.

ENERGY STAR Labeled Products

EPA and DOE have continued to expand the energy-efficient products available for homes and businesses through the ENERGY STAR program. The label is now available on more than 60 product categories. In 2008, the level of public awareness of ENERGY STAR increased to more than 75 percent. In addition to maintaining the integrity of the brand, DOE and EPA continue to identify new product categories for ENERGY STAR as well as revise existing product specifications to more stringent levels. Between 2000 and 2008, more than 2.5 billion ENERGY STAR-qualified products were sold. EPA estimates that consumption of these products helped to reduce emissions by about 64.5 Tg CO₂ Eq. in 2007 and could help to reduce emissions by 141.2 Tg. CO₂ Eq. by 2020.

ENERGY STAR for the Commercial Market

Commercial buildings use nearly 20 percent of the total U.S. energy consumed and contribute nearly the same proportion of GHGs to the atmosphere. Addressing these emissions through energy efficiency is critical to reducing GHG emissions.

EPA has continued to expand the ENERGY STAR¹⁴ program in the commercial market, offering thousands of businesses and other organizations a strategy for superior energy management and standardized measurement tools. Since 2006, EPA has expanded and improved its national performance rating system, Portfolio Manager. Introduced in 1999, Portfolio Manager evaluates building energy efficiency and helps identify cost-effective opportunities for improvements for a wide range of building types, including hospitals, schools, grocery stores, office buildings, warehouses, retail spaces, residence halls, and hotels. By 2008, about 16 percent of U.S. floor space had been rated using this building rating system. Utilities can down-

¹² See http://www1.eere.energy.gov/buildings/appliance_standards/index.html.

¹³ See <http://www.energycodes.gov/>.

¹⁴ See www.energystar.gov.

load customers' data directly into Portfolio Manager, and a number of states and municipalities are requiring the disclosure of this information as part of the key building transactions.

In addition, more than 6,000 buildings have earned the ENERGY STAR label for top performance, and are using 35–40 percent less energy than average buildings. Further, through ENERGY STAR Leaders, EPA is recognizing organizations that reduce the energy use in their buildings by as much as 30 percent or by achieving top-performing portfolios in Portfolio Manager. EPA estimates that in 2007, ENERGY STAR in the commercial sector helped avoid 66 Tg CO₂ Eq., and that continued efforts could result in reductions of about 93 Tg CO₂ Eq. by 2020.

ENERGY STAR for the Residential Market

The ENERGY STAR programs in the residential sector—in both new and existing housing markets—have continued to expand since the 2006 CAR. Despite the recent downturn in the new housing market, ENERGY STAR for New Homes has gained momentum, with nearly 17 percent of all new homes being built to ENERGY STAR specifications in 2008. The program is working with more than 6,000 builders and, in November 2009, passed the 1 million homes threshold across the country, even as EPA proceeds to increase the stringency of program requirements.¹⁵

EPA has also worked with partners across the country to expand ENERGY STAR into the existing homes market with “Home Performance with ENERGY STAR,” a whole-house retrofit program. As of 2008, more than 50,000 homeowners relied on trained and certified contractors to conduct whole-house energy audits and implement improvements. To help homeowners assess the current efficiency of their homes, EPA released interactive Web-based tools. In addition, EPA launched the ENERGY STAR HVAC Quality Installation Program to increase the number of properly installed heating, ventilation, and air conditioning systems, helping homeowners save 25 percent or more on energy.

EPA is also making ENERGY STAR tools and resources available to improve the energy efficiency of housing for lower-income families by providing housing finance agencies with recommendations and cost/benefit analysis for considerations as criteria in competitively allocating low-income housing credits. Finally, through the ENERGY STAR Mortgage program, EPA is helping to finance new energy-efficient homes, as well as energy efficiency improvements in existing homes. EPA estimates these programs helped to reduce emissions by nearly 2 Tg CO₂ Eq. in 2007 and could help to reduce emissions by 44 Tg CO₂ Eq. in 2020.

Net-Zero Energy Commercial Building Initiative¹⁶

DOE's Net-Zero Energy Commercial Building Initiative (CBI, formerly known as Commercial Building Integration) aims to achieve marketable net-zero-energy commercial buildings by 2025. Net-zero-energy buildings generate as much energy as they consume through efficiency technologies and on-site power generation. CBI encompasses all activities that support this goal, including industry partnerships, research, and tool development. The initiative provides key design and evaluation steps for developing energy-efficient and net-zero-energy buildings, including energy simulation software for evaluating building performance. DOE estimates that this initiative could generate 15.5 Tg CO₂ Eq. of emission reductions in 2020.

Under the authorization of EISA in 2007, CBI has advanced net-zero-energy commercial buildings by launching three Commercial Building Energy Alliances: the Retailer Energy Alliance, the Commercial Real Estate Energy Alliance, and the Hospital Energy Alliance. These alliances link commercial building owners and operators, by sector, who want to reduce the energy consumption, GHG emissions, and operating expenses of their buildings with the advanced technologies, analytical tools, and capabilities emerging from DOE and the national laboratories. CBI has also established the National Accounts program, which partners companies from the private sector and representatives from the national laboratories in order to construct and operate a new building and retrofit an existing building to achieve energy savings of 50 percent and 30 percent, respectively, over baselines. As of August 2009, 23 companies were signed up for the National Accounts program.

Building America¹⁷

DOE's Building America program helps design, build, and evaluate energy-efficient homes that use 30–40 percent less energy than comparable traditional homes with little or no increase in construction costs, and helps industry to adopt these practices for new home construction. The program optimizes building energy performance and savings through the integration of new technologies with innovative residential building practices. Ongoing research also focuses on integrating on-site power systems, including renewable energy technologies.

Hundreds of industry partners have followed the Building America approach in constructing more than 41,000 homes in 41 states (U.S. DOE/EERE 2010). The energy technologies and solutions being advanced by the program will contribute to a 70 percent reduction in energy use of new prototype residential buildings that, when combined with on-site energy technologies, will result in “zero-energy homes” by 2020, and an additional 20 percent reduction in energy use of exist-

¹⁵ See http://www.energystar.gov/index.cfm?fuseaction=mil_homes.showSplash.

¹⁶ See http://www1.eere.energy.gov/buildings/commercial_initiative/goals.html.

¹⁷ See http://www1.eere.energy.gov/buildings/building_america/.

ing homes. DOE estimates these efforts could help to reduce GHG emissions by 19.8 Tg CO₂ Eq. in 2020.

Energy Efficiency and Conservation Block Grants¹⁸

DOE's Energy Efficiency and Conservation Block Grants (EECBG) program represents a presidential priority to invest in the cheapest, cleanest, and most reliable energy technologies that can be deployed immediately. Through formula and competitive grants to U.S. cities, counties, states, territories, and Native American nations, the program empowers local communities to make strategic investments to meet the nation's long-term goals for energy independence and leadership on climate change. Over \$2.7 billion in formula grants are now available to U.S. states, territories, local governments, and Native American nations under this program, funded for the first time under ARRA. Authorized in EISA Title V, Subtitle E and signed into Public Law (PL 110-140) on December 19, 2007, the EECBG program provides funds to units of local and state governments, Native American nations, and territories to develop and implement projects to improve energy efficiency and reduce energy use and fossil fuel emissions.

Weatherization Assistance Program¹⁹

DOE's Weatherization Assistance Program (WAP) increases residential energy efficiency and reduces energy costs for low-income families. The program provides technical and financial assistance in support of state and local weatherization agencies throughout the United States. These providers manage one of the largest residential energy retrofit programs in the country.

Since the WAP's inception in 1976, over 6.2 million homes have been weatherized with DOE funds, with an estimated 100,000 homes weatherized in 2009. An average of 30.5 million British thermal units (Btus) of energy per household is saved as a result of weatherization, approximately a 16 percent reduction in primary heating fuel use. At 2009 prices, low-income families will save an average of \$350 in reduced first-year energy costs. In addition, weatherization projects create both direct and indirect job opportunities. ARRA dedicated \$5 billion in additional funding to support the administration's goal of weatherizing 1 million homes each year. DOE estimates that 8.9 Tg CO₂ Eq. of GHGs will be reduced in 2020.

Energy: Industrial Sector

The industrial sector contributes approximately 29 percent of U.S. GHG emissions, largely from fossil fuel combustion on site or at the power generation source.²⁰ Many U.S. industries are energy-intensive, with energy use contributing to a significant portion of operating costs. It is estimated that energy efficiency alone can reduce industry emissions by nearly 10 percent (Creys et al. 2007). The policies and measures highlighted in this section are focused on opportuni-

ties that improve energy efficiency and reduce GHG emissions by helping the industrial sector adopt cost-effective, efficient technologies that improve productivity, while reducing energy costs, energy consumption, and waste.

ENERGY STAR for Industry

EPA's ENERGY STAR for Industry program has continued to grow since the 2006 CAR. EPA's ENERGY STAR Industrial Focuses, which directly address barriers to energy efficiency by providing industry-specific energy management tools and resources, have grown to include 16 industrial sectors with the launch of the Steelmaking Focus in 2008. In 2006 EPA began recognizing energy-efficient industrial plants with the ENERGY STAR label, and by the end of 2008 45 plants had earned this label. EPA has further developed its existing relationships with industrial partners. EPA estimates that the industrial sector, with the help of the ENERGY STAR program, prevented about 23 Tg CO₂ Eq. in 2007, and could avoid 36.6 Tg CO₂ Eq. in 2020.

Save Energy Now²¹

DOE's Industrial Technologies Program (ITP) works with industry to identify plant-wide opportunities for energy savings and process efficiency. By implementing new technologies and system improvements, many companies are realizing the benefits of applying DOE's software tools and resources. In fiscal year (FY) 2006, ITP introduced Save Energy Now to address high U.S. natural gas prices. The goal of this initiative is to achieve a 25 percent reduction in U.S. industrial energy intensity over 10 years.

Since 2006, Save Energy Now has completed 2,324 energy assessments in small, medium, and large U.S. industrial plants, with resulting annual energy cost savings of \$218 million and related CO₂ reductions of 2.3 Tg CO₂ Eq.²² The assessments have ranged from plant-wide to system-specific to process-specific. On average, energy assessments identify \$1.5 million in energy cost savings per plant, or 8 percent of total plant energy costs.²³ Save Energy Now partnership development and outreach further extends the program's impact by increasing technology deployment and efficiency implementation and leveraging financial and technical resources. DOE estimates this program will reduce GHG emissions by 28.9 Tg CO₂ Eq. by 2020.

Industrial Assessment Centers²⁴

DOE funds 26 Industrial Assessment Centers (IACs) housed at universities across the nation where DOE Energy Experts and IAC faculty and students conduct no-cost energy assessments for small- and medium-sized manufacturers, identifying an average of 1,300 metric tons of potential CO₂ savings per assessment per year.²⁵ The IACs also serve as a training ground for engineers who conduct energy audits or industrial

¹⁸ See <http://www.eecbg.energy.gov/>.

¹⁹ See <http://apps1.eere.energy.gov/weatherization/>.

²⁰ See <http://www.eia.doe.gov/oiaf/archive/aco08/index.html>.

²¹ See <http://www.eere.energy.gov/industry/saveenergynow>.

²² See <http://apps1.eere.energy.gov/industry/saveenergynow/partners/results.cfm>.

²³ As of September 1, 2009. The 8 percent is a conservative estimate based on the *Results from the U.S. DOE 2007 Save Energy Now Assessment Initiative* in 2006 and 2007, which is 10 percent (ORNL 2009). See <http://apps1.eere.energy.gov/industry/saveenergynow/partners/results.cfm>.

²⁴ See <http://www1.eere.energy.gov/industry/bestpractices/iacs.html>.

²⁵ Prymak, Bill. "Energy Assessments: What Are the Benefits to Small and Medium Facilities?" February 19, 2009. Available at: http://www1.eere.energy.gov/industry/pdfs/webcast_2009-0219_small_medium_assessment_benefits.pdf

assessments, and provide recommendations to manufacturers to help them identify opportunities to improve productivity, reduce waste, and save energy.

Recommendations from the IACs have averaged \$55,000 in potential annual savings for each manufacturer.²⁶ The savings identified for IACs between 2006 and 2008 were 28.8 trillion Btus per year (TBtus/yr) and \$277.2 million per year. The continuing efforts of this program may help to reduce an estimated 5.1 Tg CO₂ Eq. in 2020 (U.S. DOE/EERE 2010).

Industry-Specific and Cross-Cutting RDD&D²⁷

DOE funds both industry-specific and cross-cutting research, development, demonstration, and deployment (RDD&D) of emerging industrial energy efficiency technologies and best practices. Industry-specific RDD&D focuses on energy-intensive industries, including aluminum, chemicals, forest products, glass, metal casting, mining, petroleum refining, and steel. Cross-cutting RDD&D focuses on key technology areas common to most energy-intensive industries, such as combustion, distributed energy, energy-intensive processes, fuel and feedstock flexibility, Industrial Materials for the Future, nanomanufacturing, and sensors and automation. From the program's inception in 1975 through 2006, and over the useful life of the newly developed technologies, industry-specific and cross-cutting technologies have saved 5,650 TBtus of energy and about 375 Tg CO₂ Eq.²⁸ The program has supported more than 600 RDD&D projects, producing 220 commercialized technologies, with more than 141 technologies expected to emerge within the next one to two years.²⁹

Energy: Supply

Electricity generation from fossil fuels is a major contributor to U.S. CO₂ emissions. Federal policies and measures aimed at the American energy supply promote CO₂ reductions through a variety of means, including energy efficiency for power generation and transmission, cleaner fuels, and the use of nuclear power and renewable energy resources. Solar, wind, and geothermal energy, and hydroelectric and biomass are some of the renewable energy resources consumed and generated by the United States. The nation's programs include the provision of tax credits and R&D, which help increase domestic investments in renewable energy and continue to accelerate the competitiveness of these emerging technologies.

Solar Energy Development Program

While no commercial-scale solar energy facilities currently exist on public lands managed by DOI's Bureau of Land Management (BLM), federal tax incentives, loan guarantees, grants, and state renewable energy portfolio standards are driving an interest in utility-scale solar energy development projects on public lands. BLM has identified approximately 12 million

hectares (ha) (29.5 million acres [ac]) of public lands in six southwestern states with solar energy potential, and is evaluating a number of alternatives to determine best management practices for environmentally responsible utility-scale solar energy development on public lands.³⁰

Wind Energy Development Program

Wind energy is the fastest-growing renewable energy resource in the nation, with an annual growth rate of over 30 percent.³¹ As of November 2009, the total installed capacity of U.S. wind energy was over 31,000 megawatts (MW).³² As of July 2009, BLM had approved 28 wind energy projects on BLM-managed public lands with installed capacity of 327 MW, and another 249 MW under construction. BLM completed a Programmatic Environmental Impact Statement (EIS) and Record of Decision (ROD) in December 2005 that established best management practices for the development of wind energy resources on the public lands. The EIS identified 8.3 million ha (20.6 million ac) of BLM-managed lands with wind energy resource potential.³³

Geothermal Energy Development Program

In 2009, BLM managed 612 geothermal leases. Of these, 58 leases were in producing status and generated approximately 1,275 MW of capacity—about 50 percent of total U.S. geothermal energy capacity. BLM has also completed a Programmatic EIS and ROD, which allocated about 45 million ha (111 million ac) of BLM-managed lands as open to geothermal leasing. In 2007–2009, BLM sold 232 geothermal lease parcels.

Energy Transmission Infrastructure

One of President Obama's top energy priorities is to speed the development of a 21st-century network to move American electricity more cleanly, efficiently, and securely around the nation. To create this network, the United States is exploring ways to develop a unified, forward-looking strategy for siting, allocating the cost of, and coordinating the permitting for proposed transmission projects.

On October 23, 2009, nine agencies signed a Memorandum of Understanding (MOU) to expedite the permitting, siting, and construction of electric transmission infrastructure on federal lands. This will be accomplished through improved coordination among project applicants, federal agencies, and other stakeholders involved in the siting process. By reducing the expense and uncertainty associated with siting new lines, the MOU will speed approval of new lines and cut costs passed on to consumers. In addition, BLM has identified and designated more than 5,000 miles of energy transport corridors on public lands in the western United States.³⁴

Energy SmartPARKS³⁵

In November 2008, DOI's National Park Service (NPS) joined DOE to establish an innovative partner-

²⁶ See http://www1.eere.energy.gov/industry/bestpractices/about_iac.html.

²⁷ See http://www1.eere.energy.gov/industry/technologies/emerging_tech.html.

²⁸ Prymak, Bill. "Energy Assessments: What Are the Benefits to Small and Medium Facilities?" February 19, 2009. Available at: http://www1.eere.energy.gov/industry/pdfs/webcast_2009-0219_small_medium_assessment_benefits.pdf.

²⁹ See http://www1.eere.energy.gov/industry/technologies/emerging_tech.html.

³⁰ See http://www.blm.gov/pgdata/etc/medialib/blm/wo/MINERALS_REALTY_AND_RESOURCE_PROTECTION_/energy.Par.28512.File.dat/09factsheet_Solar.pdf.

³¹ See http://www.blm.gov/pgdata/etc/medialib/blm/wo/MINERALS_REALTY_AND_RESOURCE_PROTECTION_/energy.Par.82982.File.dat/09factsheet_Wind.pdf.

³² See <http://www.awea.org/publications/reports/3Q09.pdf>.

³³ See http://www.blm.gov/wo/st/en/prog/energy/renewable_energy.html.

³⁴ Record of Decision, January 14, 2009. See http://www.blm.gov/pgdata/etc/medialib/blm/wo/MINERALS_REALTY_AND_RESOURCE_PROTECTION_/lands_and_realty.Par.27853.File.dat/Energy_Corridors_final_signed_ROD_1_14_2009.pdf.

³⁵ See <http://www.nps.gov/energy/>.

ship called Energy SmartPARKS. This partnership will showcase sustainable energy practices in national parks and inspire a green energy future for America. Energy SmartPARKS will enable NPS to showcase sustainable energy best practices and further its leadership mission. With combined federal government and private-sector support, Energy SmartPARKS will spark a green energy movement in America.

Clean Energy Initiative

Launched in 2001, EPA's Clean Energy Initiative consists of two partnership programs that promote cost-effective technologies that offer improved efficiencies and lower emissions than traditional energy supply options. In 2007 alone, these programs helped to reduce GHG emissions by about 17.6 Tg CO₂ Eq. and could result in reductions of 73 Tg CO₂ Eq. in 2020.

*Green Power Partnership*³⁶

EPA's Green Power Partnership facilitates the purchase of environmentally friendly electricity from renewable energy sources by addressing the market barriers that stifle demand. The program now includes more than 1,000 partners who have committed to purchasing 16 billion kilowatt-hours (kWh) of green power. There has been increasing interest in on-site renewable generation, and the partnership has developed new resources and forms of recognition to encourage this trend further. Another innovation was the creation of the Green Power Communities designation, which eligible municipalities can achieve through minimum purchases of green power and community-wide campaigns.

*Combined Heat and Power Partnership*³⁷

EPA's Combined Heat and Power (CHP) Partnership provides technical assistance to organizations across multiple sectors who invest in CHP projects, and assists state governments in designing regulations that encourage investment in CHP. As a result, the program now includes almost 270 partners who have installed over 4,700 MW of operational CHP. The CHP Partnership has targeted key sectors for action, including dry mill ethanol production, wastewater treatment facilities, and utilities. Technical guidance documents and project assistance have been provided to partners in these sectors.

*Indian Education Renewable Energy Challenge*³⁸

In September 2009, DOE's Argonne National Laboratory (ANL) and DOI's Bureau of Indian Education (BIE) and Indian Affairs Office of Indian Energy and Economic Development announced a competition for students attending tribal and BIE high schools and tribal colleges to promote careers in the fields of green and renewable energy and build sustainable tribal economies. During Phase I of the Indian Education Renewable Energy Challenge, competing teams of students designed a small wind turbine that will harness wind energy, store it mechanically or electrically,

and use it to power an array of light-emitting diodes. At the end of Phase I, five high school and five college design teams with the best submissions received \$1,300 each to construct prototypes of their inventions. During Phase II, the 10 teams conducted performance data collections to submit to ANL, along with detailed reports and videos of their prototypes in operation, for evaluation by a team of judges. In April 2010, two college teams and one high school team were announced as Energy Challenge winners.

*University-National Park Energy Partnership Program*³⁹

In 1997, NPS partnered with the Rochester Institute of Technology and the Federal Energy Management Program to launch the University-National Park Energy Partnership Program (UNPEPP). This nationwide program partners university students and faculty with NPS energy management personnel to address universities' energy concerns and provide students real-world problem-solving experience in the energy field. Since 1997, UNPEPP has established nearly 50 partnerships nationwide, creating nearly 70 separate projects ranging from energy audits to solar power implementation to public education.⁴⁰

*Biorefinery Assistance*⁴¹

The Food, Conservation, and Energy Act of 2008 (Farm Bill) includes three programs designed to provide targeted assistance to biorefineries and producers of advanced biofuels. The Biorefinery Assistance Program (Section 9003) provides loan guarantees for the development, construction, and retrofitting of commercial-scale biorefineries, and grants to help pay for the development and construction costs of demonstration-scale biorefineries. The Repowering Assistance Program (Section 9004) provides for payments to biorefineries (that were in existence at the time the 2008 Farm Bill was passed) to replace fossil fuels used to produce heat or power to operate the biorefineries with renewable biomass. The Bioenergy Program for Advanced Biofuels (Section 9005) provides for payments to eligible biofuel producers to support and ensure expanded production of advanced biofuels. The three programs are administered by the U.S. Department of Agriculture's (USDA's) Rural Development mission area.

Nuclear Technologies^{42, 43}

DOE's Office of Nuclear Energy funds a diverse portfolio of programs to research and develop nuclear energy technologies. In FY 2009, major efforts included R&D on nuclear waste management techniques and advanced reactor designs through the Generation IV Nuclear Energy Systems program (Gen IV). Another effort funded in 2009 was the Nuclear Power 2010 program. Nuclear Power 2010 is an industry cost-shared effort to demonstrate revised Nuclear Regulatory Commission licensing processes; the program will be brought to closure in FY 2010. Gen IV worked to

³⁶ See <http://www.epa.gov/greenpower/index.htm>.

³⁷ See <http://www.epa.gov/chp/index.htm>.

³⁸ See <http://www.bie.edu/downloads/641F7A3E9A724657B79FFDFF764986E7/Indian%20Education%20Renewable%20Energy%20Challenge.doc>.

³⁹ See <http://www.energypartnerships.org/>.

⁴⁰ See <http://www.rurdev.usda.gov/rbs/buspl/baplg9003.htm>.

⁴¹ See http://www.energypartnerships.org/docs/UNPEPP_10Year_Report.pdf.

⁴² See <http://www.ne.doc.gov/np2010/overview.html>.

⁴³ See <http://climatetechnology.gov/Strategy-Intensity-Reducing-Technologies.pdf>.

address critical unanswered questions about advanced nuclear reactor technologies through R&D and included support for the Next Generation Nuclear Plant project. The fuel-cycle R&D program focused on the development of fuel-cycle technologies that minimize waste and improve proliferation resistance. Many Gen IV and fuel-cycle R&D activities will be continued in FY 2010.

Renewable Energy Deployment Grants⁴⁴

Community renewable energy deployment grants, totaling nearly \$22 million, provide financial assistance for the implementation of integrated renewable energy deployment plans for communities, and construction of renewable energy systems. The grants support utility-scale renewable energy projects in up to four communities nationwide. The projects funded by these grants are expected to create jobs and avoid 50,000 tons of CO₂ annually.

Renewable Energy Production Incentive⁴⁵

The Renewable Energy Production Incentive (REPI) program was created by the Energy Policy Act of 1992, and amended in 2005, to provide financial incentives for renewable energy electricity produced and sold by qualified renewable energy generation facilities. REPI provides financial incentive payments for electricity generated and sold by new qualifying renewable energy generation facilities. Qualifying facilities are eligible for annual incentive payments of 1.5 cents/kWh (1993 dollars and indexed for inflation) for the first 10-year period of their operation, subject to the availability of annual appropriations in each federal fiscal year of operation.

Rural Energy for America Program⁴⁶

Formerly known as the Renewable Energy Systems and Energy Efficiency Improvements Program, USDA's Rural Energy for America Program provides loan guarantees and grants to agricultural producers and rural small businesses to purchase renewable energy systems and improve energy efficiency. Between 2002 and 2008, the program helped finance 694 renewable energy systems (including 271 biomass, 245 wind, 108 solar, 52 geothermal, and 18 hybrid projects) and 1,329 energy efficiency improvements. USDA estimates that these projects have achieved energy savings amounting to 46.6 million barrels of oil and an estimated reduction in GHG emissions of 8.2 Tg CO₂ Eq. Reduced GHG emissions for 2020 are projected to be 21 Tg CO₂ Eq.

Solar Energy Technologies Program⁴⁷

DOE's Solar Energy Technologies Program is improving the performance of energy systems and reducing development, production, and installation costs to competitive levels, thereby accelerating large-scale use across the nation. When federal solar energy research began in the 1970s, the cost of electricity from solar resources was about \$2.00/kWh. Technological ad-

vances over the last two decades have significantly reduced solar electricity costs, which range from as low as \$0.12/kWh for concentrating solar power to \$0.18/kWh for certain photovoltaic applications. DOE estimates that realizing the program's R&D goals could result in solar energy displacing 2.5 Tg CO₂ Eq. in 2020.

Wind Energy Program⁴⁸

Wind energy is the world's fastest-growing energy supply technology. Today, the United States has more than 31,000 MW of wind-generating capacity. DOE's Wind Energy Program has helped lower the cost of wind energy to between 5 and 8 cents/kWh, making large wind farms in certain areas of the United States cost-competitive with fossil fuel and nuclear power plants.

Since 2002, the program has focused most of its efforts on utility-scale technologies and, through its public-private partnerships, has improved the cost of energy for large systems in Class 4 onshore winds.⁴⁹ The Wind Energy Program also supports U.S. offshore wind power development prospects. DOE estimates that realizing the program's R&D goals could result in wind energy displacing more than 67.6 Tg CO₂ Eq. in 2020.

Biomass Program⁵⁰

DOE has contributed to the advancement of biomass technology by working with industry, academia, and national laboratory partners on a balanced portfolio of RD&D efforts geared toward biomass feedstocks and conversion technologies. A major effort includes deployment and further development of infrastructure and opportunities for market penetration of bio-based fuels and products. DOE seeks to develop advanced technologies for producing biofuels—including ethanol—from wood chips, crop residues, and dedicated energy crops, such as switchgrass, while bridging the gap from technology validation to deployment and promoting terrestrial carbon sequestration. The DOE research portfolio is supporting national goals related to reducing GHG emissions associated with bioenergy production and use when compared to conventional petroleum-based fuels.

DOE has contributed to the advancement of biomass technology by testing and demonstrating biomass co-firing with coal, developing advanced technologies for biomass gasification, developing and demonstrating small modular systems, and developing and testing high-yield, low-cost biomass feedstocks. This research has helped biomass become a proven commercial electricity generation option in the United States. DOE estimates that these efforts could help reduce emissions by about 55.2 Tg CO₂ Eq. in 2020.

Coal Technologies⁵¹

The mission of DOE's Office of Fossil Energy Coal Program is to ensure the availability of near-zero atmospheric emissions, and abundant, affordable, do-

⁴⁴ See http://apps1.eere.energy.gov/news/daily.cfm/hp_news_id=185.

⁴⁵ See <http://apps1.eere.energy.gov/rep1/>.

⁴⁶ See <http://www.rurdev.usda.gov/rbs/farmbill/index.html>.

⁴⁷ See <http://www1.eere.energy.gov/solar/>.

⁴⁸ See <http://www1.eere.energy.gov/windandhydro/>.

⁴⁹ Onshore sites with a Class 4 rating (7.0–7.5 meters per second at 50 ft) or higher (on a scale of 7 classes) are preferred for large-scale wind plants. See American Wind Energy Association: <http://www.awea.org/faq/basicwr.html>.

⁵⁰ See <http://www1.eere.energy.gov/biomass/>.

⁵¹ See <http://www.fossil.energy.gov/programs/powersystems/cleancoal/>.

mestic energy to fuel economic prosperity, strengthen energy security, and enhance environmental quality. In the late 1980s and early 1990s, DOE conducted a joint program with industry and state agencies to demonstrate technologies that addressed the environmental challenges of the time—primarily concerns about the impact of acid rain on forests and watersheds. In the 21st century, the focus of environmental concern has shifted to the global climate-altering impact of GHGs.

With coal likely to remain one of the nation's lowest-cost energy resources for the foreseeable future, the United States is actively funding applied R&D of advanced coal technologies that improve efficiency and reduce the intensity of CO₂ emissions. In addition, the Clean Coal Power Initiative is a cost-shared partnership between the government and industry to develop and demonstrate advanced coal-based power generation technologies. By 2020, these initiatives could prevent the emission of 23.1 Tg CO₂ Eq.

Geothermal Technologies Program⁵²

Geothermal energy is poised for widespread expansion, if enhanced geothermal systems (EGS) technology can be proven commercially viable. DOE is working to overcome a variety of technical, market, and institutional barriers. Studies indicate that these challenges can be overcome with further investment in research, changes in policy, and market conditioning. The Massachusetts Institute of Technology (MIT) and the U.S. Geological Survey (USGS) have conducted studies that point to the potential contribution of EGS to domestic electricity supply ranging from 100,000 megawatts electric (MWe) to 517,800 MWe, respectively.^{53, 54} As these studies suggest, geothermal energy, once restricted to naturally occurring hydrothermal fields in remote areas, could someday be operating in more locations and in greater proximity to large end-use markets.

DOE's Geothermal Technologies Program was relaunched in 2008. ARRA has dedicated \$400 million in investments across the spectrum of geothermal technologies, from co-produced geothermal energy from oil and gas fields to EGS technologies and more widespread deployment of geothermal heat pumps. DOE estimates that U.S. electricity generated from geothermal power could displace 1.8 Tg CO₂ Eq. in 2020.

Loan Guarantee Program⁵⁵

DOE's Loan Guarantee Program provides financial support for projects that employ new or significantly improved technologies that avoid, reduce, or sequester air pollutants or anthropogenic GHG emissions. As authorized by Title XVII of EPAct, the program promotes early commercial use of advanced technologies for projects with a reasonable prospect of repayment of

the principal and interest. In addition to \$4 billion in loan guarantee authority provided in FY 2007, DOE has the authority to issue \$18.5 billion for new nuclear plants, \$2 billion for uranium enrichment, \$8 billion for advanced coal, and \$18.5 billion for renewable or energy-efficient systems and manufacturing projects. An additional \$4 billion in credit subsidy was provided in ARRA to support up to \$40 billion in loans for renewable energy and transmission projects, including commercial and advanced technologies.

Water Power Program⁵⁶

Today, power from water resources represents the largest U.S. renewable energy source and serves as a foundation for other renewable forms of energy being developed. DOE's Water Power Program seeks to identify and undertake RDD&D to assess the potential extractable energy from water resources and to facilitate the development and deployment of renewable, environmentally sound, and cost-effective energy from U.S. rivers, estuaries, and marine waters. In 2008, the program began supporting a comprehensive suite of R&D projects geared toward advances in marine and hydrokinetic technology that has the potential to provide 43 gigawatts of additional capacity from waves, tides, and currents in U.S. waters. DOE is also supporting capacity additions for both small and large conventional hydropower, as well as advances in water power grid services to make better use of existing hydroelectric capacity and its highly valuable ancillary services.

Transportation

Renewable Fuel Standard⁵⁷

EISA made several changes to the RFS, as originally implemented under EPAct, including a significant increase in the volume of renewable fuel that must be used in transportation fuel each year. By 2022, 36 billion gallons of renewable fuel are required—a fivefold increase over the volumes included in EPAct. The statute also includes volume requirements for biomass-based diesel and other advanced biofuels, including 16 billion gallons of cellulosic biofuel by 2022.

The revised requirements also include new definitions and criteria for both renewable fuels and the feedstocks used to produce them, including new life-cycle GHG emission thresholds for renewable fuels. EPA, which issued a final rule in February 2010, is currently working to implement these changes to the RFS program, which is anticipated to achieve significant reductions in both petroleum use and GHGs.

National Clean Diesel Campaign⁵⁸

EPA's National Clean Diesel Campaign (NCDC) works aggressively to reduce diesel emissions across the country through the implementation of proven emission control technologies and innovative strategies with the involvement of national, state, and local partners. Many of the clean diesel strategies that NCDC

⁵² See <http://www1.eere.energy.gov/geothermal/>.

⁵³ Tester et al. *The Future of Geothermal Energy: Impact of Enhanced Geothermal Systems (EGS) on the United States in the 21st Century*. 2006. Refers to 100,000 MWe.

⁵⁴ Williams et al. "Assessment of Moderate- and High-Temperature Geothermal Resources of the United States." 2008. Refers to 517,800 MWe. Note that this assessment is only applicable to the western states, and does not include an eastern assessment.

⁵⁵ See <http://www.lgprogram.energy.gov/index.html>.

⁵⁶ See <http://www1.eere.energy.gov/windandhydro/>.

⁵⁷ See <http://www.epa.gov/otaq/renewablefuels/index.htm>.

⁵⁸ See <http://www.epa.gov/diesel/>.

promotes to mitigate nitrogen oxides (NO_x) and particulate matter (PM)—such as retrofits, engine repair, engine replacement, engine repower, idle reduction, and cleaner fuels—can also reduce CO₂ emissions through diesel fuel savings and help mitigate black carbon emissions. Black carbon, a component of PM, has been found to both increase atmospheric warming and speed Arctic melting. Removing PM may have a significant effect on slowing global warming due to the short-lived nature of black carbon.

The Diesel Emissions Reduction Act (DERA) provisions in EPA's Act are a significant funding source for NCDC. In the first year of the DERA program (FY 2008), EPA awarded \$49.2 million for projects across the country—including projects funded through the SmartWay Clean Diesel Finance Program, State Clean Diesel Grants, National Clean Diesel Funding Assistance Program, and Emerging Technologies Program—which will lead to emission reductions of approximately 41,700 metric tons of NO_x and 2,000 metric tons of fine particulate matter (PM_{2.5}). EPA estimates that the idle-reduction technologies funded through FY 2008 grants alone will save more than 3.2 million gallons of fuel and 32,300 metric tons of CO₂ per year. Engine replacement, repowering, and vehicle replacement projects are contributing additional fuel savings and CO₂ reductions. With an additional \$300 million of ARRA funding to be awarded for clean diesel projects and \$60 million appropriated for FY 2009 and FY 2010, EPA anticipates that the level of emissions, including CO₂ and black carbon, from the existing fleet of diesel engines will continue to decrease significantly.

SmartWaySM Transport Partnership⁵⁹

The SmartWaySM Transport Partnership is an innovative collaboration with the freight industry to increase energy efficiency while significantly reducing GHGs and air pollution. EPA provides tools and models to help SmartWay Transport partners—including producers and the trucking, rail, and marine shipping companies that deliver their products—adopt cost-effective strategies to save fuel and reduce GHG emissions. To date, more than 2,000 companies and organizations have joined the partnership. Freight shippers meet their goals by using participating carriers, while trucking and rail companies meet their goals by improving freight transport efficiency.

The SmartWay Clean Diesel Finance Program is a complementary initiative that aims to accelerate the deployment of energy-efficient and emission-control technologies by helping truck owners overcome financial obstacles. In 2008, EPA awarded \$3.4 million to support three loan programs to help small trucking companies reduce fuel costs and emissions. In 2009, EPA will award the program \$30 million from ARRA funding to support the development of new financing programs.

Other SmartWay initiatives include identification of clean and efficient SmartWay-certified vehicles, including heavy-duty trucks, upgrade kits, and components. SmartWay-designated tractor-trailers can save 10–20 percent annually in fuel and CO₂ emissions compared to a typical long-haul truck. SmartWay also promotes a national idle-reduction program for trucks and locomotives and has developed guidance on idle-reduction policies and programs for states. SmartWay's Supply Chain initiative is developing new tools to help companies quantify and track freight transport environmental performance across all modes, including truck, marine, rail, and aviation.

The SmartWay program is also working with other governments and organizations around the world to establish international benchmarks for cleaner, efficient freight transportation. EPA held the first international SmartWay workshop in December 2008, and several countries have initiated projects and programs modeled after the U.S. SmartWay program. EPA estimates that SmartWay could help the industry reduce up to 43 Tg CO₂ Eq. in 2020.

Aviation Fuel Efficiency⁶⁰

In the United States, aviation makes up about 3 percent of the national GHG inventory and about 12 percent of transportation emissions. Currently, measuring and tracking fuel efficiency from aircraft operations provide the data for assessing the improvements in aircraft and engine technology, operational procedures, and the airspace transportation system that reduce aviation's contribution to CO₂ emissions.

Although there are no mandatory U.S. or international goals or requirements with respect to aviation fuel efficiency, the Federal Aviation Administration (FAA) has a number of initiatives to improve aviation fuel efficiency. For example, FAA has aviation GHG reduction goals as part of the Next Generation Air Transportation System (NextGen). In the near term, new technologies to improve air traffic management will help reduce fuel consumption and, thus, emissions. In the long term, new engines and aircraft will feature more efficient components and aircraft aerodynamics, enhanced engine cycles, and reduced weight, thereby improving fuel efficiency and fuel economy.

Commercial Aviation Alternative Fuels Initiative⁶¹

FAA's Commercial Aviation Alternative Fuels Initiative (CAAFI) seeks to enhance energy security and environmental sustainability for aviation through alternative jet fuels. CAAFI is a government and private-sector coalition that focuses the efforts of commercial aviation to engage the emerging alternative fuels industry. It enables its diverse participants—representing all the leading stakeholders in the field of aviation—to build relationships, share and collect data, identify resources, and direct RD&D of alternative jet fuels.

⁵⁹ See <http://www.epa.gov/smartway/>.

⁶⁰ See http://ntl.bts.gov/lib/32000/32700/32779/DOT_Climate_Change_Report_-_April_2010_-_Volume_1_and_2.pdf.

⁶¹ See <http://www.caafi.org>.

*Clean Automotive Technology*⁶²

EPA's Clean Automotive Technology program searches for cost-effective advanced automotive technologies that greatly cut GHG emissions, increase fuel efficiency, reduce emissions, and are affordable for mainstream consumer and commercial vehicles. The program has developed several historic engine and drivetrain technology breakthroughs, and currently holds 60 powertrain patents with 28 more in process.

EPA has been instrumental in moving advanced vehicle technologies from the lab to the road by partnering with industry companies, such as UPS, FedEx, Navistar, Freightliner, Eaton, and Parker, to get the first series of hydraulic hybrid package-delivery vehicles on the road. The first generation of this advanced technology has improved real-world fuel efficiency by 50 percent. EPA is working to incorporate the next generation of advanced engine and fuel technologies into series hybrids to boost these gains for commercial trucks to near 100 percent.

*Fuel Cell Technologies Program*⁶³

DOE's Fuel Cells Technologies Program is implementing RD&D efforts needed for the widespread use of fuel cells and hydrogen in the stationary, portable, and transportation sectors. Through partnerships with the public and private sectors, national laboratories, and academia, the program accelerates the pace of R&D to reduce U.S. dependence on oil, GHG emissions, and criteria pollutants. Technological advances through R&D over the last seven years have successfully reduced fuel cell costs from \$275 per kilowatt (kW) to approximately \$61/kW in 2009, based on a production volume of 500,000 units per year, doubled fuel cell durability (to 60,000 miles), and reduced high-volume hydrogen costs to \$3 per gallon gasoline equivalent.

*Federal Transit Program*⁶⁴

DOT's Federal Transit Administration (FTA) grows and sustains public transportation as a low-emission alternative to automobiles by providing grants, technical assistance, research, and policy leadership to communities throughout the United States. FTA's main area of support to communities is providing more than \$10 billion per year in grants for the construction and operation of transit services ranging from local buses and paratransit services to heavy-rail subways and commuter rail. Over 1,500 transit providers in communities throughout the United States benefit from FTA grant programs as a way to assist their own efforts to provide public transportation options to their customers. FTA also encourages adoption of clean technologies by funding a significant percentage of the cost of purchasing lower-emission vehicles.

Through its technical assistance efforts focused on transportation planning and transit-oriented de-

velopment, FTA provides communities with the tools to effectively coordinate land-use and transportation decisions. Combining investment in public transportation with compact, mixed-use development around transit stations has a synergistic effect that amplifies the GHG reductions of each activity. FTA also provides environmental management systems training to transit agencies to help them continually assess and reduce the environmental impact of their operations.

FTA research on alternative fuels and high-fuel-efficiency vehicles has yielded the introduction of low-emission technologies, such as hybrid electric, compressed natural gas, and biodiesel. Current research is also supporting the development of a commercially viable fuel cell bus through a multi-year, multi-organization research effort. Finally, FTA policy research is aimed at providing the analysis to give decision makers the information to make informed decisions about the role of public transportation in reducing GHG emissions.

*Transit Investments for Greenhouse Gas and Energy Reduction*⁶⁵

Administered by FTA, DOT's Transit Investments for Greenhouse Gas and Energy Reduction (TIGGER) grant program aims to position the public transportation industry as a leader in the effort to reduce America's dependence on foreign oil and help address global climate change. Created by ARRA, the program provides \$100 million in discretionary grants to U.S. transit agencies for capital investments that will help reduce energy consumption or GHG emissions. In particular, TIGGER seeks to fund projects that will yield long-term energy savings and emission reductions from targeted investments in public transit facilities and vehicle operations.

*Vehicle Technologies Program*⁶⁶

DOE's Vehicle Technologies Program develops energy-efficient and environmentally friendly highway transportation technologies that will reduce use of petroleum in the United States. The long-term aim is to develop "leapfrog technologies" that will provide Americans with greater freedom of mobility and energy security, while lowering costs and reducing impacts on the environment. Program areas include hybrid and vehicle systems, energy storage, power electronics and electrical machine technologies, advanced combustion engines, fuel and lubricant technologies, materials, EPAAct support, and educational activities. Clean Cities, the main deployment arm of the program, is a public-private partnership designed to reduce petroleum consumption in the transportation sector by advancing the use of alternative fuels and vehicles, idle-reduction technologies, hybrid electric vehicles, fuel blends, and fuel economy measures. Industry partnerships include the FreedomCAR and Fuel Partnership and the 21st Century Truck Partnership.

⁶² See <http://www.epa.gov/otaq/technology/>.

⁶³ See <http://www1.eere.energy.gov/hydrogenandfuelcells/>.

⁶⁴ See <http://www.fta.dot.gov/>.

⁶⁵ See http://www.fta.dot.gov/index_9440_9920.html.

⁶⁶ See <http://www1.eere.energy.gov/vehiclesandfuels/>.

Congestion Mitigation and Air Quality Improvement Program⁶⁷

Administered by DOT's Federal Highway Administration (FHA) and FTA in consultation with EPA, the Congestion Mitigation and Air Quality Improvement (CMAQ) Program provides states with funding to reduce congestion and improve air quality through transportation control measures and other transportation strategies that will contribute to attainment or maintenance of the national ambient air quality standards for ozone, carbon monoxide, and PM. Funds are apportioned to states by statutory formula, and the amount of funding is primarily based on the severity of the air quality problem and the population of the area. State and local governments select CMAQ projects and coordinate them through metropolitan planning organizations (MPOs), where appropriate. The projects typically include transit improvements, alternative fuel programs, shared-ride services, traffic flow improvements, demand management strategies, freight and intermodal facilities, diesel engine retrofits, pedestrian and bicycle programs, and inspection and maintenance programs.

The Safe, Accountable, Flexible, Efficient, Transportation Equity Act: A Legacy for Users (SAFETEA-LU)⁶⁸ directed states and MPOs to give priority to two categories of funding: (1) diesel retrofits and other cost-effective emission reduction activities, taking into consideration air quality and health effects; and (2) cost-effective congestion mitigation activities that provide air quality benefits. States and local governments, however, retain their project selection authority through SAFETEA-LU, maintaining the full range of eligible CMAQ projects, such as idle-reduction efforts and public education and outreach programs.

Alternative Transport Systems and Use of Clean Vehicles

Alternative Transportation Systems⁶⁹

Alternative Transportation Systems integrate all modes of travel within a park managed by NPS, including public transit, bicycle and pedestrian linkages, automobiles, and a whole range of technologies, facilities, and transportation management strategies. There are 98 National Park Units supporting 110 Alternative Transportation Systems: 17 systems are owned and operated by NPS; 71 systems are operated by a concessionaire; and 22 systems are run by NPS, in partnership with local public transit service.

Alternative-Fuel Vehicles

BLM has reduced the size of its vehicles and fleet, has purchased more than 500 alternative-fuel vehicles, and has established a transportation policy to reduce vehicle use, which saves money, reduces fossil fuel use, and lowers GHG emissions. Current BLM targets include reducing the fleet's total consumption of petroleum products by 2 percent annually through the end of FY

2015, increasing the total fuel consumption that is non-petroleum-based by 10 percent annually, and using plug-in hybrid electric vehicles (PHEVs) when they are commercially available at a cost reasonably comparable to non-PHEVs, on the basis of life-cycle cost.

Industry: Non-CO₂ Methane Programs⁷⁰

U.S. industries and state and local governments collaborate with EPA to implement several voluntary programs that promote profitable opportunities for reducing emissions of methane, an important GHG. These programs are designed to overcome a wide range of informational, technical, and institutional barriers to reducing methane emissions, while creating profitable activities for the coal, natural gas, and petroleum industries. The collective results of EPA's voluntary methane partnership programs have been substantial. Total U.S. methane emissions in 2004 were 10 percent lower than emissions in 1990, despite robust economic growth over that period. EPA expects that these programs will maintain emissions below 1990 levels through and beyond 2020 due to expanded industry participation and the continuing commitment of the participating companies to identify and implement cost-effective technologies and practices.

Coalbed Methane Outreach Program⁷¹

The fraction of coal mine methane captured and used by degasification systems grew from 25 percent in 1990 to more than 80 percent in 2006. Initiated in 1994, EPA's Coalbed Methane Outreach Program (CMOP) is working to demonstrate technologies that can eliminate the remaining emissions from active mine degasification systems, including mitigating methane emissions in mine ventilation air. The program also addresses opportunities to recover and use methane emitted from abandoned (closed) underground mines. EPA estimates that CMOP reduced 7 Tg CO₂ Eq. in 2007. Based on a number of anticipated conditions, including enhanced market opportunities for natural gas and power, further refinement of technical options for the capture and utilization of mine methane, a growing reliance on methane degasification in the U.S. West, and CMOP's anticipated success in reducing ventilation air methane over the next few years, EPA projects that the program could help reduce emissions by 12 Tg CO₂ Eq. in 2020.

Natural Gas STAR⁷²

Through this partnership program, EPA works with oil and natural gas companies to promote proven, cost-effective technologies and practices that improve operational efficiency and reduce methane (i.e., natural gas) emissions. Methane is emitted by oil production and all sectors of the natural gas industry, from drilling and production, through processing and storage, to transmission and distribution. Since its launch

⁶⁷ See <http://www.fhwa.dot.gov/environment/cmaqpgs/>.

⁶⁸ Public Law 109-59.

⁶⁹ See <http://www.nps.gov/transportation/tmp/shuttles.htm>.

⁷⁰ See <http://www.epa.gov/methane/index.html>.

⁷¹ See <http://www.epa.gov/cmop/index.html>.

⁷² See <http://www.epa.gov/gasstar/index.htm>.

in 1993, Natural Gas STAR has been successful in working with U.S. oil and natural gas companies to reduce methane emissions and bring more energy to markets. As of 2007, Natural Gas STAR partner companies represented almost 60 percent of the U.S. natural gas industry. For calendar year 2007, Natural Gas STAR domestic partners reported emission reductions of approximately 37 Tg CO₂ Eq. EPA projects that the program could help reduce methane emissions by 46.9 Tg CO₂ Eq. in 2020.

High Global Warming Potential Programs⁷³

The United States is one of the first nations to develop and implement a national strategy to control emissions of high global warming potential (GWP) gases. The strategy is a combination of industry partnerships and regulatory mechanisms to minimize atmospheric releases of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆), which are potent GHGs that contribute to global warming, while ensuring a safe, rapid, and cost-effective transition away from chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), halons, and other ozone-depleting substances (ODS) across multiple industry sectors.

Environmental Stewardship Initiative

EPA's Environmental Stewardship Initiative aims to limit emissions of HFCs, PFCs, and SF₆ in three industrial applications: semiconductor production,⁷⁴ electric power distribution,⁷⁵ and magnesium production.⁷⁶ Since 2002, the SF₆ emission reduction partnership for magnesium has worked toward its goal of eliminating emissions of SF₆ by the end of 2010. Additional sectors are being assessed for the availability of cost-effective emission reduction opportunities and are being added to this initiative. EPA estimates that partnerships in this initiative reduced emissions by 17.3 Tg CO₂ Eq. in 2007 and projects that the programs could help reduce emissions by 44.7 Tg CO₂ Eq. in 2020.

Voluntary Code of Practice for the Reduction of Emissions of HFC & PFC Fire Protection Agents⁷⁷

In 2002, EPA and several hundred equipment and chemical manufacturers and distributors representing the U.S. fire protection industry launched the Voluntary Code of Practice for the Reduction of Emissions of HFC & PFC Fire Protection Agents (VCOP). Successful implementation of VCOP achieves the dual goals of minimizing nonfire emissions of HFCs and PFCs (predominantly HFCs), which are used as fire-suppression alternatives to ozone-depleting halons, and can effectively protect people and property from the threat of fire. In addition, approximately 22 manufacturers annually report to the HFC Emissions Estimating Program, tracking industry-wide emissions of HFCs and progress under VCOP.

HFC-23 Emission Reduction Partnership⁷⁸

EPA's HFC-23 Emission Reduction Partnership continued to encourage companies to develop and implement technically feasible, cost-effective processing practices or technologies to reduce HFC-23 emissions from the manufacture of HCFC-22. Despite a 4 percent increase in the production of HCFC-22 compared to 1990, EPA estimates that total HFC emissions in 2007 were significantly below 1990 levels. Compared to business as usual, EPA estimates the partnership reduced emissions by 17.8 Tg CO₂ Eq. in 2007, and projects that this partnership could help reduce GHG emissions by 20.9 Tg CO₂ Eq. for 2020, due to manufacturers switching away from the production of this chemical.

Mobile Air Conditioning Climate Protection Partnership⁷⁹

EPA's Mobile Air Conditioning Climate Protection Partnership has been reducing GHG emissions from vehicle air conditioning fuel use and refrigerant emissions. In 2007, the partnership demonstrated new, commercially available technology that would reduce vehicle air conditioner fuel use by over 30 percent, cut refrigerant emissions by 50 percent, reduce cooling loads, and improve refrigerant recovery and recycling. These technologies are currently being integrated into vehicles and refrigerant recovery and recycling equipment sold in the United States and worldwide. In addition, partnership members have announced plans to switch to a low-GWP refrigerant. This transition, which will begin in 2010, could help displace 24.6 Tg CO₂ Eq. of GHG in 2020.⁸⁰

GreenChill Advanced Refrigeration Partnership⁸¹

Formerly known as Green Grocer, the GreenChill Advanced Refrigeration Partnership is an EPA cooperative alliance with the supermarket industry to promote advanced technologies, strategies, and practices that reduce supermarkets' impact on the ozone layer and climate system. Through GreenChill, EPA works with supermarkets to reduce the amount of refrigerants they use in their stores. Refrigerants are responsible for high-GWP and ozone-depleting gases, so their minimization is especially beneficial for the environment.

EPA launched GreenChill in November 2007 with 10 founding partners. GreenChill now has 45 partners with more than 6,500 supermarkets (18 percent of all U.S. supermarkets) in 47 states. Upon joining, partners measure their refrigerant emissions annually and set goals to reduce those emissions. On average, more than 20 percent of the refrigerant used each year in the supermarket industry is released into the atmosphere in the form of dangerous GHGs. In 2008—GreenChill's first year of measuring supermarket emission reductions—partners reduced their aggregate total corporate emission rate from 13 percent to 11.9 per-

⁷³ See <http://www.epa.gov/highwp/>.

⁷⁴ See <http://www.epa.gov/semiconductor-pfc/>.

⁷⁵ See <http://www.epa.gov/highwp/electricpower-sf6/index.html>.

⁷⁶ See <http://www.epa.gov/magnesium-sf6/>.

⁷⁷ See <http://epa.gov/ozone/snap/fire/vcopdocument.pdf>.

⁷⁸ See <http://www.epa.gov/highwp/voluntary.html>.

⁷⁹ See <http://www.epa.gov/cppd/mac/>.

⁸⁰ According to the latest U.S. GHG Inventory Report (U.S. EPA/OAP 2009), HFC-134a emissions from U.S. vehicle air conditioners account for 50 MMTCO₂ Eq. per year. Transition to a low-GWP refrigerant (either CO₂, GWP 1, or HFO-1234yf, GWP 4) will reduce CO₂ Eq. emissions by well over 99 percent).

⁸¹ See <http://www.epa.gov/greenchill/>.

cent per year. As the partnership continues to grow, EPA estimates it could help reduce annual GHG emissions in 2020 by 1.9 Tg CO₂ Eq.

Responsible Appliance Disposal Program⁸²

Announced in 2006, the Responsible Appliance Disposal Program is reducing GHG emissions from refrigerant-containing home appliances that have reached their end of life. Through this voluntary program, partners ensure the disposal of refrigerant-containing appliances using the best environmental practices available. Through such responsible disposal practices, partners are able to recover and recycle refrigerants and foam, thereby reducing emissions of high-GWP gases. They also prevent the release of hazardous materials (e.g., used oil, polychlorinated biphenyls, and mercury), and they save landfill space and energy by recycling durable materials. EPA estimates that the annual emission reduction in 2010 from this effort will be 0.1 Tg CO₂ Eq. In 2020, the program could help to save 0.4 Tg CO₂ Eq. (not including possible CO₂ reductions from energy savings).

Significant New Alternatives Policy Program⁸³

Since the 2006 CAR, EPA's Significant New Alternatives Policy Program has continued to identify substitutes for ODS, such as CFCs and HCFCs. EPA has worked closely with industry to research, identify, and implement climate- and ozone-friendly alternatives, supporting a smooth transition to these new technologies. In addition, EPA has initiated programs with different industry sectors to monitor and minimize emissions of global-warming gases, such as HFCs and PFCs, used as substitutes for ozone-depleting chemicals. By limiting use of these gases in specific applications where safe alternatives are available, EPA reduced annual emissions by an estimated 115 Tg CO₂ Eq. in 2007, and the program could help to reduce GHG emissions by an estimated 240 Tg CO₂ Eq. in 2020.

Voluntary Aluminum Industry Partnership⁸⁴

EPA's Voluntary Aluminum Industry Partnership continued to reduce PFCs, tetrafluoromethane, and hexafluoroethane where cost-effective technologies and practices are technically feasible. Since 2006, the partnership has intensified its efforts to further reduce PFC emissions and direct carbon emissions from anode consumption. EPA estimates that the partnership reduced PFC emissions by 10.0 Tg CO₂ Eq. in 2007, and EPA projects reductions of 8.2 Tg CO₂ Eq. in 2020.

Agriculture

Through a portfolio of conservation, renewable energy, and energy efficiency programs, USDA provides incentives and other support for voluntary actions by private landowners to reduce GHG emissions and increase carbon sequestration. Depending on the program and activity, USDA support can include financial incentives, technical assistance, demonstrations, pilot programs, education and capacity building, and

frameworks and tools for assessing success in achieving GHG benefits. Major elements of the USDA actions to reduce GHGs are described in the sections below.

AgSTAR⁸⁵

AgSTAR is a voluntary effort jointly sponsored by EPA, USDA, and DOE. The program encourages the use of methane recovery (biogas) technologies at confined animal feeding operations that manage manure as liquids or slurries. These technologies reduce methane emissions while achieving other environmental benefits. Although the overall impact of AgSTAR on GHG emissions has been comparatively small on a national scale, livestock producers in the dairy and swine sector have demonstrated that the practices can reduce GHG emissions and achieve other pollution control benefits while increasing farm profitability. The practices recommended under AgSTAR have been incorporated into USDA's broader technical, conservation, and cost-share programs.

Conservation Reserve Program⁸⁶

The Conservation Reserve Program (CRP) encourages farmers to convert environmentally sensitive acreage to native grasses, wildlife plantings, trees, restored wetlands, filter strips, or riparian buffers. Administered by USDA's Farm Service Agency (FSA), the CRP sequesters more carbon on private lands than any other federally administered program. CRP contracts last 10–15 years, and landowners retain the right to put land back into production once contracts end. Hence, the benefits of many contracts are not permanent. FSA allows the private sale of carbon credits for lands enrolled in the CRP. FSA has also included carbon sequestration potential in its ranking process by which offers are selected for enrollment. In addition to increasing carbon sequestration, CRP lands produce GHG benefits in the form of reduced CO₂ emissions from fewer field operations and reduced N₂O emissions from avoided fertilizer applications. For 2008, FSA estimates the net GHG benefits of the CRP were emission reductions of 56 Tg CO₂ Eq. This value is expected to decrease to 53 Tg CO₂ Eq. in 2012 and remain at that level through 2020.

Environmental Quality Incentives Program⁸⁷

The Environmental Quality Incentives Program (EQIP) provides financial assistance for conservation practices on working farm and ranch lands. NRCS has provided guidance to its state offices to recognize actions that provide GHG benefits within the EQIP ranking systems. A wide array of conservation practices can reduce GHG emissions, including residue management, irrigation and water management, nutrient management, crop rotations, cover crops, restoring wetlands, and grazing land management. However, these benefits are not permanent, as EQIP contracts last for 10 years, and producers retain the right to put land back into production after the contract ends. In

⁸² See <http://www.epa.gov/Ozone/partnerships/rad/>.

⁸³ See <http://www.epa.gov/ozone/snap/>.

⁸⁴ See <http://www.epa.gov/highgwp/aluminum-pfc/index.html>.

⁸⁵ See <http://www.epa.gov/agstar/> and <http://www.rurdev.usda.gov/rbs/farmbill/index.html>.

⁸⁶ See <http://www.fsa.usda.gov/dafp/cepd/crp.htm>.

⁸⁷ See <http://www.nrcs.usda.gov/programs/eqip/>.

2009, NRCS estimated the GHG mitigation benefits associated with 17 conservation practices that it identified as sequestering carbon and/or reducing emissions. For 2007, total GHG mitigation attributable to these practices is estimated at 3.9 Tg CO₂ Eq. This value is projected to increase to 14.2 Tg CO₂ in 2020.

Conservation Stewardship Program⁸⁸

Formerly known as the Conservation Security Program, USDA's Conservation Stewardship Program (CSP) is a voluntary nationwide program that provides financial and technical assistance to promote the conservation and improvement of soil, water, air, energy, plant and animal life, and other conservation purposes on tribal and private working lands. Working lands include cropland, grassland, prairie land, improved pasture, and range land, as well as forested land that is an incidental part of an agriculture operation. CSP contracts last 5 years, and landowners retain the right to put land back into production once contracts end. Hence, the benefits of many contracts are not permanent. CSP has the potential to support activities and actions that increase carbon sequestration and reduce GHG emissions. The program began in FY 2009. GHG emission reductions will depend on the contracts enrolled and practices those contracts put into place.

Wetlands Reserve Program⁸⁹

The Wetlands Reserve Program (WRP) is a voluntary program offering landowners the opportunity to protect, restore, and enhance wetlands on their property. NRCS provides technical and financial support to help landowners with their wetland restoration efforts, toward the goal of achieving the greatest wetland functions and values, along with optimum wildlife habitat, on every acre enrolled in the program. This program offers landowners an opportunity to establish long-term conservation and wildlife practices and protection. Activities associated with wetland conservation often increase carbon sequestration and reduce GHG emissions. For 2007, NRCS estimates the WRP reduced GHG emissions by 0.18 Tg CO₂ Eq. These reductions are projected to increase to 0.25 Tg CO₂ Eq. in 2020.

Grassland Reserve Program⁹⁰

NRCS's Grassland Reserve Program (GRP) is a voluntary conservation program that emphasizes support for working grazing operations, enhancement of plant and animal biodiversity, and protection of grassland under threat of conversion to other uses. Participants voluntarily limit future development and cropping uses of the land, while retaining the right to conduct common grazing practices and operations related to the production of forage and seeding, subject to certain restrictions during nesting seasons of bird species that are in significant decline or are protected under federal or state law. A grazing management plan is

required for participants. Many of the conservation practices encouraged under the GRP increase the quantity of carbon sequestered in the affected soils. However, only part of these benefits is permanent, as the program includes both permanent easements and 10- to 20-year rental contracts. Once rental contracts end, farmers retain the right to put land back into production. For 2007, NRCS estimates the GRP reduced GHG emissions by 0.007 Tg CO₂ Eq. These reductions are projected to increase to 0.027 Tg CO₂ Eq. in 2020.

Wildlife Habitat Incentives Program⁹¹

The 2008 Farm Bill reauthorized the Wildlife Habitat Incentives Program (WHIP) as a voluntary approach to improving the nation's wildlife habitat. NRCS administers WHIP to provide both technical assistance and up to 75 percent cost-share assistance to establish and improve fish and wildlife habitat. WHIP cost-share agreements between NRCS and the participant generally begin one year after the last conservation practice is implemented and end not more than 10 years from the date the agreement is signed. Establishing and enhancing wildlife habitats often increase carbon sequestration and reduce GHG emissions. However, these benefits are not permanent, as landowners retain the right to put land back into production once the contracts end. For 2007, NRCS estimates WHIP reduced GHG emissions by 0.25 Tg CO₂ Eq. These reductions are projected to increase to 0.50 Tg CO₂ Eq. in 2020.

Forestry

The U.S. government supports efforts to sequester carbon in both forests and harvested wood products to minimize unintended carbon emissions from forests by reducing the catastrophic risk of wildfires.

Enhancing Ecosystem Services on Forests, Grasslands, Parks, and Wildlife Reserves

To address the effects of climate change on federal lands administered by DOI and other agencies, DOI, in conjunction with USDA, EPA, other federal agencies, academic institutions, and the private sector, is conducting thorough ecoregional analyses. These analyses will help DOI conserve, enhance, restore, and adapt ecosystems, find opportunities for carbon sequestration, and provide opportunities for renewable energy development. As a result of extreme fire events, other natural disasters, and human activities, public lands present a substantial opportunity to optimize the potential benefits of a carbon sequestration program. Those benefits include long-term capture and storage of CO₂, improved biodiversity and wildlife habitat condition and connectivity, improved water quality and quantity, reduced soil erosion, decreased invasive species, improved environmental esthetics, and enhanced recreational experiences.⁹²

⁸⁸ See <http://www.nrcs.usda.gov/programs/CSP/>.

⁸⁹ See <http://www.nrcs.usda.gov/Programs/WRP/>.

⁹⁰ See <http://www.nrcs.usda.gov/programs/grp/>.

⁹¹ See <http://www.nrcs.usda.gov/programs/whip/>.

⁹² U.S. Forest Service, Forest Inventory and National Analysis Program. Forest Inventory Data Online. See <http://fiatools.fs.fed.us/fido/>. The estimate was prepared by DOI. The footnote refers generally to the USDA Forest Inventory data.

Healthy Forest Initiative

Today, up to 81 million ha (200 million ac) of federal lands are currently at risk for catastrophic wildfires, in large part due to significant changes in forest structure and density during the last 60–70 years, prolonged drought, and other environmental changes. The need for innovative, large-scale management to restore the health and productivity of at-risk ecosystems prompted the development of the Healthy Forest Initiative, which now includes the National Fire Plan⁹³ and the joint federal–state 10-Year Strategy Implementation Plan.⁹⁴ One goal of these efforts is to increase biomass and wood fiber utilization as an integral component of restoring the nation’s forests, woodlands, and rangelands. Addressing hazardous fuels on federal lands is a key element of the National Fire Plan and related efforts, with almost 7.3 million ha (18 million ac) being treated by USDA since 2001.

Woody Biomass Utilization Grant Program⁹⁵

The Woody Biomass Utilization Grant Program focuses on creating markets for small-diameter material and low-valued trees removed from forest restoration activities, such as reducing hazardous fuels, handling insect and disease conditions, or treating forestlands impacted by catastrophic weather events. Most of this woody biomass would have been piled and burned in the open, so the program reduces GHG emissions when that material is used for energy or substitutes for fossil fuel-intensive products instead. For 2008, the U.S. Forest Service estimates this grant program reduced GHG emissions by 0.43 Tg CO₂ Eq. These reductions are projected to increase to 0.77 Tg CO₂ Eq. in 2020.

Waste Management

The U.S. government’s waste management programs reduce municipal solid waste and GHG emissions through energy savings, increased carbon sequestration, and avoided methane emissions from landfill gas—the largest contributor to U.S. anthropogenic methane emissions.

Stringent Landfill Rule⁹⁶

Promulgated under the Clean Air Act in March 1996, the New Source Performance Standards and Emissions Guidelines (Landfill Rule) require large landfills to capture and combust their landfill gas emissions. The implementation of the rule began at the state level in 1998. Recent data on the rule’s impact indicate that increasing its stringency has significantly increased the number of landfills that must collect and combust their landfill gas. The current EPA projection is that reductions will be about 10 Tg CO₂ Eq. in 2020.

Landfill Methane Outreach Program⁹⁷

EPA’s Landfill Methane Outreach Program (LMOP) reduces GHG emissions at landfills by supporting the recovery and use of landfill gas for energy. Capturing

and using landfill gas reduces methane emissions directly and reduces CO₂ emissions by displacing the use of fossil fuels through the utilization of landfill gas as a source of energy.

Since the 2006 CAR, the LMOP continues to partner with landfill owners and operators, state energy and environmental agencies, utilities and other energy suppliers, corporations, industry, and other stakeholders to lower the barriers to installing cost-effective landfill gas energy projects. LMOP focuses its efforts on smaller landfills not required to collect and combust their landfill gas, as well as larger, regulated operations that are combusting their gas but not utilizing it as a clean energy source. LMOP has developed a range of technical resources and tools to help the landfill gas industry overcome barriers to energy project development, including feasibility analyses, project evaluation software, a database of more than 500 candidate landfills across the country, a project development handbook, commercial and industrial sector analyses, and economic analyses. Due to these efforts, the number of landfill gas energy projects has grown from approximately 100 in 1990 to 500 projects today. EPA estimates that LMOP reduced GHG emissions from landfills by 19 Tg CO₂ Eq. in 2007, and projects reductions of 30.8 Tg CO₂ Eq. in 2020.

WasteWise⁹⁸

WasteWise encourages waste reduction through preventing and recycling waste and purchasing recycled-content products. EPA is implementing a number of targeted efforts within this program and is working with organizations to reduce solid waste through voluntary waste reduction activities. New efforts since the 2006 CAR include WasteWise Communities, a WasteWise campaign in support of local governments to reduce residential municipal solid waste and its impact on climate change; WasteWise Re-TRAC, a valuable new Web-based tool to assist organizations with tracking and analyzing their waste reduction activities; and the Office Carbon Footprint Tool, which assists office-based organizations in making decisions to reduce the GHG emissions associated with their activities. In addition to program implementation, EPA’s climate and waste programs support outreach, technical assistance, and research efforts on the linkages between climate change and waste management. EPA estimates GHG emission reductions in 2007 were 20 Tg CO₂ Eq. EPA projects reductions will increase to 38 Tg CO₂ Eq. in 2020.

Cross-Sectoral

Carbon Monitoring and Sequestration

Under EISA, DOI’s USGS is charged with assessing the status of U.S. carbon stores.⁹⁹ This includes the potential for global, active, long-term containment of carbon in subsurface geologic areas and the natural capacity of ecosystems—including forests, soils, wet-

⁹³ See <http://www.forestsandrangelands.gov/reports/documents/2001/8-20-en.pdf>.

⁹⁴ See http://www.forestsandrangelands.gov/plan/documents/10-YearStrategyFinal_Dec2006.pdf.

⁹⁵ See <http://www.fs.fed.us/woodybiomass/opportunities.shtml>.

⁹⁶ See <http://www.epa.gov/ttn/atw/landfill/landflpg.html>.

⁹⁷ See <http://www.epa.gov/lmop/>.

⁹⁸ See <http://www.epa.gov/waste/partnerships/wastewise/index.htm>.

⁹⁹ See http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=110_cong_public_laws&docid=f:publ140.110.pdf.

lands, and coastal areas—to store carbon. DOI, in consultation with DOE, USDA, and others, conducts national assessments of biologic carbon sequestration, ecosystem GHG fluxes, and potential effects of management practices and policies on ecosystem carbon sequestration and GHG emissions. This work is essential to developing science-based best management practices for GHG mitigation within the United States and globally.

USGS scientists are helping to assess ways to limit human-caused CO₂ emissions and remove GHGs from the atmosphere through both geologic and biological carbon sequestration. They are also closely evaluating the potential environmental risks and economic costs of capturing and storing CO₂, as well as other carbon management strategies, and are studying the global carbon cycle by observing both natural and human sources for CO₂ and how it moves and interacts in the environment. These data are crucial to establishing a baseline of carbon and GHG emissions essential to source attribution and reduced uncertainty in global carbon and climate models.

USGS also operates remote-sensing and satellite monitoring systems, such as Landsat, which help monitor afforestation and prevention of deforestation efforts globally. The Landsat data set contains over 2.4 million scenes of the Earth's surface spanning over 37 years and is the only global, radiometrically accurate, terrestrial database available today. As such, it is critical to studying land-use trends and ecosystem performance that occurs as a consequence of climate change. Landsat is Web-enabled and delivered over 1 million scenes to 166 countries during FY 2009.

*Interagency Partnership for Sustainable Communities*¹⁰⁰

In June 2009, DOT, HUD, and EPA announced the Interagency Partnership for Sustainable Communities.¹⁰¹ This partnership has identified six principles to guide the alignment of federal transportation, environmental protection, and housing policies:

- Provide more transportation choices.
- Promote equitable, affordable housing.
- Enhance economic competitiveness.
- Support existing communities.
- Coordinate polices and leverage investment.
- Value communities and neighborhoods.

The interagency partnership will pursue these principles by establishing incentives for integrated regional design, identifying and removing federal barriers to sustainable design strategies, and providing information and training to federal employees to incorporate these principles at the local level. Key benefits of this partnership include reduced vehicle miles traveled, lower per-capita GHG emissions, and reduced dependence on fossil fuels.

*Voluntary Greenhouse Gas Reporting in Agriculture and Forestry*¹⁰²

In 2006, USDA completed the first phases of its development of comprehensive accounting rules and guidelines for forest and agriculture GHG emissions and carbon sequestration. These technical guidelines enable farmers, ranchers, and forest landowners to construct entity-level GHG inventories that account for emissions and removals from virtually all agriculture and forestry sources and sinks. By preparing annual inventories, farmers and forest landowners can quantify and track changes in GHG emissions and terrestrial carbon sequestration associated with changes in production activities and land-use practices. DOE has adopted USDA's technical guidelines for use in this voluntary GHG reporting program, which was originally established by Section 1605(b) of the Energy Policy Act of 1992. USDA will continue to develop technical guidelines and science-based methods for energy efficiency and quantifying GHG emissions and removals from agriculture and forestry sources and sinks, as directed by EISA.

*Climate Leaders*¹⁰³

EPA launched Climate Leaders in 2002. In recent years, the program has initiated work in several new areas—providing lower-emitting companies with more streamlined tools and guidance, advancing measurement of indirect emissions associated with firms' supply chains, and allowing partners to meet their voluntary reduction goals with offsets. Companies that join the partnership receive a number of benefits, such as understanding and managing their emissions, increased identification of cost-effective reduction opportunities, and strategic preparation for the future as the climate change policy discussion evolves. Climate Leader partners set aggressive, corporate-wide GHG reduction goals and conduct annual inventories of their emissions to measure progress. The program has expanded from its original 12 Charter Partners to over 250 partners across a number of industrial sectors from heavy manufacturing to banking and retail. The GHG emissions from these partners comprise more than 8 percent of total U.S. emissions.

*Climate Showcase Communities Grant Program*¹⁰⁴

In 2009, EPA issued \$10 million in grants through the Climate Showcase Communities program, an initiative to help local and tribal governments take steps to reduce GHG emissions while achieving additional environmental, economic, and social benefits.¹⁰⁵ The goal of these grants was to create models of community action that generate cost-effective and persistent GHG reductions and can be replicated across the country. Local and tribal activities funded through the grants included energy performance in municipal, residential, commercial, and industrial operations; land use and transportation; waste management; renewable

¹⁰⁰ See <http://www.epa.gov/dced/2009-0616-epahuddot.htm>.

¹⁰¹ See <http://www.dot.gov/affairs/2009/dot8009.htm>.

¹⁰² See http://www.usda.gov/oc/global_change/gg_reporting.htm.

¹⁰³ See <http://www.epa.gov/climateleaders/>.

¹⁰⁴ See <http://www.epa.gov/RDEE/energy-programs/state-and-local/showcase.html>.

¹⁰⁵ See <http://www.epa.gov/RDEE/energy-programs/state-and-local/showcase.html>.

energy; heat island management; removal of barriers to GHG management; and other innovative activities that generate measurable reductions of GHGs. EPA is offering peer exchange, training, and technical support to grant recipients, and showcasing the recipients' successes to spur additional action.

State Climate and Energy Partner Network¹⁰⁶

The State Climate and Energy Partner Network is the next generation of EPA's Clean Energy-Environment State Partnership, which operated from 2005 to 2009 and included 16 partner states (California, Colorado, Connecticut, Georgia, Hawaii, Massachusetts, Minnesota, New Jersey, New Mexico, New York, North Carolina, Ohio, Pennsylvania, Texas, Utah, and Virginia). Through the partnership, each state took important steps toward developing clean energy action plans and integrating energy and environmental strategies to achieve multiple benefits. Lessons learned from the partnership will be shared broadly through the new partner network.

Climate Friendly Parks¹⁰⁷

Climate Friendly Parks (CFP) was launched in 2003 as a collaborative partnership between NPS and EPA. Run independently by NPS since July 2009, the CFP program is dedicated to helping NPS and the general public understand the interaction between climate change and national parks. The program now involves more than 70 parks and focuses on providing the necessary tools and resources so that parks can (1) measure their GHG emissions, (2) plan ways to reduce their impact on the global climate, (3) adapt to a changing climate, and (4) effectively promote sound science by educating park staff and the public about climate change. CFP's Climate Leadership in Parks tool, an Excel-based calculator designed for parks to assess their own GHG emissions, focuses on in-park operational activities, such as electricity use, transportation, waste and wastewater treatment, and other GHG-emitting activities inside parks.

National Action Plan for Energy Efficiency¹⁰⁸

Since 2005, DOE and EPA have facilitated the National Action Plan for Energy Efficiency, which engages more than 60 leading electric and gas utilities, state utility regulators and energy agencies, energy consumers, and others. The Action Plan focuses on the critical state-level policies that have a profound impact on the overall level of investment in energy efficiency across the country. Through its "Vision for 2025," this leadership group offers a complete policy framework to implement substantial cost-effective energy efficiency measures by 2025. A number of best-practice-based guides, reports, and tools are available to help organizations expand and meet their commitments to energy efficiency.

State Energy Program¹⁰⁹

The State Energy Program (SEP) provides grants and technical assistance to states and U.S. territories to promote energy conservation and reduce the growth of energy demand in ways that are consistent with national energy goals. State energy offices use SEP funds to develop state plans that identify new opportunities for states to adopt renewable energy and energy efficiency technologies. SEP funds are also used to implement programs to improve energy sustainability.

SEP is the only program in the DOE Office of Energy Efficiency and Renewable Energy that supports outreach for energy technologies in every sector of the economy: industry; businesses; residences; public facilities, schools, and hospitals; and transportation. SEP effectively leverages investment in renewable energy and energy efficiency. Based on the nationally peer-reviewed 2005 Oak Ridge National Laboratory methodology, for each \$1 of federal investment in SEP, states report \$10 of nonfederal investment in energy projects and \$7.22 savings in energy costs. State energy offices propagate this financial leverage of SEP funds by co-sponsoring energy projects with local stakeholders and private-sector partners. Those partners, in turn, provide feedback and help DOE direct requests for technical assistance.

SEP is playing a central role in implementing ARRA. Under ARRA, states have received \$3.1 billion for energy projects through SEP. These funds are allocated among the states according to the following formula: one-third equally among states and territories, one-third according to population, and one-third according to energy consumption. States will use this funding to upgrade the efficiency of state and local facilities, expand utility energy efficiency programs that help families save money on their energy bills, promote consumer products that carry the ENERGY STAR® label for energy efficiency, and invest in alternative fuel infrastructure.

Federal Government Programs

Federal Energy Management Program¹¹⁰

The federal government is the largest single user of energy in the nation. DOE's Federal Energy Management Program (FEMP) works to reduce the cost and environmental impact of the federal government by advancing energy efficiency and water conservation, promoting the use of distributed and renewable energy, and improving utility management decisions at federal sites. FEMP accomplishes its mission by leveraging both federal and private resources to provide federal agencies with the technical and financial assistance they need to achieve their energy goals and statutory requirements. FEMP provides project transaction services (assistance with alternative financing mechanisms), applied technology services, and decision support services. FEMP also provides guidance

¹⁰⁶ See <http://www.epa.gov/cleanenergy/energy-programs/state-and-local/index.html>.

¹⁰⁷ See <http://www.nps.gov/climatefriendlyparks/>.

¹⁰⁸ See <http://www.epa.gov/eactionplan/>.

¹⁰⁹ See http://apps1.eere.energy.gov/state_energy_program/.

¹¹⁰ See <http://www1.eere.energy.gov/femp/>.

and assistance for implementing and managing energy-efficient and alternative-fuel vehicles within federal fleets.

As of 2007, FEMP had assisted federal agencies in reducing the energy intensity of their buildings by 11 percent compared to 2003. DOE estimates that realizing FEMP's goal of providing financing and technical assistance to federal agencies to further the use of cost-effective energy efficiency and renewable energy could result in energy savings of about 3.4 Tg CO₂ Eq. in 2020.

NONFEDERAL POLICIES AND MEASURES

Within the United States, several regional, state, and local initiatives supplement the federal effort to reduce GHG emissions. These policies either directly regulate GHG emissions or encourage investments in energy efficiency and renewable energy, thereby leading to GHG reductions. Through the U.S. Department of State and its Office of Global Intergovernmental Affairs, the results of and feedback from state and local climate protection efforts will play an integral role in the development of the federal actions to address climate change. In addition, some of these actions serve as a model for countries that are beginning to formulate their response to climate change because they can be tailored to local and regional conditions, are often scalable, and can create economic opportunities and job growth through the promotion of clean energy.

Direct Greenhouse Gas Policies and Measures

Regional Initiatives

Many states have joined regional initiatives to reduce GHG emissions and promote clean energy. States participating in regional GHG cap-and-trade initiatives are shown in Figure 4-1.

Regional Greenhouse Gas Initiative

Launched on January 1, 2009, the Regional Greenhouse Gas Initiative (RGGI) is the first mandatory market-based U.S. cap-and-trade program to reduce GHG emissions. Emissions from large electricity generators in 10 Northeast and Mid-Atlantic states are capped at approximately 188 million short tons (approximately 171 million metric tons) of CO₂ per year from 2009 to 2014. Then the cap will be reduced by 2.5 percent in each of the four years from 2015 through 2018, for a total reduction of 10 percent. As of August 2009, the RGGI states auctioned more than 110 million allowances and raised \$367 million. Most states have decided to auction the majority of allowances for public benefit and use the proceeds to invest in energy efficiency improvements and renewable energy programs at the state and local levels.¹¹¹

Western Climate Initiative

The Western Climate Initiative (WCI) was launched in February 2007 by the governors of five western states, with the goal of aggregate GHG emission re-

ductions of 15 percent below 2005 levels by 2020. Beginning in 2012, WCI aims to cap emissions from the electricity sector (including imported electricity) and large industrial sources (including combustion and process emissions). The second phase is set to begin in 2015, when the program expands to include transportation fuels and residential, commercial, and industrial fuels not otherwise covered.¹¹² The WCI also includes commitments to “complementary policies” promoting clean energy.

Midwestern Greenhouse Gas Reduction Accord

The Midwestern Greenhouse Gas Reduction Accord includes six midwestern states that have agreed to develop a market-based and multisector cap-and-trade mechanism, along with complementary policies to help achieve GHG reduction targets. Details and recommendations are under development, but the group is considering mid-term targets that would reduce emissions by 16–20 percent from 2005 levels by 2020 and long-term targets that would reduce emissions by 80 percent¹¹³ from 2005 levels by 2050.¹¹⁴

State Policies and Measures

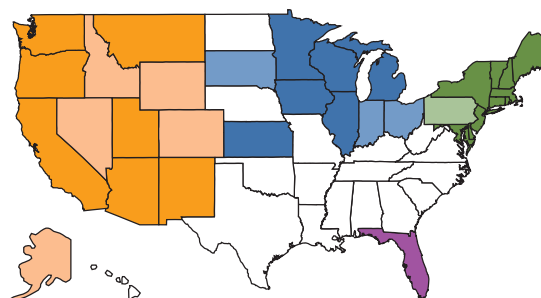
Many state governments are reducing GHG emissions through a wide range of policies and measures, from voluntary measures, such as tax credits, to legislative mandates, such as state GHG caps. Appreciating the value of collaboration, states are working with public- and private-sector stakeholders to develop the most cost-effective mitigation strategies. Table 4-2 illustrates the range of actions that states are taking on climate change.

State Emission Targets and Caps

As of November 2009, 23 of the 50 states had adopted a state GHG reduction target, although these vary in stringency, timing, and enforceability. In 2006, Cali-

Figure 4-1 U.S. Regional Climate Initiatives

Many states across the nation have joined regional initiatives to reduce greenhouse gas emissions and promote clean energy.



- Regional Greenhouse Gas Initiative (RGGI)
- RGGI Observer
- Midwest Greenhouse Gas Reduction Accord (MGGRA)
- MGGRA Observer
- Western Climate Initiative (WCI)
- WCI Observer
- Individual State Cap-and-Trade Program

Source: Pew Center on Global Climate Change.

¹¹¹ See <http://www.rggi.org/>.

¹¹² See <http://www.westernclimateinitiative.org/>.

¹¹³ See <http://www.pewclimate.org/node/6572>.

¹¹⁴ See <http://www.midwesternaccord.org/>.

California became the first state to adopt legislation specifying mandatory GHG reductions. It was soon joined by Hawaii, New Jersey, Washington, Connecticut, Massachusetts, Minnesota, and Maryland. These laws cap state GHG emissions by a certain percentage relative to a baseline year, such as 1990. For example, California's Global Warming Solution Act has capped the state's GHG emissions at 1990 levels by 2020.¹¹⁵ In May 2009, Maryland passed a law requiring that the state achieve a 25 percent reduction in GHG emissions from 2005 levels by 2020. Maryland expects that decreasing emissions by this amount will have a positive net economic benefit of \$2 billion by 2020.¹¹⁶

In another example of state-based action on climate change, Florida passed legislation in 2008 that authorizes its Department of Environmental Protection to develop a cap-and-trade program for the electric utility sector. The state is currently evaluating whether to implement its own program or join one of the other existing regional cap-and-trade programs.

Performance Standards for Electric Power

As of July 2009, five states had enacted legislation requiring entities that sell electricity to customers to adhere to a standard of maximum allowable emissions per megawatt-hour (MWh) of electricity produced. In California, for example, the maximum emission level is 1,100 pounds (500 kg) of CO₂ per MWh of electricity produced.¹¹⁷

Local Policies and Measures County Climate Protection Program

The County Climate Protection Program, under the aegis of the National Association of Counties (NACo), works to encourage and support counties in their actions to combat climate change. Several counties have made significant strides in implementing and achieving the objectives of emissions reduction and air quality improvement. The Fresh AIRE Program of Arlington, Virginia, and the Climate Protection Campaign of Sonoma County, California, are two examples of work being done under the County Climate Protection Program.

Local Governments for Sustainability

Several counties and municipalities are also making commitments to Local Governments for Sustainability (ICLEI), such as California's Alameda and San Francisco counties, and Florida's Miami-Dade County. These partnerships encourage the establishment and implementation of goals to reduce GHG emissions. Special attention is paid to producing identifiable and measurable results from these goals.

National League of Cities

The National League of Cities (NLC) is a driving force in strengthening and promoting local government in the United States. NLC is actively coordinating and encouraging climate change initiatives across the na-

tion. NLC's commitment to sustainability is illustrated by the climate protection agreements and pledges made at the 2009 Congress of Cities, and also by NLC's determination to urge Congress and the Obama administration to study and address climate change.

Examples of initiatives undertaken by NLC members include the Clean and Green Program in Riverside, California; the Cambridge Energy Alliance in Cambridge, Massachusetts; and the Energy Efficiency and Climate Change Rally for residents and local businesses in Waterbury, Vermont.

U.S. Conference of Mayors Climate Protection Agreement

To date, 965 mayors have signed the U.S. Conference of Mayors Climate Protection Agreement to reduce GHG emissions in their cities to 7 percent below 1990 levels by 2012.¹¹⁸ While signatories are embracing a wide range of measures to meet this ambitious goal, recent best practices award winners include Denver, which has reduced emissions by over 60,000 metric tons of CO₂ through investment in rapid transit, and San Francisco, whose restaurant grease recycling program is reducing emissions by over 6,000 metric tons of CO₂ annually.¹¹⁹

Cities for Climate Protection Campaign

As of August 2009, 569 U.S. cities and counties are participating in the International Council for Local Environmental Initiatives' Cities for Climate Protection Campaign.¹²⁰ Participants pledge to reduce GHG emissions from local government operations and throughout their communities, while the program provides training and technical assistance. Participants are developing plans for their respective communities, such as the Arlington (Virginia) Initiative to Reduce Emissions, which aims to achieve a 10 percent reduction in GHG emissions from county operations by 2012 through building efficiency, employee engagement, and fleet efficiency.¹²¹

Clean Energy and Energy Efficiency Policies and Measures

State Policies and Measures

A number of state governments have made energy efficiency and renewable energy a high priority, recognizing the significant economic and environmental benefits and widespread public support. Table 4-2 illustrates the range of actions that states are taking on clean energy and energy efficiency.

Lead by Example

Many state and local governments lead by example by establishing programs that achieve substantial energy cost savings within their own operations and buildings (owned or leased). These "lead-by-example" programs include energy standards for new buildings, binding usage reduction targets for existing buildings, and innovations in financing efficiency projects. In addition

¹¹⁵ See http://www.pewclimate.org/what_s_being_done/in_the_states/emissionstargets_map.cfm.

¹¹⁶ See http://www.climatestrategies.us/What_New.cfm.

¹¹⁷ Rubin, E.S. "A Performance Standards Approach to Reducing CO₂ Emissions from Electric Power Plants." Coal Initiative Series. Pew Center on Global Climate Change. June 2009.

¹¹⁸ See <http://www.usmayors.org/climateprotection/revise/>.

¹¹⁹ See <http://usmayors.org/pressreleases/uploads/ClimateBestPractices061209.pdf>.

¹²⁰ See <http://www.iclei.org/index.php?id=1484®ion=NA>.

¹²¹ See <http://www.arlingtonva.us/portals/Topics/Climate.aspx>.

Table 4-2 State Actions on Climate Change (as of August 2009)

A number of state governments have made energy efficiency and renewable energy a high priority, recognizing the significant economic and environmental benefits of and widespread public support for taking action.

Type of Action	Participating States	Number of States
Greenhouse Gas Policies and Measures		
Mandatory Greenhouse Gas Reductions ¹	California, Connecticut, Hawaii, Maryland, Massachusetts, Minnesota, New Jersey, Washington	8
Emission Targets and Goals ²	Arizona, Colorado, Florida, Illinois, Maine, Michigan, Montana, New Hampshire, New Mexico, New York, Oregon, Rhode Island, Utah, Vermont, Virginia	15
Greenhouse Gas Performance Standards for Power Plant Emissions ³	California, Illinois, Minnesota, Montana, Oregon, Washington	5
Offsets and Limits on Power Plant Emissions ⁴	California, Massachusetts, Montana, Oregon, New Hampshire, Washington	6
Greenhouse Gas Emission Standards for Vehicles ⁵	Arizona, California, Connecticut, Florida, Maine, Maryland, Massachusetts, New Jersey, New Mexico, New York, Oregon, Pennsylvania, Rhode Island, Vermont, Washington	15
Low-Carbon Fuel Standard ⁶	California	1
Renewable Fuels Standards ⁷	California, Florida, Hawaii, Iowa, Louisiana, Massachusetts, Minnesota, Missouri, Montana, New Mexico, Oregon, Washington	12
Energy Efficiency and Renewable Energy Policies		
Green Building Standards for State Buildings ⁸	Arizona, California, Colorado, Connecticut, Florida, Illinois, Indiana, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Nevada, New Jersey, New Mexico, New York, Oklahoma, Rhode Island, South Carolina, South Dakota, Virginia, Washington	23
Net Metering ⁹	Arizona, Arkansas, California, Colorado, Connecticut, Delaware, District of Columbia, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, Wyoming	46
Green Power Purchasing ¹⁰	Connecticut, Illinois, Indiana, Maine, Maryland, Massachusetts, New York, Pennsylvania, Wisconsin	9
Green Pricing ^{11,12}	Colorado, Iowa, Montana, New Mexico, Oregon, Washington (Alabama, Alaska, Arizona, Arkansas, California, Connecticut, Delaware, District of Columbia, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New York, North Carolina, North Dakota, Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, West Virginia, Wisconsin, Wyoming)	6 (+ 39 states green pricing programs available)
Renewable Portfolio Standards (RPS) ^{13,14}	Arizona, California, Colorado, Connecticut, Delaware, District of Columbia, Hawaii, Illinois, Iowa, Kansas, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oregon, Pennsylvania, Rhode Island, Texas, Washington, Wisconsin (North Dakota, South Dakota, Utah, Vermont, Virginia [Florida])	30 (+ 5 state voluntary standards [and 1 state with a utility that offers an RPS])
Public Benefit Funds for Renewables and Efficiency ^{15,16}	California, Connecticut, Delaware, District of Columbia, Illinois, Maine, Massachusetts, Michigan, Minnesota, Montana, New Jersey, New York, Ohio, Oregon, Pennsylvania, Rhode Island, Vermont, Wisconsin	18
Public Benefits Funds for Energy Efficiency ¹⁷	Hawaii, Nevada, New Hampshire, New Mexico, Nebraska, Texas	6
Energy Efficiency Resource Standards ¹⁸	California, Colorado, Hawaii, Illinois, Maryland, Massachusetts, Michigan, Minnesota, Nevada, New Mexico, New York, New Jersey, North Carolina, Ohio, Pennsylvania, Texas, Vermont, Virginia, Washington	19
Appliance and Equipment Efficiency Standards ¹⁹	Arizona, California, Connecticut, District of Columbia, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island, Vermont, Washington	12
Compliance with Stringent Residential Energy Building Codes ²⁰	Alaska, California, Florida, Georgia, Idaho, Iowa, Kentucky, Louisiana, Maryland, Massachusetts, Minnesota, Nevada, New Hampshire, New Jersey, New Mexico, North Carolina, Oregon, Pennsylvania, Rhode Island, South Carolina, Utah, Vermont, Virginia, Washington, Wisconsin	25

¹ See <http://www.ncsl.org/?TabId=13240>.

² See http://www.pewclimate.org/what_s_being_done/in_the_states/emissionstargets_map.cfm.

³ Rubin, E.S. June 2009. "A Performance Standards Approach to Reducing CO₂ Emissions from Electric Power Plants." Coal Initiative Series. Pew Center on Global Climate Change. See <http://www.pewclimate.org/white-papers/coal-initiative/performance-standards-electric>.

⁴ Pew Center on Climate Change. 2009. "Climate Change 101: State Action." See <http://www.pewclimate.org/docUploads/Climate101-State-Jan09.pdf>.

⁵ See http://www.pewclimate.org/what_s_being_done/in_the_states/vehicle_ghg_standard.cfm.

⁶ See <http://www.pewclimate.org/docUploads/Climate101-State-Jan09.pdf>.

⁷ See <http://www.pewclimate.org/docUploads/Climate101-State-Jan09.pdf>.

⁸ See http://www.pewclimate.org/what_s_being_done/in_the_states/leed_state_buildings.cfm.

⁹ See <http://www.dsireusa.org/summarytables/rrpre.cfm>.

¹⁰ See <http://www.dsireusa.org/summarytables/rrpre.cfm>.

¹¹ See <http://apps3.eere.energy.gov/greenpower/markets/pricing.shtml?page=4>.

¹² See http://www.pewclimate.org/what_s_being_done/in_the_states/west_coast_map.cfm.

¹³ See <http://www.dsireusa.org/summarytables/rrpre.cfm>.

¹⁴ See http://www.pewclimate.org/what_s_being_done/in_the_states/rps.cfm.

¹⁵ See <http://www.dsireusa.org/summarytables/rrpre.cfm>.

¹⁶ See http://www.pewclimate.org/what_s_being_done/in_the_states/public_benefit_funds.cfm.

¹⁷ See http://www.pewclimate.org/what_s_being_done/in_the_states/public_benefit_funds.cfm.

¹⁸ See http://www.pewclimate.org/what_s_being_done/in_the_states/efficiency_resource.cfm.

¹⁹ See http://www.pewclimate.org/what_s_being_done/in_the_states/energy_eff_map.cfm.

²⁰ See http://www.pewclimate.org/what_s_being_done/in_the_states/res_energy_codes.cfm.

to reducing state energy bills and emissions, these efforts demonstrate the feasibility and benefits of clean energy to the larger market.

Net Metering

Most states have at least one utility that permits customers to sell electricity back to the grid, a practice known as net metering.¹²² Net metering is available statewide in 18 states, and is offered by select utilities in 27 states.¹²³ Limits on the capacity of eligible installations range from 10 kW in Indiana to 80 MW in New Mexico.¹²⁴ While the utilization of these programs varies greatly among states and utilities, PG&E in California has reported more than 31,600 total installations with a combined capacity of 275 MW of solar and wind power as of June 2009, representing 1.3 percent of the peak load (the program is limited to 2.5 percent of the peak load).¹²⁵

Renewable Energy Standards

A mandatory renewable energy standard (RES), sometimes referred to as a renewable portfolio standard (RPS), requires utilities to generate a certain amount of electricity or install a certain amount of capacity from renewable energy sources in a set time frame. As of November 2009, 30 states had mandatory RES programs, and an additional 5 states had voluntary RES programs.^{126, 127}

In 1999, Texas passed its first RPS, which mandated that electricity providers collectively provide 2,000 MW of additional renewable energy capacity by 2009. The program exceeded expectations, and the state reached this goal in six years. During that time, wind power development in Texas more than quadrupled. In 2005, the state legislature expanded the RPS mandate to 5,880 MW by 2015, with a target of 10,000 MW for 2025. The required increase in renewable energy generation capacity is allocated between providers according to percentage market share of energy sales. Like most states with an RES in place, the Texas program includes a renewable energy credit (REC) program that allows utility companies to buy or trade RECs and use them toward compliance. In Texas, each REC represents 1 MW of installed capacity from renewable sources. If a utility earns extra RECs through its renewable energy generation, it may sell these credits to other utilities that do not have sufficient renewable energy capacity to meet the RPS requirements.¹²⁸

Although Massachusetts has had an RPS program since the late 1990s, in July 2008 the state doubled existing requirements by mandating that its RPS requirement must grow by 1 percent per year. Under these guidelines, renewable energy will account for 15 percent of electricity generation by 2020 and 25 percent by 2030. The new legislation also divided renewable energy into two classes based on age of operating facility in order to support the continued operation of

older renewable energy facilities. In Massachusetts, electricity providers may meet their obligations by producing renewable energy, purchasing a REC or paying an Alternative Compliance Payment.^{129, 130}

Public Benefit Funds

Currently, 24 states have some form of public benefit funds, in which utility consumers pay a small charge to a common fund, often as part of the monthly billing cycle. The utility uses these funds to invest in energy efficiency and renewable energy projects, such as home weatherization and renewable technologies. Existing funds are anticipated to generate \$7.3 billion for renewable energy by 2017.^{131, 132, 133}

Tax Credits for Renewable Energy

Currently 21 states offer personal and/or corporate tax credits for investment in renewable energy.¹³⁴ Oregon's program includes both residential tax credits for small-scale renewable capacity and business tax credits up to \$20 million for renewable energy equipment manufacturing, thereby cultivating both renewable energy and green jobs in the state.¹³⁵ Most other states offer some type of deduction or exemption from sales, income, corporate, or property taxes tied to renewable energy.¹³⁶

Local Policies and Measures

Local, state, and tribal governments and territories are using funds made available under ARRA through the Energy Efficiency and Conservation Block Grant Program to develop and implement projects that improve energy efficiency and reduce energy consumption. The first 19 cities and counties received funds in July 2009 to develop energy efficiency and conservation strategies, to be supported with additional funds for implementation.¹³⁷

Many local and tribal governments are developing their own programs to foster the development of renewable energy. The City of Madison (Wisconsin) has initiated the MadiSUN Solar Energy Program to double solar electric and solar hot water installations by 2011, which would reduce the city's CO₂ emissions by 100,000 tons. The Ogala Sioux Tribe Renewable Energy Development Authority will oversee community and commercial-scale renewable energy development on the Pine Ridge Indian Reservation in South Dakota. The Authority estimates that the reservation has the potential to develop several hundred megawatts of wind power.¹³⁸

Local governments are also active in promoting weatherization projects in their jurisdictions. For example, the City of Portland's (Oregon) Block-by-Block Weatherization Program provides basic weatherization and education to low-income households, and hopes to weatherize 1,250 homes by 2020, reducing annual energy demand by 215 billion Btus (63,000 MWh).¹³⁹

¹²² See http://www.pewclimate.org/what_s_being_done/in_the_states/net_metering_map.cfm.

¹²³ See <http://www.dsireusa.org/summarytables/rprpre.cfm>.

¹²⁴ See <http://www.dsireusa.org/summarytables/rprpre.cfm>.

¹²⁵ See <http://www.pge.com/mybusiness/energysavingsrebates/solar/nemtracking/index.shtml>.

¹²⁶ See <http://www.dsireusa.org/summarytables/rprpre.cfm>.

¹²⁷ See http://www.pewclimate.org/what_s_being_done/in_the_states/rps.cfm.

¹²⁸ See http://www.seco.cpa.state.tx.us/re_rps-portfolio.htm.

¹²⁹ See http://www.pewclimate.org/what_s_being_done/in_the_states/rps.cfm.

¹³⁰ See http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=MA05R&state=MA&CurrentPageID=1.

¹³¹ See <http://www.dsireusa.org/summarytables/rprpre.cfm>.

¹³² See http://www.pewclimate.org/what_s_being_done/in_the_states/public_benefit_funds.cfm.

¹³³ See http://www.dsireusa.org/documents/SummaryMaps/PBF_Map.ppt.

¹³⁴ See http://www.dsireusa.org/documents/SummaryMaps/TaxIncentives_Map.ppt.

¹³⁵ See <http://www.dsireusa.org/incentives/index.cfm?re=1&ce=&spv=0&st=0&srp=1&state=OR>.

¹³⁶ See <http://www.dsireusa.org/summarytables/finre.cfm>.

¹³⁷ See <http://www.eecbg.energy.gov/>.

¹³⁸ See <http://www.indiancountrytoday.com/national/50848652.html>.

¹³⁹ See <http://www.smartcommunities.ncat.org/success/block.shtml>.

Table 4-3 Summary of U.S. Actions to Reduce Greenhouse Gas Emissions (Tg CO₂ Eq.)¹

Name of Policy or Measure	Objective and/or Activity Affected	Greenhouse Gas Affected	Type of Program	Status	Implementing Entities	Estimated Mitigation Impact for 2007	Estimated Mitigation Impact for 2010	Estimated Mitigation Impact for 2015	Estimated Mitigation Impact for 2020
Energy: Residential and Commercial²									
Appliances and Commercial Equipment Standards Program, Appliance Energy Efficiency Standards	Analyzes, develops, reviews and updates efficiency standards for most major household appliances and major commercial building technologies and equipment.	CO ₂	Regulatory	Implemented	DOE	0.0	1.3	4.3	6.1
Building Energy Codes Program	Promotes stronger building energy codes and helps states adopt, implement, and enforce them. Recognizes that energy codes maximize energy efficiency only when they are fully embraced by users and supported through education, implementation, and enforcement.	CO ₂	Regulatory	Implemented	DOE	0.0	1.3	5.8	11.3
Lighting Energy Efficiency Standards	Mandates standards that will result in phasing out the 130-year-old incandescent light bulb by the middle of the next decade and phases out less efficient fluorescent tubes. New standards will also apply to reflector lamps—the cone-shaped bulbs used in recessed and track lighting.	CO ₂	Regulatory	Implemented	DOE	0.0	0.4	1.2	1.5
ENERGY STAR Labeled Products	Labels distinguish energy-efficient products in the marketplace.	CO ₂	Voluntary	Implemented	EPA/DOE	64.5	82.5	113.6	141.2
ENERGY STAR for the Commercial Market	Promotes the improvement of energy performance in commercial buildings.	CO ₂	Voluntary	Implemented	EPA	66.0	56.8	75.0	93.5
ENERGY STAR for the Residential Market	Promotes the improvement of energy performance in residential buildings beyond the labeling of products.	CO ₂	Voluntary	Implemented	EPA	1.8	5.5	21.1	44.0
Net-Zero-Energy Commercial Building Initiative	Achieves marketable net-zero-energy commercial buildings by 2025. Encompasses all activities that support this goal, including industry partnerships, research, and tool development.	CO ₂	Voluntary	Implemented	DOE	N/A	8.2	12.7	15.5
Building America	Develops cost-effective solutions that reduce the average energy use of housing by 40–100% through research partnerships with all facets of the residential building industry.	CO ₂	Economic	Implemented	DOE	0.0	3.8	11.0	19.8
Energy Efficiency and Conservation Block Grants	Provides funds to units of local and state government, Native American nations, and territories to develop and implement projects to improve energy efficiency and reduce energy use and fossil fuel emissions in their communities.	CO ₂	Economic	Implemented	DOE	N/A	N/A	N/A	N/A

Table 4-3 (Continued) **Summary of U.S. Actions to Reduce Greenhouse Gas Emissions (Tg CO₂ Eq.)¹**

Name of Policy or Measure	Objective and/or Activity Affected	Greenhouse Gas Affected	Type of Program	Status	Implementing Entities	Estimated Mitigation Impact for 2007	Estimated Mitigation Impact for 2010	Estimated Mitigation Impact for 2015	Estimated Mitigation Impact for 2020
Energy: Residential and Commercial² (Continued)									
Weatherization Assistance Program	Enables low-income families to permanently reduce their energy bills by making their homes more energy efficient.	CO ₂	Economic	Implemented	DOE	N/A	6.7	7.8	8.9
Energy: Industrial									
ENERGY STAR for Industry	Enables industrial companies to evaluate and cost-effectively reduce energy use.	CO ₂	Voluntary	Implemented	EPA	23.1	18.0	25.6	36.6
Save Energy Now	National initiative of the Industrial Technologies Program to drive a 25% reduction in industrial energy intensity in 10 years.	CO ₂	Voluntary	Implemented	DOE	N/A	9.4	28.2	28.9
Industrial Assessment Centers	Provide in-depth assessments of a plant's site and its facilities, services, and manufacturing operations.	CO ₂	Voluntary	Implemented	DOE	N/A	0.6	2.7	5.1
Industry-Specific and Cross-Cutting RDD&D	Develops and delivers advanced energy efficiency, renewable energy, and pollution prevention technologies for industrial applications through partnerships with industry, government, and nongovernment organizations.	CO ₂	Information and Research	Implemented	DOE	N/A	0.0	0.8	3.4
Energy: Supply									
Solar Energy Development Program	Provides opportunities for and encourages use of federal public lands for the development of solar energy.	CO ₂	Research and Information	Implemented	DOI	N/A	N/A	N/A	N/A
Wind Energy Program	Seeks to improve the cost-effectiveness of wind energy technology and lower market and regulatory barriers to the use of wind.	CO ₂	Research and Information	Implemented	DOE	N/A	1.9	30.2	67.6
Geothermal Energy Development Program	Provides opportunities for and encourages use of federal public lands for the development of geothermal energy.	CO ₂	Research and Information	Implemented	DOI	N/A	N/A	N/A	N/A
Energy Transmission Infrastructure	Provides for new and updated transmission for new energy development and improvement of the existing system.	CO ₂	Voluntary	Initiated	DOI	N/A	N/A	N/A	N/A
Energy Smart Parks	Works to reduce carbon emissions in all aspects of national park operations and deploys renewable and efficient energy technologies throughout the national park system.	CO ₂	Voluntary	Initiated	DOI/DOE	N/A	N/A	N/A	N/A

Table 4-3 (Continued) **Summary of U.S. Actions to Reduce Greenhouse Gas Emissions (Tg CO₂ Eq.)¹**

Name of Policy or Measure	Objective and/or Activity Affected	Greenhouse Gas Affected	Type of Program	Status	Implementing Entities	Estimated Mitigation Impact for 2007	Estimated Mitigation Impact for 2010	Estimated Mitigation Impact for 2015	Estimated Mitigation Impact for 2020
Energy: Supply (Continued)									
Clean Energy Initiative; Green Power Partnership; Combined Heat and Power Partnership	Remove market barriers to increased penetration of a cleaner, more efficient energy supply.	CO ₂	Voluntary, Education	Implemented	EPA	17.6	19.8	44.0	73.3
Indian Education Renewable Energy Challenge	Provides opportunities for students attending tribal high schools and colleges to pursue careers in the fields of green and renewable energy.	—	Voluntary	Initiated	DOI/DOE	N/A	N/A	N/A	N/A
University-National Park Energy Partnership Program	Provides parks assistance in addressing their energy concerns.	CO ₂	Voluntary	Initiated	DOI/DOE	N/A	N/A	N/A	N/A
Biorefinery Assistance	Provides loan guarantees for the development, construction, and retrofitting of commercial-scale biorefineries, and grants to help pay for the development and construction costs of demonstration-scale biorefineries.	CO ₂	Economic	Implemented	USDA	N/A	N/A	N/A	N/A
Nuclear Power (AFCI, NP2010, Loan Guarantee Program, Standby Support for Certain Delays, PAA)	Provides risk insurance against construction and operational delays beyond the control of the plants' sponsors and against liability claims from nuclear incidents. Also provides loan guarantees for new plants and R&D support for advanced nuclear technologies.	CO ₂	Economic, Fiscal, Regulatory, Research	Implemented	DOE	0.0	0.0	5.2	14.4
Renewable Energy Production Incentive	Provides financial incentives for electricity generated by new qualifying renewable energy generation, cost-sharing incentives for RDD&D of renewable energy technology manufacturing, and 50% matching grants for small-scale renewable projects.	CO ₂	Economic, Fiscal, Research	Implemented	DOE	N/A	N/A	N/A	N/A
Rural Energy for America Program	Provides grants and loan guarantees to rural residents, agricultural producers, and rural businesses for energy efficiency and renewable energy systems, energy audits, and technical assistance; and for projects ranging from biofuels to wind, solar, geothermal, methane gas recovery, advanced hydro, and biomass.	CO ₂	Economic	Implemented	USDA	2.0	0.9	0.7	1.2

Table 4-3 (Continued) **Summary of U.S. Actions to Reduce Greenhouse Gas Emissions (Tg CO₂ Eq.)¹**

Name of Policy or Measure	Objective and/or Activity Affected	Greenhouse Gas Affected	Type of Program	Status	Implementing Entities	Estimated Mitigation Impact for 2007	Estimated Mitigation Impact for 2010	Estimated Mitigation Impact for 2015	Estimated Mitigation Impact for 2020
Energy: Supply (Continued)									
Solar Energy Technologies Program	Supports R&D and deployment of cost-effective technologies toward growing the use of solar energy throughout the nation and the world. Seeks to make solar electricity cost-competitive with conventional forms of electricity by 2015.	CO ₂	Research and Information	Implemented	DOE	N/A	0.2	1.5	2.5
Wind Energy Development Program	Provides opportunities for and encourages use of federal public lands for development of wind energy.	CO ₂	Voluntary	Implemented	DOI	N/A	N/A	N/A	N/A
Biomass Program (BFI, Integrated Cellulosic Biorefineries and Financial Assistance, Woody Biomass Utilization, BRDI, Grants for Advanced Biofuels, Biorefinery Energy Efficiency)	Develops a portfolio of RD&D geared toward biomass feedstocks and conversion technologies. Includes development and deployment of infrastructure and opportunities for market penetration of bio-based fuels and products.	CO ₂	Research and Information	Implemented	DOE	0.0	3.3	29.2	55.2
Coal Technologies (Innovations for Existing Plants, Carbon Sequestration Program, Gasification Technologies Program, CCPI, FutureGen, Demonstration)	Seeks to develop and demonstrate a portfolio of technologies that can increase operating efficiency and capture and permanently store GHGs in new commercial-scale plants or existing plants. Also includes tax credits.	CO ₂	Research, Fiscal, Information	Implemented	DOE	0.0	18.6	25.3	23.1
Geothermal Technologies Program	Supports deployment, market transformation, technology diffusion, information, and technical assistance for expanding the use of geothermal resources.	CO ₂	Research and Information	Implemented	DOE	N/A	0.0	1.1	1.8
Transportation									
Renewable Fuel Standard (RFS)	Implements the Energy Independence and Security Act of 2007 requirements revising the RFS. Changes include increasing the total volume of renewable fuel used in transportation to 36 billion gallons by 2022, as well as adding specific volume standards for cellulosic biofuel, biomass-based diesel, and advanced biofuel within the total volume required. Also includes new definitions and criteria for both renewable fuels and the feedstocks used to produce them, including new life-cycle (GHG) emission thresholds for renewable fuels.	All	Regulatory	New: Being Implemented	EPA	N/A	N/A	N/A	138

Table 4-3 (Continued) **Summary of U.S. Actions to Reduce Greenhouse Gas Emissions (Tg CO₂ Eq.)¹**

Name of Policy or Measure	Objective and/or Activity Affected	Greenhouse Gas Affected	Type of Program	Status	Implementing Entities	Estimated Mitigation Impact for 2007	Estimated Mitigation Impact for 2010	Estimated Mitigation Impact for 2015	Estimated Mitigation Impact for 2020
Transportation (Continued)									
Corporate Average Fuel Economy Standards	Raise the fuel economy standard for light-duty trucks for MY 2005–2010.	CO ₂	Regulatory	Implemented	DOT	8.7	29.1	33.7	35.9
Corporate Average Fuel Economy Standards (Model Year 2011)	Raise the fuel economy standard for light-duty trucks and passenger cars for MY 2011 (cumulative with savings from previous rules).	CO ₂	Regulatory	Implemented	EPA/DOT	N/A	N/A	37.6	43.4
National Policy to Establish Vehicle GHG Emissions and Corporate Average Fuel Economy Standards	EPA and DOT are jointly proposing GHG and fuel economy standards for passenger cars, light-duty trucks, and medium-duty passenger vehicles, covering MY 2012–2016. These standards that would achieve an average of 250 grams per mile in 2016 (with a related fuel economy standard of about 35.5 miles per gallon).	All	Regulatory	Implemented	EPA/DOT	N/A	N/A	39.0	132.0
National Clean Diesel Campaign	Works aggressively to reduce diesel emissions across the country through the implementation of proven emission control technologies and innovative strategies with the involvement of national, state, and local partners, including financial support through DERA.	CO ₂ and black carbon	Voluntary, Education, Information	Implemented	EPA	N/A	N/A	N/A	N/A
SmartWay Transport Partnership	Accelerates the uptake of low-GHG technologies and strategies in the freight and consumer sectors.	CO ₂	Voluntary, Information, Education	Implemented	EPA	4.2	15.8	36.8	43
Aviation Fuel Efficiency, Renewable Fuels, and Market Measures ³	Improve aircraft/engine technology and operational procedures, enhance the airspace transportation system to reduce aviation's CO ₂ emissions contribution, develop environmentally clean and affordable alternative fuels, secure energy future for sustainable aviation growth, and apply market measures, such as charges or cap and trade.	CO ₂	Research	Implemented	FAA	N/A	N/A	N/A	N/A
Commercial Aviation Alternative Fuels Initiative	Develops environmentally clean and affordable alternative fuels and secures energy future for sustainable aviation growth.	CO ₂	Research	Implemented	FAA	N/A	N/A	N/A	N/A

Table 4-3 (Continued) **Summary of U.S. Actions to Reduce Greenhouse Gas Emissions (Tg CO₂ Eq.)¹**

Name of Policy or Measure	Objective and/or Activity Affected	Greenhouse Gas Affected	Type of Program	Status	Implementing Entities	Estimated Mitigation Impact for 2007	Estimated Mitigation Impact for 2010	Estimated Mitigation Impact for 2015	Estimated Mitigation Impact for 2020
Transportation (Continued)									
Clean Automotive Technology Program	Searches for cost-effective advanced automotive technologies that cut GHG emissions, increase fuel efficiency, reduce health-related emissions, and are affordable for mainstream consumer and commercial vehicles, while partnering with industry to move these technologies to the road.	CO ₂	Research	Implemented	EPA	N/A	N/A	N/A	N/A
Fuel Cell Technologies Program	Supports R&D of fuel cell technologies and infrastructure for electricity generation and transportation to reduce energy use, GHG emissions, and criteria pollutants	CO ₂	Research	Implemented	DOE	0.0	0.0	0.0	0.0
Federal Transit Program	Provides grants and technical assistance to support public transportation systems across the country.	All	Voluntary	Implemented	DOT	N/A	N/A	N/A	N/A
Transit Investments for Greenhouse Gas and Energy Reduction	Provides funds to public transit agencies for capital investments that will assist in reducing the energy consumption or GHG emissions of public transportation systems.	All	Voluntary	Implemented	DOT	N/A	N/A	N/A	N/A
Loan Programs (Advanced Battery Loan Guarantee, Advanced Technology Vehicles Manufacturing Incentive)	Provide loan guarantees to advanced vehicle manufacturers and their component suppliers for the construction of facilities that manufacture U.S.-developed and -produced advanced vehicle batteries, lithium ion batteries, and hybrid electrical systems.	CO ₂	Economic	Implemented	DOE	N/A	N/A	N/A	N/A
Congestion Mitigation and Air Quality Improvement Program	Provides states with funds to reduce congestion and to improve air quality through transportation control measures and other strategies.	CO ₂	Fiscal	Implemented	DOT	N/A	N/A	N/A	N/A
Alternative Transport Systems and Use of Clean Vehicles	Replace traditional fueled vehicles with "clean" energy vehicles and reduce the size of vehicles and vehicle fleets.	CO ₂	Voluntary	implemented	DOI	N/A	N/A	N/A	N/A

Table 4-3 (Continued) **Summary of U.S. Actions to Reduce Greenhouse Gas Emissions (Tg CO₂ Eq.)¹**

Name of Policy or Measure	Objective and/or Activity Affected	Greenhouse Gas Affected	Type of Program	Status	Implementing Entities	Estimated Mitigation Impact for 2007	Estimated Mitigation Impact for 2010	Estimated Mitigation Impact for 2015	Estimated Mitigation Impact for 2020
Industry (Non-CO₂)									
Coalbed Methane Outreach Program	Reduces methane emissions from U.S. coal mining operations through cost-effective means.	CH ₄	Education, Information	Implemented	EPA	7.3	9.9	11	12.1
Natural Gas STAR Program	Reduces methane emissions from U.S. natural gas systems through the widespread adoption of industry best management practices.	CH ₄	Voluntary	Implemented	EPA	37	27.5	35.6	46.9
Environmental Stewardship Initiative	Limits emissions of HFCs, PFCs, and SF ₆ in industrial applications.	HFCs, PFCs, SF ₆	Voluntary	Implemented	EPA	17.3	25.5	34.1	44.7
Voluntary Code of the Reductions of Emissions of HFC and PFC Fire Protection Agents	Minimizes non-fire emissions of HFCs and PFCs used as fire-suppression alternatives and protects people and property from the threat of fire through the use of proven, effective products and systems.	HFCs, PFCs	Voluntary	Implemented	EPA	N/A	N/A	N/A	N/A
HFC-23 Partnership	Encourages reduction of HFC-23 emissions through cost-effective practices or technologies.	HFC-23	Voluntary	Implemented	EPA	17.8	22.9	20.7	20.9
Mobile Air Conditioning Climate Protection Partnership	Identifies near-term opportunities to improve the environmental performance of mobile air conditioners and promotes cost-effective designs and improved service procedures to minimize emissions from mobile air conditioning systems.	CO ₂ , HFC-134a	Voluntary, Research	Implemented	EPA	0.0	0.2	13.6	24.6
GreenChill Advanced Refrigeration Partnership	Reduces ozone-depleting and GHG refrigerant emissions from supermarkets.	HFCs	Voluntary, Information, Education	Implemented	EPA	N/A	0.3	1.0	1.9
Responsible Appliance Disposal Program	Reduces emissions of refrigerant and foam-blowing agents from end-of-life appliances.	HFCs	Voluntary	Implemented	EPA	0.0	0.1	0.2	0.4
Significant New Alternatives Policy Program	Facilitates smooth transition away from ozone-depleting chemicals in industrial and consumer sectors.	HFCs, PFCs, SF ₆	Regulatory, Information	Implemented	EPA	115.4	159.8	208.5	243
Voluntary Aluminum Industry Partnership	Encourages reduction of CF ₄ and C ₂ F ₆ where technically feasible and cost-effective.	PFCs	Voluntary	Implemented	EPA	10.0	8.1	8.1	8.2

Table 4-3 (Continued) **Summary of U.S. Actions to Reduce Greenhouse Gas Emissions (Tg CO₂ Eq.)¹**

Name of Policy or Measure	Objective and/or Activity Affected	Greenhouse Gas Affected	Type of Program	Status	Implementing Entities	Estimated Mitigation Impact for 2007	Estimated Mitigation Impact for 2010	Estimated Mitigation Impact for 2015	Estimated Mitigation Impact for 2020
Agriculture									
AgSTAR	Promotes practices to reduce GHG emissions from U.S. farms.	CH ₄	Information, Education	Implemented	EPA/USDA	N/A	N/A	N/A	N/A
Conservation Reserve Program	Encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to native grasses, wildlife plantings, trees, filter strips, or riparian buffers to improve soil, water, wildlife, and other natural resources.	CO ₂ , N ₂ O	Voluntary	Implemented	USDA	59.6	57.1 4	53	53
Environmental Quality Incentives Program	Offers innovation grants to livestock producers and owners of working farmlands to accelerate the development, transfer, and adoption of innovative technologies and approaches, including those that deliver GHG benefits and improve the quality of nutrient management systems.	CO ₂ , CH ₄ , N ₂ O	Voluntary	Implemented	USDA/NRCS	3.9	6.3	10.2	14.2
Conservation Stewardship Program	This new program will provide financial and technical assistance to promote conservation on working cropland, pasture, and range land, as well as forested land that is an incidental part of an agriculture operation. Significant GHG emission reductions are possible, depending on the contracts enrolled.	CO ₂ , CH ₄ , N ₂ O	Voluntary	Implemented Beginning in 2009	USDA	0	0.3	0.6	0.7
Wetlands Reserve Program	Purchases easements and restores the hydrology of previously drained wetlands, frequently restoring woody wetlands and producing carbon sequestration benefits.	CO ₂ , CH ₄ , N ₂ O	Voluntary	Implemented	USDA	0.18	0.19	0.22	0.25
Grassland Reserve Program	Purchases easements to restore or maintain grassland to a good or excellent condition to enhance carbon sequestration.	CO ₂ , CH ₄ , N ₂ O	Voluntary	Implemented	USDA	0.007	0.01	0.02	0.03
Wildlife Habitat Incentives Program	Provides funds to help private landowners create habitat for specific wildlife species, frequently resulting in the establishment of woody and grass species that sequester carbon.	CO ₂ , CH ₄ , N ₂ O	Voluntary	Implemented	USDA	0.2	0.3	0.4	0.5

Table 4-3 (Continued) **Summary of U.S. Actions to Reduce Greenhouse Gas Emissions (Tg CO₂ Eq.)¹**

Name of Policy or Measure	Objective and/or Activity Affected	Greenhouse Gas Affected	Type of Program	Status	Implementing Entities	Estimated Mitigation Impact for 2007	Estimated Mitigation Impact for 2010	Estimated Mitigation Impact for 2015	Estimated Mitigation Impact for 2020
Forestry									
Enhancing Ecosystems Services on Forestland, Grasslands, Parks, and Wildlife Reserves	Conducts regional analyses to determine opportunities for carbon sequestration and to conserve, enhance, and restore, or assist in the adaptation of ecosystems.	CO ₂	Voluntary	Initiated	DOI	N/A	N/A	N/A	N/A
Healthy Forest Initiative	Restores the health of U.S. forests, woodlands, and rangelands. Coordination among DOI, USDA, and DOE and cooperative work with states, tribes, private landowners, nongovernmental organizations, and other interested parties and potential partners is key to success. Improves air quality, particularly emissions from smoke, PM, CO ₂ , and NO _x .	CO ₂	Voluntary	Implemented	USDA	N/A	N/A	N/A	N/A
Woody Biomass Utilization Grants Program	Focuses on creating markets for small-diameter material and low-valued trees removed from forest restoration activities, such as reducing hazardous fuels, handling insect and disease conditions, or treating forestland impacted by catastrophic weather events. Helps communities, entrepreneurs, and others turn residues into marketable forest and/or energy products.	CO ₂	Economic	Implemented	USDA	N/A	N/A	N/A	N/A
Waste Management									
Stringent Landfill Rule	Reduces methane/landfill gas emissions from U.S. landfills.	CH ₄	Regulatory	Implemented	EPA	9.2	9.2	9.5	9.9
Landfill Methane Outreach Program	Reduces methane emissions from U.S. landfills through cost-effective means.	CH ₄	Voluntary, Information, Education	Implemented	EPA	19.1	22.7	26.4	30.8
Waste Wise	Encourages recycling, source reduction, and other progressive integrated waste management activities to reduce GHG emissions.	All	Voluntary, Information, Research	Implemented	EPA	20.1	23.4	29.9	38.1
Cross-Sectoral									
Carbon Monitoring and Sequestration	Assesses the potential for global, active, long-term containment of carbon geologic areas and the natural capacity of ecosystems to store carbon.	CO ₂	Regulatory	Initiated	DOI	N/A	N/A	N/A	N/A

Table 4-3 (Continued) **Summary of U.S. Actions to Reduce Greenhouse Gas Emissions (Tg CO₂ Eq.)¹**

Name of Policy or Measure	Objective and/or Activity Affected	Greenhouse Gas Affected	Type of Program	Status	Implementing Entities	Estimated Mitigation Impact for 2007	Estimated Mitigation Impact for 2010	Estimated Mitigation Impact for 2015	Estimated Mitigation Impact for 2020
Cross-Sectoral (Continued)									
Interagency Partnership for Sustainable Communities	Encourages integrated regional planning by aligning federal policies for housing, transportation, and the environment. Aims to reduce vehicle-miles traveled, per-capita GHG emissions, and dependence on fossil fuels.	All	Voluntary, Economic, and Information	Implemented	EPA/DOT/HUD	N/A	N/A	N/A	N/A
Voluntary Reporting of Greenhouse Gases (1605(b))	Provides a means for organizations and individuals to record the results of voluntary measures to reduce, avoid, or sequester GHG emissions.	All	Voluntary	Implemented	DOE/EPA/USDA	N/A	N/A	N/A	N/A
Climate Leaders	Assists companies with developing long-term comprehensive climate change strategies.	All	Voluntary	Implemented	EPA	N/A	N/A	N/A	N/A
Climate Showcase Communities Grant Program	Creates models of local and tribal government community actions that generate cost-effective and persistent GHG reductions and can be replicated across the country.	All	Economic, Information	Implemented	EPA	N/A	N/A	N/A	N/A
State Climate and Energy Partner Network	Motivates GHG emission reductions as one of several benefits states derive from implementing a comprehensive suite of cost-effective clean energy policies and programs.	All	Information, Education	Implemented	EPA	N/A	N/A	N/A	N/A
Climate Friendly Parks	Parks conduct emission inventories, develop strategies for reducing emissions by developing action plans, and educate park visitors about climate change and what parks are doing to address the issue.	CO ₂	Voluntary	Implemented	DOI	N/A	N/A	N/A	N/A
National Action Plan for Energy Efficiency	Provides policy recommendations, reports, technical assistance, and outreach to encourage states, utilities, and stakeholders to meet electricity and natural gas demand with zero-GHG-emitting energy efficiency.	All	Information, Education	Implemented	EPA/DOE	N/A	N/A	N/A	N/A
State Energy Program	Strengthens and supports the capabilities of states to promote energy efficiency and to adopt renewable energy technologies, helping the nation achieve a stronger economy, a cleaner environment, and greater energy security.	CO ₂	Economic, Information	Implemented	DOE	2.5	3.7	3.7	3.7

Table 4-3 (Continued) **Summary of U.S. Actions to Reduce Greenhouse Gas Emissions (Tg CO₂ Eq.)¹**

Name of Policy or Measure	Objective and/or Activity Affected	Greenhouse Gas Affected	Type of Program	Status	Implementing Entities	Estimated Mitigation Impact for 2007	Estimated Mitigation Impact for 2010	Estimated Mitigation Impact for 2015	Estimated Mitigation Impact for 2020
Federal Programs									
FEMP, Renewable Energy Purchases, Purchasing of Energy-Efficient Products, Fleet Conservation Requirements, Renewable Energy Goals, Efficiency Performance Standards	Promotes energy efficiency and renewable energy use in federal buildings, facilities, and operations.	All	Economic, Information, Education	Implemented	DOE	N/A	0.4	2.3	3.4

¹ Estimates of the mitigation impacts of programs are provided by the federal agency responsible for each individual program, based on the agency's experience and assumptions related to the implementation of voluntary programs. These estimates may include assumptions about the continued or increased participation of partners, development and deployment goals, and/or whether the necessary commercialization or significant market penetration is achieved.

² Estimates of mitigation impacts for individual policies or measures should not be aggregated to the sectoral level, due to possible synergies and interactions among policies and measures that might result in double counting.

³ Aviation fuel efficiency is defined as the fuel burned per unit distance traveled.

⁴ This value may change, depending on the outcome of an interagency process relating to the operation of the Conservation Reserve Program. The value shown is a straight-line interpolation between the values calculated for 2007 and 2012 and may not necessarily reflect the outcome of the interagency process.

AFCI = Advanced Fuel Cycle Initiative; BFI = Biofuels Initiative; BRDI = Biomass Research and Development Initiative; CCPI = Clean Coal Power Initiative; DOE = U.S. Department of Energy; DOI = U.S. Department of the Interior; DOT = U.S. Department of Transportation; C₂F₆ = hexafluoroethane; CF₄ = tetrafluoromethane; CH₄ = methane; CO₂ = carbon dioxide; DERA = Diesel Emissions Reduction Act; EPA = U.S. Environmental Protection Agency; EQIP = Environmental Quality Incentives Program; FAA = Federal Aviation Administration; FEMP = Federal Energy Management Program; GHG = greenhouse gas; GWP = global warming potential; HFCs = hydrofluorocarbons; HUD = U.S. Department of Housing and Urban Development; MY = model year; N₂O = nitrous oxide; N/A = not available; NO_x = nitrogen oxides; NP = nuclear power; NRCS = Natural Resources Conservation Service; PAA = Price-Anderson Act; PFCs = perfluorocarbons; PM = particulate matter; R&D = research and development; RD&D = research, development, and demonstration; RDD&D = research, development, demonstration, and deployment; SF₆ = sulfur hexafluoride; USDA = U.S. Department of Agriculture.