



4 Policies and Measures

In February 2002, President Bush set a national goal to reduce the greenhouse gas (GHG) intensity¹ of the American economy by 18 percent by 2012.² Meeting this commitment will prevent the release of more than 1,833 teragrams of carbon dioxide equivalent (Tg CO₂ Eq.) to the atmosphere, adding to the 255 Tg CO₂ Eq. avoided in 2002. To help achieve this goal, President Bush has taken the following actions:

- created an interagency, cabinet-level committee to coordinate and prioritize federal research on global climate science and advanced energy technologies;
- increased the federal budget for climate change activities; and
- proposed tax incentives that help spur GHG reductions by spurring cleaner, renewable energy and more energy-efficient technologies.

The Administration is pursuing a broad range of policy measures, financial incentives, voluntary programs, and other federal programs that can help to slow the growth in GHG emissions and reduce GHG intensity. The Administration's approach balances near-term opportunities with long-term investments in breakthrough technologies needed for greater emission reductions in the future. These federal efforts span the major sectors of the U.S. economy encompassing generation and use of energy in the commercial, residential, industrial, and transportation sectors; management of agriculture and forestry; and management of waste streams and industrial byproducts. In addition, businesses, state and local governments, and nongovernmental organizations (NGOs) are addressing global climate change in numerous ways.

NATIONAL POLICYMAKING PROCESS

In 2001, the President created the National Climate Change Technology Initiative (NCCTI), charging the Secretaries of Commerce and Energy, working with other federal agencies, to:

- evaluate the state of U.S. climate change technology research and development (R&D) and make recommendations for improvement;
- provide guidance on strengthening basic research at universities and national laboratories, including the development of advanced mitigation technologies that offer the greatest promise for low-cost reductions of GHG emissions;
- develop opportunities to enhance private–public partnerships in applied R&D to expedite innovative and cost-effective approaches to reducing GHG emissions;
- make recommendations for funding demonstration projects for cutting-edge technologies; and

¹ Defined as the amount of CO₂ equivalents emitted per unit of gross domestic product (GDP).

² The national commitment to improve U.S. GHG intensity by 18 percent by 2012 is based on projections of U.S. GHG emissions and GDP as estimated in 2002. The commitment is to improve GHG intensity by 4 percentage points over a *Business As Usual* case, which is expected to avoid GHG emissions of about 100 million metric tons of carbon equivalents (MMTCE) (367 Tg CO₂ Eq.) in 2012 and 500 MMTCE (1,833 Tg CO₂ Eq.) cumulatively by 2012.

- evaluate improved technologies for measuring and monitoring gross and net terrestrial GHG emissions.

In February 2002, the President reorganized federal oversight, management, and administrative control of climate change activities. He established the cabinet-level Committee on Climate Change Science and Technology Integration (CCCSTI), thereby directly engaging the heads of all relevant departments and agencies in guiding and directing climate change activities, and charged the CCCSTI with developing innovative approaches in accord with a number of basic principles:

- Be consistent with the long-term goal of stabilizing GHG concentrations in the atmosphere.
- Be measured, and continually build on new scientific data.
- Be flexible to adjust to new information and take advantage of new technology.
- Ensure continued economic growth and prosperity.
- Pursue market-based incentives and spur technological innovation.
- Base efforts on global participation, including developing countries.³

The CCCSTI makes recommendations to the President on matters concerning climate change science and technology plans, investment, and progress. Under the auspices of the CCCSTI, two multi-agency programs were established to coordinate federal activities in this area: the U.S. Climate Change Science Program (CCSP),⁴ led by the U.S. Department of Commerce (DOC), and the U.S. Climate Change

Technology Program (CCTP), led by the U.S. Department of Energy (DOE). CCSP and CCTP are discussed in greater detail in Chapter 8.

The U.S. global climate change strategy and the progress being made are routinely reviewed by the relevant committees and working groups. This fourth national communication demonstrates U.S. progress toward implementing the provisions of the United Nations Framework Convention on Climate Change in accordance with current knowledge of the science and U.S. efforts to develop longer-term solutions.

Federal Policies and Measures

Federal policies and measures play a central role in achieving the President's GHG intensity goal and longer-term climate change objectives. Policies consist of a balanced mix of near- and long-term, voluntary and regulatory,⁵ research and development, CO₂ and other potent GHGs, and commercial, residential, industrial, and transportation sector initiatives. Federal programs and initiatives provide a comprehensive approach for the near term, and a foundation for climate science and technologies that will reduce uncertainties and deliver even greater emission reductions in the future. The United States will continue to pursue lowering GHG intensity in parallel with reducing the uncertainties in climate science and technology. The domestic policies and programs promoted by the President allow consumers and businesses to make flexible decisions about emission reductions, rather than only mandating particular control options or rigid targets. The President's policies challenge and provide incentives to businesses to reduce their GHG emissions by joining federal partnership programs promoting improved energy efficiency and increased use of renewable energy technologies. Going forward, future initiatives will build on these successes.

With sustained efforts, emission reductions accompanied by economic growth are expected to achieve the President's

goal. Established programs have demonstrated the accomplishments that well-designed policies can achieve. However, the program projections in this chapter should not be compared to the information presented in Chapter 5 and should not be used directly to calculate the national projections.⁶ In addition, several programs are not included in the Chapter 5 projections for a number of reasons, including double counting of benefits and stage of implementation. However, these unscored programs are still expected to contribute to the overall emission reductions and reaching the 2012 target. Representative federal domestic climate programs and their estimated GHG reduction goals are listed in Table 4-2 at the end of this chapter.

NEW INITIATIVES SINCE THE 2002 CAR

Since the last *Climate Action Report* (CAR) was published in 2002, new initiatives have been introduced to augment existing climate change activities at the federal level. They target additional sources of emissions and provide opportunities for significant reductions. Some examples of these new initiatives follow.

Climate VISION

Climate VISION⁷ assists industry efforts to accelerate the transition to practices, improved processes, and energy technologies that are cost-effective, cleaner, more efficient, and more capable of reducing, capturing, or sequestering GHGs. Already, business associations representing 14 industry sectors and The Business Roundtable have become program partners with the federal government and have issued letters of intent to meet specific targets for reducing GHG emissions intensity. These partners represent a broad range of industry sectors: oil and gas production, transportation, and refining; electricity generation; coal and mineral production and mining; manufacturing; railroads; and forestry products. Partnering sectors account for about 40–45 percent of total U.S. emissions.

³ See <<http://www.climatechange.gov/vision2005/cctp-vision2005.pdf>>.

⁴ See <<http://www.climatechange.gov/>>.

⁵ For example, the Landfill Rule and the Significant New Alternatives Program, discussed later in this chapter.

⁶ The reported impacts of individual policies and measures in this chapter are based on specific assumptions of the impacts and adoption of each measure, but recognize fewer interactions and competitive effects within and between economic sectors than the aggregate estimates used in Chapter 5. For a more detailed explanation, see Chapter 5.

⁷ See <<http://www.climatechange.gov/>>, <<http://www.pi.energy.gov/enhancingGHGRegistry/>>, and <<http://www.eia.doe.gov/oiaf/1605/aboutcurrent.html>>.

Revised Guidelines for Voluntary GHG Emissions Reporting

Revised Guidelines for Voluntary Greenhouse Gas Emissions Reporting under section 1605(b) of the Energy Policy Act of 1992 are intended to encourage utilities, industries, farmers, landowners, and other participants to submit to an on-line registry comprehensive reports on their emissions and emission reductions, including sequestration. The enhanced registry is intended to boost measurement accuracy, reliability, and verifiability, working with and taking into account emerging domestic and international approaches. For the most recent reporting year (2004), 226 U.S. companies and other organizations filed GHG reports.

Climate Leaders

Climate Leaders⁸ was launched in early 2002 to encourage individual companies to develop long-term, comprehensive climate change strategies. Under this program, partners set corporate-wide GHG reduction goals and inventory their emissions to measure progress. The partnership now includes more than 100 partners, half of whom have already set GHG emission reduction goals. The U.S. GHG emissions of these partners are equal to nearly 10 percent of the U.S. total.

Green Power Partnership

As part of the U.S. Environmental Protection Agency's (EPA's) Clean Energy Initiative, the Green Power Partnership⁹ assists organizations in demonstrating environmental leadership by choosing electricity products generated from renewable energy sources. The partnership now has more than 600 partners committed to purchasing more than 4 million megawatt-hours (MWh) of green power (U.S. EPA/OAR 2006).

SmartWay Transport Partnership

SmartWay Transport Partnership¹⁰ works to increase U.S. energy efficiency and energy security, while significantly reducing air pollution and GHGs. It creates strong market-based incentives for corporations and the maritime, trucking, and rail companies that deliver their products to improve the environmental performance of freight operations.

New ENERGY STAR Products

The ENERGY STAR¹¹ program has expanded substantially to include new products and building types, such as schools, grocery stores, hotels, hospitals and medical office buildings, and warehouses. A national campaign challenges building owners and managers to improve energy efficiency by 10 percent or more. New ENERGY STAR-labeled products for homes and businesses have been introduced into the marketplace, including external power supplies, battery chargers, and vending machines. To date, consumers have purchased 2 billion ENERGY STAR-qualified products.

Clean Energy–Environment State Partnership Program

The Clean Energy–Environment State Partnership Program¹² encourages states to develop and implement cost-effective clean energy and environmental strategies that help further both environmental and clean energy goals and achieve public health and economic benefits.

Mobile Air Conditioning Climate Protection Partnership

Launched in 2004, the Mobile Air Conditioning Climate Protection Partnership¹³ strives to reduce GHG emissions from vehicle air conditioning systems through voluntary approaches. The program promotes cost-effective designs and improved service procedures that minimize emissions from mobile air conditioning systems.

Energy Policy Act of 2005

In August 2005, President Bush signed into law the Energy Policy Act of 2005 (EPAct), a bill with far-reaching impacts

on the U.S. energy economy. In addition to R&D programs, EPAct has a number of provisions designed to accelerate market penetration of advanced, clean-energy technologies. The provisions include tax breaks for production from advanced nuclear power; clean coal facilities; integrated gasification-combined cycle; energy-efficient commercial buildings, homes, and appliances (i.e., ENERGY STAR); residential energy-efficient property; business installation of fuel cells and stationary microturbine power plants; business solar investment tax credit; alternative motor vehicle credit; and nuclear power.

EPAct authorizes DOE to enter into loan guarantees for a variety of early commercial projects that use advanced technologies that avoid, reduce, or sequester air pollutants or anthropogenic sources of GHGs, and have a reasonable prospect of the borrower's repayment of the principal and interest on the obligation.¹⁴ Eligible projects include renewable energy systems; advanced fossil fuel technology; hydrogen fuel cell technology; advanced nuclear energy facilities; carbon capture and sequestration practices and technology; efficient end-use energy technologies; efficient energy generation, transmission, and distribution; production facilities for fuel-efficient vehicles; pollution control equipment; and refineries. EPAct also provides standby default coverage for certain regulatory and litigation delays for the first six nuclear power plants. Under this provision, DOE is authorized to indemnify certain covered costs up to \$500 million for each of the first two and \$250 million for each of the next four nuclear power plants if full power operation is delayed because of an unmet regulatory schedule or the initiation of litigation. The provision also offers production tax credits for 6,000 megawatts of new nuclear capacity.

In addition, EPAct mandates an increase in the renewable content of gasoline from 4 billion gallons (15.1 billion liters) in 2006 to 7.5 billion gallons (28.4 billion liters) in 2012, establishes 16 new efficiency mandates covering a variety of

⁸ See <<http://www.epa.gov/climateleaders/>>.

⁹ See <<http://www.epa.gov/greenpower/>>.

¹⁰ See <<http://www.epa.gov/otaq/smartway/index.htm>>.

¹¹ See <<http://www.energystar.gov/>>.

¹² See <<http://www.epa.gov/cleanenergy/stateandlocal/partnership.htm>>.

¹³ See <<http://www.epa.gov/cppd/mac/>>.

¹⁴ See Title XVII of the Energy Policy Act of 2005.

appliances, and requires federal agencies to improve the efficiency of their buildings. EPA also provides for U.S. agencies to undertake a range of cooperative activities designed to reduce the greenhouse gas intensity of large developing country economies.

NEAR-TERM MEASURES

The programs discussed in this section are representative of the U.S. government's efforts to curb the growth of GHG emissions. The near-term measures in this *Climate Action Report* are defined by their implementing federal agencies as measures contributing directly to the achievement of the President's 2012 GHG intensity goal. Estimates of mitigation impacts of programs are provided by the 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. 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.

Energy: Residential and Commercial Sectors

Representing approximately 35 percent of U.S. GHG emissions, the residential and commercial sectors¹⁵ remain an important 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. These sectors continue to have potential for significant

reductions that can be realized through both regulatory and voluntary programs that set standards, provide information, develop measurement tools, and build partnerships. By using commercially available, energy-efficient products, technologies, and best practices, many commercial buildings and homes could save up to 30 percent on energy bills and substantially reduce GHG emissions. Following are descriptions of key policies and measures aimed at saving energy and avoiding GHG emissions in the residential and commercial sectors.

ENERGY STAR for the Commercial Market

The ENERGY STAR program has expanded in the commercial market, as it continues to offer thousands of organizations a strategy for superior energy management and standardized tools for measuring their energy efficiency. Since 2002, the U.S. Environmental Protection Agency (EPA) has expanded a key effort first introduced in 1999—a national energy performance rating system that allows interested parties to rate the energy efficiency of a building on a scale from zero to 100 and to recognize top-performing ENERGY STAR buildings. This system has been valuable in identifying cost-effective opportunities for improvements for a wide range of building types, including hospitals, schools, grocery stores, office buildings, warehouses, and hotels.

The ENERGY STAR program is helping the commercial marketplace respond to the President's challenge to business to voluntarily take actions that reduce GHG emissions. In 2005, EPA joined more than 20 trade associations, businesses, and state-based institutions to challenge businesses and institutions across the country to take the necessary steps to identify the many buildings where financially attractive improvements can reduce energy use by 10 percent or more, and to make the improvements. EPA has also announced it will recognize organizations, businesses, and institutions demonstrating energy

savings across their building portfolios by 10, 20, or 30 points, as ENERGY STAR Leaders. EPA estimates that in 2002, ENERGY STAR in the commercial building market helped businesses reduce GHG emissions by 35 Tg CO₂ Eq. and save \$3 billion in energy costs. EPA projects that pursuing this effort could result in reductions of 64 Tg CO₂ Eq. in 2012.

Commercial Building Integration

The Commercial Building Integration¹⁶ (CBI) program works to realize energy-saving opportunities provided by advancing a whole-building approach for commercial construction and major renovation. CBI is increasing its industry partnerships in design, construction, operation and maintenance, indoor environment, and control and diagnostics of heating, ventilation, air conditioning, lighting, and other building systems. Through these efforts, DOE helps transfer the most energy-efficient building techniques and practices into commercial buildings through regulatory activities, such as supporting the upgrade of voluntary (model) building energy codes and promulgating upgraded federal commercial building energy codes.

Since 2002, CBI has facilitated a 10 percent increase in commercial building designs that incorporate energy efficiency design tools. In 2005, the program assessed control technologies, optimization methods, and market opportunities to establish a framework for developing programmatic pathways to improve energy efficiency in buildings by 50 percent or better, enabling the development of energy-efficient design and technology packages for new commercial buildings. DOE estimates that CBI, in conjunction with Rebuild America, could reduce GHG emissions by 0.5 Tg CO₂ Eq. in 2012.

Rebuild America

Rebuild America¹⁷ is being redesigned to be better integrated with DOE's Commercial Building Integration program, described above. This program works with a network of hundreds of community-based partnerships across the Nation that

¹⁵ See <<http://www.eere.energy.gov/buildings/>>.

¹⁶ See <http://www.eere.energy.gov/buildings/high_performance/>.

¹⁷ See <http://www.eere.energy.gov/buildings/program_areas/rebuild.html>.

are saving energy, improving building performance, decreasing air pollution through reduced energy demand, and enhancing the quality of life through energy efficiency and renewable energy technologies. In 2005, the program helped Rebuild America community partnerships to upgrade 5.6 million square meters (60 million square feet) of floor space in K-12 schools, colleges, public housing, and state and local governments, reducing the average energy used in these buildings by 18 percent.

Residential Building Integration: Building America

The objective of Building America¹⁸ is to design, build, and evaluate energy-efficient homes that use 30–40 percent less total energy than comparable traditional homes with little or no increase in construction costs, and for 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.

The Building America approach has built more than 32,000 homes in 36 states. Through the program, DOE and its more than 470 industry partners are conducting research to develop advanced building energy systems to make homes and communities much more energy-efficient. 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 a 20 percent reduction in energy use of existing homes. DOE estimates these efforts could generate 3.8 Tg CO₂ Eq. of emission reductions in 2012.

ENERGY STAR for the Residential Market

The ENERGY STAR programs in the residential sector have been expanded since

2002. In addition to ongoing efforts in the new construction marketplace, this program is developing several program models for the existing homes stock that focus on energy efficiency opportunities with the home envelope (e.g., windows) and heating and cooling systems. With new construction, close to 10 percent of the new homes were built to ENERGY STAR specifications in 2005, meaning they were 30 percent more efficient than model energy code (or 15 percent more efficient than state energy code, whichever is stricter).

In the existing homes market, ENERGY STAR has expanded to a whole-house retrofit program, Home Performance with ENERGY STAR. Trained and certified contractors conduct whole-house energy audits and implement the requisite cost-effective efficiency improvements, backed by a strong quality assurance program. EPA estimates that homeowners could save 20–30 percent on their total energy bills under this program.

ENERGY STAR has also expanded into the affordable housing market in partnership with the U.S. Department of Housing and Urban Development. EPA estimates that these programs may provide about 7 Tg CO₂ Eq. in emission reductions in 2012.

Residential Appliance Standards

This DOE-managed program develops, promulgates, and enforces test procedures and energy conservation standards for residential appliances and certain commercial equipment. Federal residential energy efficiency standards¹⁹ that have been in effect since 1988 or that will take effect by the end of 2007 could save an estimated total of 34 quadrillion Btus of energy by 2020. In 2012 alone, DOE estimates a reduction of 5 Tg CO₂ Eq.

Emerging Buildings Technologies²⁰

This DOE program develops cost-effective, energy-efficient, advanced technologies for residential and commercial buildings, including lighting, building envelope, and space heating and cooling technologies. Technologies developed by this program could penetrate the market

and avoid an estimated 4.4 Tg CO₂ Eq. in 2012 and 25.4 Tg CO₂ Eq. in 2020.

ENERGY STAR-Labeled Products

ENERGY STAR continues to grow in its coverage of efficient products for the home and business and partnerships with major retailers, energy utilities, states, and others. The label is now available on models in more than 40 product categories. Awareness of the ENERGY STAR label has grown to more than 60 percent, and many consumers report using the ENERGY STAR label as part of their purchasing decisions. The program is currently focused on maintaining the integrity of the ENERGY STAR brand, identifying new product categories for ENERGY STAR, as well as increasing the stringency of performance requirements for existing product categories, where appropriate. About 2 billion ENERGY STAR-qualified products were purchased through 2005. Due to the increased penetration of these products, EPA estimates that 39 Tg CO₂ Eq. of emissions were avoided in 2002 and projects that 102 Tg CO₂ Eq. may be avoided in 2012.

Weatherization Assistance Program

During the last 30 years, DOE’s Weatherization Assistance Program²¹ has provided cost-effective energy efficiency improvements to more than 5.5 million low-income households through the weatherization of homes. The program gives priority to the elderly, people with disabilities, families with children, and households that spend a disproportionate amount of their income on energy bills. (Low-income families spend 15–20 percent of household expenses on utility bills, compared to 5 percent or less for all other Americans.) On average, DOE estimates that weatherization reduces heating bills by 31 percent and overall energy bills by \$358 per year at current prices,

¹⁸ See <http://www.eere.energy.gov/buildings/building_america/>.

¹⁹ See <http://www.eere.energy.gov/buildings/appliance_standards/>.

²⁰ See <<http://www.eere.energy.gov/buildings/tech/emerging.html>>.

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

thereby assisting low-income families in meeting their energy needs, while also reducing GHG emissions. DOE estimates that the homes being weatherized through this program could displace 4 Tg CO₂ Eq. in 2012.

Additional Policies and Measures

*State Energy Program*²²—This federal program strengthens and supports the capabilities of states to promote energy efficiency and to adopt renewable energy technologies. DOE estimates that this program will displace 3 Tg CO₂ Eq. in 2012.

Energy: Industrial Sector

At about 30 percent, the industrial sector has the greatest GHG emissions, largely from fossil fuel combustion on site or at the power generation source. The numerous energy-intensive U.S. industries provide ample opportunities for efficiency improvements and emission reductions. Policies and measures included in this section target the industrial sector by promoting cost-effective investments in technologies and practices to improve industrial productivity, lower energy costs, and reduce waste.

ENERGY STAR for Industry

The ENERGY STAR program also works with manufacturing industries to enable them to enhance their corporate energy management systems. EPA is working with specific industries to identify barriers to energy performance, define strategies for minimizing these barriers, and design management tools that will assist the industries with improvements. These efforts include the development of plant energy performance indicators that enable the industries to assess the efficiency of particular manufacturing plants, building upon the successful energy performance and benchmarking work in the commercial sector.

Since 2002, the program has worked with hundreds of industrial companies across energy-intensive and nonintensive sectors, including the automobile manufacturing, cement, corn refining, food processing, glass, petroleum, pharmaceutical,

and water and wastewater industries. ENERGY STAR has provided strategies and guidance to help these businesses voluntarily improve the energy efficiency of their operations, and at the same time contribute to the President's overall GHG intensity improvement goal. EPA estimates that in 2002, ENERGY STAR in the industrial sector prevented 14 Tg CO₂ Eq. and could avoid 21 Tg CO₂ Eq. in 2012.

Industrial Technologies Program

ITP: Research and Development—The Industrial Technologies Program²³ (ITP) works in partnership with the Nation's industrial sector to improve its energy intensity, enhance its long-term competitiveness, and accelerate research, development, and commercialization of technologies that increase energy and resource efficiency. ITP develops, manages, and implements a balanced portfolio of technology investments to address industry requirements throughout the technology development cycle. R&D—particularly high-risk, high-return R&D—is conducted to target efficiency opportunities in manufacturing processes and crosscutting energy systems. Validation and verification of technology benefits through intermediate-term pilot and demonstration phases help emerging technologies gain commercialization and near-term adoption.

ITP has contributed to the development of hundreds of commercialized industrial technologies, perhaps accelerating energy savings that might not have happened without DOE assistance. DOE estimates this program could reduce approximately 18 Tg CO₂ Eq. in 2012.

ITP: Best Practices and Save Energy Now—This program 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 a Best Practices²⁴ approach. In 2006, the program introduced a new campaign called Save Energy Now²⁵ to address high U.S. natural gas prices. Also in 2006, DOE continued energy savings assessments of 200 energy-

intensive facilities, and will offer an additional 250 assessments in 2007. The facilities received a targeted, three-day steam-or process-heating assessment by a DOE energy efficiency expert using the DOE software analysis tools. The 200 assessments identified \$475 million per year in potential energy cost savings, that could reduce natural gas consumption by more than 50 trillion Btus per year, equivalent to the natural gas consumed by more than 725,000 typical homes. The annual carbon reduction from these energy savings is estimated at 17 Tg CO₂ Eq.

*ITP: Industrial Assessment Centers*²⁶—These centers provide eligible small- and medium-sized manufacturers no-cost energy assessments, serve as a training ground for engineers who conduct energy audits or industrial assessments, and provide recommendations to manufacturers to help them identify opportunities to improve productivity, reduce waste, and save energy. The continuing efforts of this program may reduce an estimated 18 Tg CO₂ Eq. in 2012.

*ITP: Process Technologies*²⁷—This activity addresses the critical technology challenges partners face for developing materials and production processes. An example is the isothermal melting (ITM) technology, which reduces energy use by 50 percent and emissions by 80 percent. The first ITM has been installed at the Aleris International Rolled Products plant in Uhrichsville, Ohio. This technology could save the U.S. aluminum industry 18 trillion Btus per year and reduce carbon emissions by 1 Tg CO₂ Eq. per year by 2020.

*ITP: Crosscutting Technologies*²⁸—This activity addresses technologies that affect all

²² See <http://www.eere.energy.gov/state_energy_program/>.

²³ See <http://www.eere.energy.gov/industry/best_practices/>.

²⁴ See <<http://www.eere.energy.gov/industry/>>

²⁵ See <http://www.eere.energy.gov/industry/best_practices/index.html>.

²⁶ See <http://www.eere.energy.gov/industry/program_areas/industries.html>.

²⁷ See <http://www.eere.energy.gov/industry/best_practices/iacs.html>.

²⁸ See <http://www.eere.energy.gov/industry/program_areas/crosscutting_technologies.html>.

manufacturing sector energy systems. An example is the Super Boiler technology, which can achieve 94 percent boiler steam efficiency with NO_x emissions below 5 parts per million volume. DOE estimates this technology could save the U.S. industry 180 trillion Btus per year and reduce carbon emissions by an estimated 10 Tg CO₂ Eq. per year by 2020.

Energy: Supply

Electricity generation from fossil fuels is a major contributor to U.S. CO₂ emissions. Federal policies and measures aimed at energy supply promote CO₂ reductions through the development of more energy-efficient technologies for power generation and transmission, cleaner fuels, and the use of more nuclear power and renewable resources. Solar energy, wind power, biopower, and hydrogen are some of the renewable resources supported by the United States. Tax credits have helped increase domestic investments in renewable energy and continue to accelerate the cost-competitiveness of these emerging technologies.

Nuclear Energy Plant Optimization Program

The Nuclear Energy Plant Optimization Program supports the use of nuclear energy in the United States by conducting research and development focused on improving the operations and reliability of currently operating nuclear power plants, while maintaining a high level of safety and security. The program made significant progress toward addressing many of the aging material and generation optimization issues, which have been identified as the key long-term issues facing current operating plants. This program has helped extend the life of the existing fleet of nuclear power plants without compromising safety, thus reducing the need for additional fossil fuel-fired generation capacity.

Nuclear Power 2010 Program

Nuclear Power 2010,²⁹ funded at \$66 million in fiscal year 2006, supports deployment of new U.S. nuclear power plants. Activities include completing the cost-shared Early Site Permit demonstra-

tion projects, with issuance of three Early Site Permits at three utility sites by the U.S. Nuclear Regulatory Commission (NRC). In addition, the program supports the development of advanced nuclear plant technologies, evaluates the business case for building new nuclear power plants, and demonstrates the NRC's new Construction and Operating License process.

Renewable Energy Commercialization

*Wind Energy*³⁰—Wind energy is the world's fastest-growing energy-supply technology. Today, the United States has more than 10,000 MW of wind-generating capacity. DOE's wind program has successfully graduated its high-speed wind effort, meeting its cost-of-energy goal of 3 cents/kilowatt-hour (kWh) in Class 6 winds in 2004. Electricity generated from wind power in America displaced approximately 11,000 short tons of CO₂ emissions in 2004. (Note that this figure assumes that wind displaces new coal generation.) Since 2002, the program has focused most of its efforts on low-wind-speed technologies and, through its public-private partnerships, has improved the cost of energy for large systems in Class 4 onshore winds from 5.5 cents/kWh in 2002 to 4.3 cents/kWh in 2005. Based on the recent emergence of U.S. offshore wind power development prospects and assessments of potential national benefits, the program is also supporting activities addressing barriers and opportunities for this U.S. energy market segment. DOE estimates that realizing the program's R&D goals could result in wind energy displacing 5 Tg CO₂ Eq. in 2012.

*Solar Energy*³¹—This program is improving the performance of solar energy systems and reducing development, production, and installation costs to competitive levels, thereby accelerating large-scale usage 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 advances over the last two decades have significantly reduced solar electricity costs. Today, the cost of solar electricity ranges

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 0.2 Tg CO₂ Eq. in 2012.

*Geothermal Energy*³²—This program works in partnership with industry to establish geothermal energy as an economically competitive contributor to the U.S. energy supply. Geothermal energy production generates electricity or provides heat for direct applications, including aquaculture, crop drying, and district heating, or for use in heat pumps to heat and cool buildings. The technologies developed by this program will provide the Nation with new sources of electricity that are highly reliable and cost-competitive and do not add to America's air pollution or GHG emissions. In 2004, U.S. electricity generated from geothermal power displaced about 11,000 short tons of CO₂ emissions.

*Biofuels*³³—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. With about 9,700 MW of installed capacity in 2004 (wood and waste), it is estimated that biomass displaced approximately 50,000 tons of CO₂ emissions in 2004.

Distributed Energy

The Distributed Energy Program³⁴ supports cost-effective R&D aimed at lowering costs, reducing emissions, and improving reliability and performance to

²⁹ See <<http://np2010.ne.doe.gov/>> and <<http://www.ne.doe.gov/infosheets/np2010.pdf>>.

³⁰ See <http://www.eere.energy.gov/windandhydro/wind_research.html>.

³¹ See <<http://www.energy.gov/energysources/solar.htm>>.

³² See <<http://www.eere.energy.gov/geothermal/>>.

³³ See <<http://www.eere.energy.gov/biomass/>>.

³⁴ See <<http://www.eere.energy.gov/de/>>.

expand opportunities for the current and future installation of distributed energy equipment. The program is working to develop and commercialize by 2015 a diverse array of high-efficiency, integrated, distributed-generation, and thermal-energy technologies at market-competitive prices, so that homes, businesses, industry, communities, and electricity companies choose to use them. Along with reducing GHG emissions, these technologies will increase the reliability of America's electricity system. DOE anticipates that the efforts of this program could avoid almost 24 Tg CO₂ Eq. in 2012.

Clean Energy Initiative

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. EPA projects the continued efforts of these two programs will spur new clean energy investments that could avoid 29 Tg CO₂ Eq. of GHG emissions in 2012.

*Green Power Partnership*³⁵—This program facilitates the purchase of environmentally friendly electricity from renewable energy sources by addressing the market barriers that stifle demand. Since its launch in 2001, the Green Power Partnership has grown to more than 600 partners who have committed to purchasing 4 billion kWh of green power.

*Combined Heat and Power (CHP) Partnership*³⁶—Also launched in 2001, CHP provides technical assistance to organizations across multiple sectors that invested in CHP projects and assisted state governments in designing regulations that encourage investment in CHP. As a result, the program now includes 170 partners who have installed 3,460 MW of operational CHP.

Carbon Sequestration Program

DOE's Carbon Sequestration Program³⁷ will focus primarily on developing capture and separation technologies that dramatically lower the costs and energy requirements of reducing CO₂ emissions from

fossil fuel process treatment. The program's goal is to research and develop a portfolio of safe, cost-effective GHG capture, storage, and mitigation technologies by 2012, leading to substantial market penetration beyond 2012. DOE estimates the impacts of resultant technologies to be 30.3 Tg CO₂ Eq. in 2012 and 34.0 Tg CO₂ Eq. in 2020.

Additional Policies and Measures

Woody Biomass—The Secretaries of Agriculture, Energy, and the Interior signed an agreement in June 2003 to encourage the use of woody biomass from forest, rangeland, and woodland land management treatments wherever ecologically sustainable. Such use can reduce smoke and GHG emissions by up to 97 percent, compared to open burning. Use of woody biomass as a bio-based product (timber, engineered lumber, paper and pulp, furniture, plastics, etc.) may also sequester carbon by an unspecified amount.

In May 2005, the Department of the Interior (DOI) issued a regulation authorizing the removal and use of woody biomass from all land management projects, wherever ecologically appropriate and in accordance with the law, from the 500 million acres managed by DOI.

Transportation

Corporate Average Fuel Economy Program

The Corporate Average Fuel Economy³⁸ (CAFE) program requires automobile manufacturers to meet average fuel economy standards for the light-duty vehicle fleet sold in the United States. The passenger car standard has been set by statute at 11.7 kilometers per liter (kpl) (27.5 miles per gallon (mpg)), but can be amended through rulemaking. In 2003, the National Highway Traffic Safety Administration (NHTSA) raised the standard for minivans, pickup trucks, sport utility vehicles (SUVs), and other light trucks from 8.8 kpl (20.7 mpg) to 8.9 kpl (21.0 mpg) for 2005, 9.2 kpl (21.6 mpg) for 2006, and 9.4 kpl (22.2 mpg) for 2007. The action more than doubles the increase in the standard that occurred between 1986 and 2001, a

period of more than 15 years. It is predicted that this activity might save approximately 412 trillion Btus (3.6 billion gallons) of gasoline over the life of model year 2005–07 light-truck fleets and is projected to result in emission reductions of 42 Tg of CO₂ Eq. in 2012 for all light trucks after model year 2005.

In March 2006, NHTSA issued a new rule for light trucks covering model years 2008–11. The new rule raises required light-truck fuel economy to 24 mpg by model year 2011 and will save nearly 1,259 trillion Btus (11 billion gallons) of gasoline (73 Tg of CO₂ Eq.) over the life of the affected vehicles. The new rule includes an innovative reform that varies fuel economy standards according to the size of the vehicle. The regulation has also been extended for the first time to large passenger vans and SUVs.

SmartWay Transport Partnership

This voluntary partnership³⁹ between EPA and the transportation industry aims to increase energy efficiency while significantly reducing GHGs and air pollution. EPA provides tools and models to help SmartWay Transport partners adopt cost-effective strategies to save fuel and reduce emissions.

To date, more than 500 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 National Transportation Idle Free Corridor Program has established 86 projects to reduce long-duration truck and locomotive idling, converting more than 5,000 parking spaces to no-idle zones. To help states improve idle-reduction policies and programs, EPA published a model idle-reduction law.

³⁵ See <<http://www.epa.gov/greenpower/index.htm>>.

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

³⁷ See <<http://www.fe.doe.gov/programs/sequestration/index.html>>.

³⁸ See <<http://www.nhtsa.dot.gov/portal/site/nhtsa/menuitem.d0b5a45b55bfbe582f57529cdba046a0/>>.

³⁹ See <<http://www.epa.gov/smartway/>>.

SmartWay Upgrade Kits, available through truck dealerships and parts dealers, can save companies up to 15 percent in fuel and CO₂ emissions per year. EPA partnered with the Small Business Administration to offer SmartWay Upgrade Kit loans, and will publish guidance for states to initiate these projects.

Other SmartWay initiatives include EPA's recent announcement of a SmartWay designation for new, clean, and efficient tractor-trailer combination trucks, which can save 10–20 percent annually in fuel and CO₂ emissions. SmartWay's supply-chain initiative is developing new strategies to provide a more efficient integration of marine transport, port operations, and logistics. And to encourage the use of low-carbon renewable fuels, EPA recently introduced SmartWay Grow and Go, which aims for 25 percent of SmartWay partners to use biofuels by 2012.

EPA estimates the SmartWay Transport partnership could reduce emissions by 33 Tg CO₂ Eq. in 2012.

Renewable Fuel Standard

Under the Energy Policy Act of 2005, EPA is responsible for promulgating regulations to ensure that gasoline sold in the United States contains a specific volume of renewable fuel. This national Renewable Fuel Standard will increase the volume of renewable fuel that is blended into gasoline, starting with calendar year 2006. The standard is intended to double the amount of renewable fuel usage by 2012.

FreedomCAR and Fuel Partnership and Vehicle Technologies Program

This public-private partnership⁴⁰ with the Nation's automobile manufacturers and petroleum companies promotes the development of hydrogen as a primary fuel for cars and trucks. Its focus is on research needed to develop hydrogen from domestic renewable sources and technologies that utilize hydrogen, such as fuel cells. The program⁴¹ works jointly with DOE's hydrogen, fuel cell, and infrastructure R&D efforts and the efforts to develop improved technology for hybrid electric vehicles. These advanced

technologies—which include the hybrid electric components (such as batteries and electric motors), advanced materials to reduce the weight of vehicles, advanced high-efficiency combustion engines, and advanced fuels—could result in dramatic reductions of criteria pollutants and GHG emissions from the transportation sector.⁴² DOE estimates that achieving its vehicle technology R&D goals could reduce carbon emissions by about 11.5 Tg CO₂ Eq. by 2012.

Clean Cities

The benefits of Clean Cities⁴³ are now included in the FreedomCAR and Fuel Partnership and in the Vehicle Technologies Program. This DOE program supports efforts to deploy alternative fuel vehicles (AFVs) and develop the necessary supporting infrastructure. Clean Cities works through a network of more than 85 volunteer, community-based coalitions to promote the use of alternative fuels and petroleum-displacement technologies, and to advance the use of alternative fuel blends, idle-reduction technologies, hybrid electric vehicles, and fuel economy practices. Clean Cities stakeholders have added approximately 200,000 AFVs to their fleets, which have displaced more than 109 trillion Btus (950 million gallons) of petroleum since 1994.

Congestion Mitigation and Air Quality Improvement Program

Administered by DOT in consultation with EPA, the Congestion Mitigation and Air Quality (CMAQ) Improvement Program,⁴⁴ provides states with funds to reduce congestion and to improve air quality through transportation control measures and other strategies. The amount of funding given to a state is based on the severity of the air quality problem and the population of the area that does not meet air quality standards. State and local governments select the projects to fund and coordinate them through metropolitan planning organizations. The projects vary by region, but typically include transit improvements, alternative fuel programs, shared-ride serv-

ices, traffic flow improvements, demand management strategies, pedestrian and bicycle programs, and inspection and maintenance programs. Other activities, such as idle-reduction, diesel engine retrofits, and education and outreach programs, may also be eligible for CMAQ funds. Transportation control measures in air quality plans—strategies to reduce pollution by reducing vehicle use or improving traffic flow—receive priority funding under CMAQ. Nearly 16,000 air quality projects have received CMAQ funding since 1992, resulting in significant reductions in vehicle emissions, including GHG emissions.

Aircraft Fuel Efficiency

Aviation yields GHG emissions that have the potential to influence global climate. 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. DOT has a goal to improve aviation fuel efficiency per revenue plane-mile by 1 percent per year through 2009. In the near term, new technologies to improve air traffic management will help reduce fuel burn 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.

*Biomass and Biorefinery Systems Program*⁴⁵

DOE and the U.S. Department of Agriculture (USDA) partner with industry to foster R&D of advanced technologies that

⁴⁰ See <<http://www.eere.energy.gov/vehiclesandfuels/about/partnerships/freedomcar/index.html>>.

⁴¹ See <<http://www.eere.energy.gov/vehiclesandfuels/>>.

⁴² The U.S. government uses six "criteria pollutants" as indicators of air quality: ozone, carbon monoxide, sulfur dioxide, nitrogen dioxides, particulate matter, and lead.

⁴³ See <<http://www.eere.energy.gov/cleancities/>>.

⁴⁴ See <<http://www.fhwa.dot.gov/environment/cmaqpgs/>>.

⁴⁵ See <<http://www.eere.energy.gov/biomass/>>.

will convert U.S. biomass resources into affordable industrial products (including energy and higher-valued chemicals and materials) through the development of biorefineries. An analogy to this approach is the petroleum refinery that refines crude oil into a broad range of industrial products. In the future, biorefineries will use advanced technology—such as hydrolysis of cellulosic biomass to sugars and lignin and thermochemical conversion of biomass to synthesis gas for fermentation and catalysis of these platform chemicals—to produce slates of biopolymers and fuels. Today, America's environment is reaping the benefits of the public-private R&D partnerships that have formed over the past two decades and that, in combination with government energy policies, have resulted in such alternative fuels as gasohol (a combination of gasoline and ethanol), accounting for approximately 10 percent of the fuel used on U.S. highways. By 2012 these efforts could yield an estimated 0.6 Tg CO₂ Eq. in avoided emissions.

Industry: Non-CO₂

Methane Programs

U.S. industries, along with state and local governments, collaborate with EPA to implement several voluntary programs that promote profitable opportunities for reducing emissions of methane, an important GHG.⁴⁶ 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 projects these programs may maintain emissions below 1990 levels beyond 2012, due to expanded industry participation and the continuing commitment of the participating companies to identify and implement cost-effective technologies and practices.

*Natural Gas STAR*⁴⁷—Through this partnership program, EPA works with companies that produce, process, transmit, and distribute natural gas to identify and promote the implementation of cost-effective technologies and practices to reduce methane emissions. Since its launch in 1993, Natural Gas STAR has been successful in reducing methane emissions and bringing more energy to markets. As of 2004, Natural Gas STAR partner companies represented almost 60 percent of the U.S. natural gas industry. EPA estimates the program reduced methane emissions by 20 Tg CO₂ Eq. in 2002. Because of the program's expanded reach, EPA estimates the reduction for 2012 may be 28 Tg CO₂ Eq.

*Coalbed Methane Outreach Program*⁴⁸—The fraction of coal mine methane from degasification systems captured and used grew from 25 percent in 1990 to more than 70 percent in 2002. Initiated in 1994, the Coalbed Methane Outreach Program (CMOP) is working to demonstrate technologies that can eliminate the remaining emissions from degasification systems, and is addressing methane emissions in mine ventilation air. EPA estimates that CMOP reduced 6 Tg CO₂ Eq. in 2002. Due to enhanced market opportunities for natural gas and power, EPA anticipates further refinement of technical options for the capture and utilization of mine methane, a growing reliance on methane degasification in the western United States, and CMOP's continued success in reducing ventilation air methane over the next few years. EPA projects CMOP could reduce emissions by 10 Tg CO₂ Eq. in 2012.

High-GWP Programs

The United States is one of the first nations to develop and implement a national strategy to control emissions of high-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 across multiple industry sectors.

Environmental Stewardship—The objective of this initiative is to limit emissions of HFCs, PFCs, and SF₆ in three industrial applications: semiconductor production,⁴⁹ electric power distribution,⁵⁰ and magnesium production.⁵¹ Since 2002, the SF₆ emission reduction partnership for magnesium set a goal to eliminate 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 Environmental Stewardship partners reduced emissions by 5 Tg CO₂ Eq. in 2002, and projects they may reduce emissions by 35 Tg CO₂ Eq. in 2012. Because of a significant decline in the growth rates of domestic production, particularly in the magnesium and semiconductor industries, EPA's estimate of the total 2012 reduction is more than 50 percent less than had been expected in 2002. Nonetheless, significant reductions per unit of activity in these sectors are attributable to this initiative's voluntary partnerships.

HFC-23—This 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 the ozone-depleting substance HCFC-22. Despite a 4 percent increase in production compared to 1990, EPA estimates that total emissions in 2002 were significantly below 1990 levels. Compared to the *Business As Usual* case in 2002, there was a reduction of 17 Tg CO₂ Eq. EPA

⁴⁶ See <<http://www.epa.gov/methane/index.html>>.

⁴⁷ See <<http://www.epa.gov/gasstar/index.htm>>.

⁴⁸ See <<http://www.epa.gov/cmop/index.html>>.

⁴⁹ See <<http://www.epa.gov/semiconductor-pfc/>>.

⁵⁰ See <<http://www.epa.gov/highgwp/electricpower-sf6/index.html>>.

⁵¹ See <<http://www.epa.gov/magnesium-sf6/>>.

estimates a reduction of 16 Tg CO₂ Eq. for 2012, which is lower than EPA anticipated in 2002. One major U.S. producer stopped manufacturing HCFC-22 in 2002; thus, the reduction potential has declined due to lower total production.

Voluntary Aluminum Industry Partnership⁵²—This partnership has continued to reduce CF₄ and C₂F₆ where cost-effective technologies and practices are technically feasible. Since 2002, the partnership expanded its reduction goal to reduce direct carbon emissions from anode consumption as well as PFCs. EPA estimates that the partnership reduced PFC emissions by 7 Tg CO₂ Eq. in 2002 and projects reductions of 10 Tg CO₂ Eq. in 2012.

Significant New Alternatives Program⁵³—Since the 2002 CAR, the Significant New Alternatives Program (SNAP) has continued its progress in phasing down the use of ozone-depleting substances (ODSs), such as CFCs and HCFCs. SNAP 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, SNAP 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, SNAP reduced emissions by an estimated 26 Tg CO₂ Eq. in 2002 and is projected to reduce emissions by 150 Tg CO₂ Eq. in 2012.

Mobile Air Conditioning Climate Protection Partnership⁵⁴—Announced in 2004, the Mobile Air Conditioning Climate Protection Partnership is striving to reduce GHG emissions from vehicle air conditioning systems through voluntary approaches. The program will identify near-term opportunities to improve the environmental performance of mobile air conditioners and to promote cost-effective designs and improved service procedures

that minimize emissions from mobile air conditioning systems. Partnership members are pursuing two goals: reduce fuel consumption from the operation of vehicle air conditioning by at least 30 percent, and reduce direct refrigerant emissions by 50 percent, thereby avoiding emissions of HFC-134a, a very potent GHG. Drivers will save money by using less fuel, and will benefit from improved air conditioning reliability due to improved technology. EPA estimates that this effort will avoid more than 5 Tg CO₂ Eq. in 2012.

Additional Policies and Measures

Voluntary Code of Practice for the Reduction of Emissions of HFC & PFC Fire Protection Agents—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, used as fire-suppression alternatives to ozone-depleting halons, and continuing to protect people and property from the threat of fire through the use of proven, effective products and systems.

Green Grocer—EPA is working with supermarket companies and equipment manufacturers to promote the deployment of new, energy-efficient technologies that reduce emissions of fluorocarbon refrigerants (including HFCs). The first stage of this program is underway and includes EPA and industry evaluations of the performance, feasibility, costs, and benefits of alternative systems in stores.

Agriculture

USDA is providing incentives and supporting voluntary actions by private landowners to conserve and protect natural resources on agricultural lands. USDA conservation programs were established to provide broad conservation goals, such as cleaner water and reduced soil erosion. Many of the actions and activities sup-

ported by these programs also reduce GHG emissions and increase carbon sequestration. To bolster these benefits, in 2003, USDA announced that, for the first time, it would give consideration to GHG benefits in implementing the Nation's forest and agriculture conservation programs. Major elements of the USDA actions to reduce GHGs are described in the following sections.

Environmental Quality Incentives Program

The Environmental Quality Incentives Program⁵⁵ (EQIP) provides financial assistance for conservation practices on working farm and ranch lands. The Natural Resources Conservation Service (NRCS) provided guidance to its state offices that noted that conservation technologies and systems for reducing emissions, increasing carbon sequestration, and achieving other environmental benefits can be compatible with production agriculture, and encouraged recognition for these extra efforts within the local EQIP ranking systems. A wide array of conservation practices can reduce GHG emissions, including residue management, irrigation water management, nutrient management, crop rotations, cover crops, wetland restoration, and grazing land management.

For two practices, NRCS has estimated EQIP's contribution to mitigating GHG emissions. In 2005, EQIP provided assistance to farmers to adopt residue management on about 1 million hectares (ha) (2.47 million acres (ac)), which is estimated to sequester about 2 Tg CO₂ Eq. per year. In addition, reduced use of diesel fuel on these same lands could lower CO₂ emissions by as much as 0.1 Tg CO₂ Eq. per year. Also in 2005, EQIP provided assistance to ranchers to undertake prescribed grazing on 1.8 million ha (4.5 million ac), which is estimated to sequester about 0.3 Tg CO₂ Eq. per year.

⁵² See <<http://www.epa.gov/highwgp/aluminum-pfc/index.html>>.

⁵³ See <<http://www.epa.gov/ozone/snap/index.html>>.

⁵⁴ See <<http://www.epa.gov/cppd/mac/>>.

⁵⁵ See <<http://www.nrcs.usda.gov/programs/eqip/>>.

Under EQIP, NRCS also offers innovation grants to accelerate the development, transfer, and adoption of innovative technologies and approaches, including those with GHG benefits. USDA awarded 37 percent of its fiscal year 2005 Conservation Innovation Grants funding to energy-related proposals that addressed energy conservation or the production of renewable fuels. USDA estimates that efforts under EQIP could avoid 26.1 Tg CO₂ Eq. by 2012.

Conservation Reserve Program

The Conservation Reserve Program⁵⁶ (CRP) encourages farmers to convert environmentally sensitive acreage to native grasses, wildlife plantings, trees, restored wetlands, filter strips, or riparian buffers. USDA's Farm Service Agency (FSA) has issued a new rule that explicitly allows the private sale of carbon credits for lands enrolled in the CRP. FSA has also modified the Environmental Benefits Index used to score and rank offers to enroll land in the CRP to give more points for installing vegetative cover that sequesters more carbon. Finally, FSA has announced it will target 500,000 acres of continuous signup enrollment toward hardwood tree planting. In fiscal year 2005, 50 Tg CO₂ Eq. were sequestered on land enrolled in the CRP—an increase of 2 Tg CO₂ Eq. relative to 2001. Of this increase, 5 percent can be attributed to the policies and initiatives FSA adopted to increase sequestration. USDA estimates the sequestration attributable to these new policies and initiatives will offset U.S. GHG emissions by 3.1 Tg CO₂ Eq. in 2012.

Conservation Security Program

The Conservation Security Program⁵⁷ (CSP) is a voluntary program that pro-

vides 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. NRCS is providing enhancement payments under the CSP to promote energy conservation and the production and use of renewable fuels and electricity.

AgSTAR

Jointly sponsored by EPA, USDA, and DOE, AgSTAR⁵⁸ encourages the voluntary use of methane-recovery (biogas) technologies at the 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 AgSTAR practices can reduce GHG emissions and achieve other pollution control benefits while increasing farm profitability. These practices have been incorporated into USDA's broader technical, conservation, and cost-share programs.

Renewable Energy Systems and Energy Efficiency Improvements Program

Under this program, USDA provides loan guarantees and grants to agricultural producers and rural small businesses to purchase renewable energy systems and improve energy efficiency. Between 2002 and 2006, the program helped finance 272 renewable energy systems (including 11 biodiesel and 7 ethanol refineries, 82 anaerobic digesters, 121 wind projects, 17 solar projects, and 4 geothermal projects) and 165 energy efficiency improvements. USDA estimates that these projects may achieve energy savings amounting to 755 billion Btus (6.6 million barrels) of oil and an estimated reduction in GHG emissions of approximately 1 Tg CO₂ Eq.

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.

Healthy Forest Initiative

Today, between 40.5 and 81 million ha (100 and 200 million ac) of federal lands are at risk of catastrophic wildfires, in large part due to significant changes in forest and woodland structure that have occurred in the last century. Innovative, large-scale management is needed to restore at-risk ecosystems to healthy, resilient conditions. This threat to forests prompted the development of the President's Healthy Forest Initiative, which now includes the *National Fire Plan*⁵⁹ and the joint federal–state 10-year *Comprehensive Strategy Implementation Plan*.⁶⁰ The goal of these efforts is to increase biomass and wood fiber utilization as an integral component of restoring the Nation's precious forests, woodlands, and rangelands. Coordination among DOI, USDA, and DOE is important to the success of these initiatives, as is working cooperatively with states, tribes, private landowners, non-governmental organizations, and other interested parties and potential partners. These efforts are expected to lead to substantial co-benefits in terms of reduced air pollution and better air quality, particularly with respect to smoke, particulate matter, and nitrogen oxides.

Forest Land Enhancement Program

USDA's Forest Service administers the Forest Land Enhancement Program⁶¹ (FLEP). Created as part of the Farm Security and Rural Investment Act of 2002, the program provides assistance to nonindustrial private forest landowners for forest stewardship. Through FLEP, the Forest Service, working with states, can promote carbon sequestration with tree planting, forest stand improvements, and agroforestry practices. Program enrollment in fiscal year 2005 was just over 456,000 ha (1.1 million ac), and program-related carbon sequestration is estimated at 0.2 Tg CO₂ Eq.

⁵⁶ See <<http://www.fsa.usda.gov/daftp/cepd/crp.htm>>.

⁵⁷ See <<http://www.nrcs.usda.gov/Programs/csp/>>.

⁵⁸ See <<http://www.epa.gov/agstar/>> and <<http://www.rurdev.usda.gov/rbs/farbill/index.html>>.

⁵⁹ See <http://www.fireplan.gov/reports/10-YearStrategyFinal_Dec2006.pdf>.

⁶⁰ See <<http://www.fireplan.gov/reports/11-23-en.pdf>>.

⁶¹ See <<http://www.fs.fed.us/spf/coop/programs/loa/flep.shtml>>.

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.

Landfill Methane Outreach Program

The Landfill Methane Outreach Program⁶² (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 use of landfill gas as a source of energy. Since the 2002 CAR, 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 promote 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 using 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 1,300 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 fewer than 100 in the early 1990s to more than 400 projects today. EPA estimates that LMOP reduced GHG emissions from landfills by about 14 Tg CO₂ Eq. in 2002, and projects reductions of 24 Tg CO₂ Eq. in 2012.

Stringent Landfill Rule

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. EPA estimates that methane reductions in 2002 were 9 Tg CO₂ Eq., and reductions for 2012 may remain about the same.

WasteWise

WasteWise⁶³ continues to encourage recycling and source reduction. 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 2002 CAR include a *Coal Combustion Products Partnership*⁶⁴ and a *GreenScapes*⁶⁵ program, which promotes sustainable landscaping techniques, such as increased use of compost and recycled-content materials. EPA continues to promote product stewardship (promoting further waste reduction efforts through voluntary or negotiated agreements with product manufacturers) and its *Pay-As-You-Throw Initiative* to provide information and education on community-based programs that provide cost incentives for residential waste reduction. In addition to program implementation, EPA's *Climate and Waste* program supports outreach, technical assistance, and research efforts on the linkages between climate change and waste management to complement these activities. EPA estimated GHG emission reductions in 2002 were 10 Tg CO₂ Eq. EPA projects reductions could increase to 21 Tg CO₂ Eq. in 2012.

Federal Woody Biomass Working Group

Chartered under the Biomass R&D Board, the Federal Woody Biomass Working Group is working on alternative disposal options for woody biomass resulting from catastrophic events (hurricanes, floods, fire, tornadoes, volcanic eruption, etc). Hurricane Katrina, for example, damaged an estimated 19 billion board feet of

timber, much of which will be burned or disposed of in a landfill. The Working Group seeks to use much of this disaster material for bio-based products and bioenergy applications, thus reducing GHG emissions. As bioenergy and wood product markets develop, this effort may serve as an alternative to green waste disposal in landfills.

Cross-Sectoral

Public-private partnerships are an important component of efforts to meet the President's goal of reducing GHG intensity. Several of these cross-sectoral partnership programs are described below, with estimates of expected reductions that would be reported by participants. The estimated reductions for some of these programs have not been included in the scoring of mitigation impacts in this chapter, due to the potential for double counting.

Climate VISION

*Climate VISION*⁶⁶—Voluntary Innovative Sector Initiatives: Opportunities Now—is a new public-private partnership initiative launched by the federal government in 2003 for the industrial sector to boost its contribution to the President's goal of reducing GHG intensity. Business associations representing 14 energy-intensive industry sectors and The Business Roundtable have become program partners with the federal government and have issued letters of intent to meet specific targets for reducing GHG emissions intensity. These Climate VISION partners include some of the largest companies in America and represent a broad range of industry sectors: oil and gas refining, electricity generation, coal and mineral production and mining, automobile manufacturing, cement, iron and steel, magnesium, aluminum, chemicals, semiconductors, railroads, and forestry products. Climate VISION works with its

⁶² See <<http://www.epa.gov/lmop/>>.

⁶³ See <<http://www.epa.gov/wastewise/>>.

⁶⁴ See <<http://www.epa.gov/epaoswer/osw/conserve/c2p2/>>.

⁶⁵ See <<http://www.epa.gov/greenscapes/>>.

⁶⁶ See <<http://www.climatevision.gov/>>.

partners to standardize measuring and monitoring; find cost-effective solutions to reduce energy use and GHG emissions; accelerate R&D; and explore cross-sector efficiency gains to reduce emissions. Based solely on the specific numeric targets in their letters of commitment, Climate VISION partners are estimated conservatively to reduce emissions by about 90 Tg CO₂ Eq. in 2012, including the reductions from the non-CO₂ industry programs discussed previously.⁶⁷ This estimate indicates the scale of GHG reductions from this program; however, there may be an overlap with other programs and a potential for double counting.

Voluntary Reporting of Greenhouse Gases Under 1605(b)

Authorized under Section 1605(b) of the Energy Policy Act of 1992, this voluntary program⁶⁸ provides a means for utilities, industries, and other entities to establish a public record of their emissions and the results of voluntary measures to reduce, avoid, or sequester GHG emissions. Currently, about 230 U.S. companies and other organizations file reports. The information collected through the program is made available through a public use database that supports educational exchanges, informs public policy development, and encourages public recognition of initiatives to reduce GHGs.

Each year, a report is published highlighting the results of reported activities to reduce emissions. For the 2004 reporting year, 226 U.S. companies and other organizations reported that they had undertaken 2,154 projects to reduce or sequester GHGs. The reported GHG emission reductions for the projects reported included 277 Tg CO₂ Eq. of direct reductions, 92 Tg CO₂ Eq. of indirect reductions, 7 Tg CO₂ Eq. of reductions from carbon sequestration, and 14 Tg CO₂ Eq. of unspecified reductions. These estimates of reductions may overlap with other programs and may result in a potential for double counting.

New general and technical guidelines for reporting will be effective in 2007 for the

2006 reporting year. The new guidelines are intended to strengthen the program by encouraging comprehensive, entity-wide reporting of emissions and emission reductions, including sequestration, and by increasing the measurement accuracy, reliability, and verifiability of reports.

Climate Leaders

EPA launched the Climate Leaders program⁶⁹ in 2002 as part of the President's climate change strategy to challenge individual companies to demonstrate leadership by setting aggressive GHG reduction goals for their sectors. 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 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 more than 100 partners across a number of industrial sectors from heavy manufacturing to banking and retail. The total U.S. GHG emissions of these partners equal nearly 10 percent of total U.S. emissions.

Clean Energy-Environment State Partnership Program

EPA's Clean Energy-Environment State Partnership Program⁷⁰ motivates GHG emission reductions as one of several benefits states derive from implementing a comprehensive suite of cost-effective clean energy policies and programs. (U.S. EPA 2006a). (See the following Nonfederal Policies and Measures section for more specific information on a variety of state programs.)

Under the Partnership Program, the 15 member states work across their relevant agencies to develop and implement state-specific action plans, applying existing and new policies and programs to promote energy efficiency, clean distributed generation, renewable energy, and other clean energy strategies that can provide benefits

involving GHGs, air quality, public health, energy diversity, and economic growth. To communicate these benefits to other interested state governments, EPA provides technical support and actively shares with them effective strategies and lessons learned. EPA projects that in 2012, this program could contribute 7.3 Tg CO₂ Eq. in GHG reductions.

Federal Energy Management Program

The federal government is the largest single user of energy in the Nation. The Federal Energy Management Program⁷¹ (FEMP) reduces energy use in federal buildings, facilities, and operations by advancing energy efficiency and water conservation, promoting the use of renewable energy, and managing the utility choices of federal agencies. The program accomplishes its mission by leveraging both federal and private resources to provide federal agencies the technical and financial assistance they need to achieve their goals. As of 2005, FEMP had assisted federal agencies in reducing the energy intensity of their buildings by 30 percent using 1985 as a baseline. 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 nearly 2.2 Tg CO₂ Eq. in 2012.

NONFEDERAL POLICIES AND MEASURES

In addition to the national effort, state and local governments and private and nonprofit organizations are taking a variety of steps that contribute to the overall GHG intensity reduction goal. These non-federal climate change activities can be an

⁶⁷ Projections for partnerships in the aluminum, semiconductor, and magnesium sectors are provided in the Industry: Non-CO₂ section of this chapter under Voluntary Aluminum Industry Partnership and Environmental Stewardship, and are not double counted in the overall projections.

⁶⁸ See <<http://www.eia.doe.gov/oiaf/1605/frntvrgg.html>>.

⁶⁹ See <<http://www.epa.gov/climateleaders/>>.

⁷⁰ See <<http://www.epa.gov/cleanenergy/stateandlocal/partnership.htm>>.

⁷¹ See <<http://www1.eere.energy.gov/femp/>>.

important factor in the success of emission reduction policies.

State Initiatives

Many state governments have made clean energy, energy efficiency, and climate change initiatives high priorities, recognizing their significant economic and environmental benefits and widespread public support. These states are implementing a wide range of policies and measures to achieve the multiple benefits of minimizing their GHG emissions, encouraging the development of cleaner energy sources, and achieving air quality goals. Appreciating the value of collaboration, states are working across agencies, regionally, and with public- and private-sector stakeholders to develop the most cost-effective mitigation and clean energy strategies. Table 4-1 illustrates the range of actions that states are taking on climate change, as of 2006.

Regional Initiatives

Appreciating the economic value of integrating their strategies, many states have joined to launch regional initiatives to reduce GHG emissions and promote clean energy. Current examples include:

*West Coast Governors' Global Warming Initiative*⁷²—Created by the governors of California, Oregon, and Washington to reduce GHG emissions.

*Regional Greenhouse Gas Initiative*⁷³—Made up of mid-Atlantic and northeastern states to establish a regional CO₂ emissions cap-and-trade program for electric power generators.

*Western Governors' Association Clean and Diversified Energy Initiative*⁷⁴—Eighteen states working together to meet the goal of clean and diversified energy by developing 30,000 MW of clean electricity by 2015 and increasing energy efficiency by 20 percent by 2020.

*Powering the Plains*⁷⁵—Five states collaborating on energy and agriculture initiatives that address climate change while promoting regional economic development.

*Carbon Sequestration Regional Partnerships*⁷⁶—Seven partnerships that represent 40 states, 300 organizations, four Canadian provinces, and three Indian nations that work to determine the most suitable technologies, regulations, and infrastructure needs for carbon capture and storage technology across the United States.

*U.S. Mayors Climate Protection Agreement*⁷⁷—Agreement by 376 U.S. mayors to reduce GHGs by 7 percent below 1990 levels by 2012.

Climate Action Plans

Some states have developed comprehensive climate change action plans through stakeholder processes that lay out cost-effective strategies for reducing their GHG emissions. Following are some recent examples.

California: Issued April 2006—Developed by the Governor's Climate Action Team, the report identifies 46 specific strategies California can use to meet the governor's near-term target of 1990 levels by 2020 (i.e., a 30 percent reduction of the *Business As Usual* baseline). The report also includes nine key policy recommendations to help ensure the targets are met, along with a preliminary macroeconomic analysis of the recommended strategies that suggests net economic and employment benefits to the state.

Connecticut: Issued February 2005—Developed through the Governor's Steering Committee on Climate Change, the action plan is comprised of 55 measures that are estimated to reduce GHG emissions by 9 Tg CO₂ Eq. in 2010 and 19 Tg CO₂ Eq. in 2020. The plan is designed to help achieve the regional goals set out by the New England Governors/Eastern Canadian Premiers 2001 *Climate Change Action Plan* (NEG/ECP 2001).

Massachusetts: Issued May 2004—Motivated by the joint goals of reducing GHG emissions and improving energy efficiency, the plan is a comprehensive set of near- and mid-term actions that help the environment, energy system, and economy of the Commonwealth. Consistent with the

NEG/ECP 2001 *Climate Change Action Plan*, Massachusetts' goals are to reduce GHG emissions to 1990 levels by 2010, reduce emissions to 10 percent below 1990 levels in 2020, and eliminate any dangerous threat to climate in the long run.

New Mexico: Issued December 2006—Developed by the Governor's Climate Change Advisory Group, the report includes policy recommendations for reducing New Mexico's total GHG emissions to 2000 levels by 2012, to 10 percent below 2000 levels by 2020, and to 75 percent by 2050. The report lays out 69 policy recommendations that address energy supply and demand, transportation and land use, agriculture and forestry, and emissions reporting.

Oregon: Issued December 2004—Recommended by the Governor's Advisory Group, the Oregon plan put primary emphasis on real, measurable, meaningful reductions that also were cost-effective and created investment and entrepreneurial opportunities. Its goals are to stop growth of GHG emissions in 2010, reduce GHG emissions to 10 percent below 1990 levels by 2020, and stabilize emissions to at least 75 percent below 1990 levels by 2050. This action plan complements the agenda of the West Coast Governors' Global Warming Initiative.

Lead by Example Programs

Many state governments are implementing programs and policies that are lowering GHGs within their own facilities and operations. States are leveraging their purchasing power, their ability to control significant energy-using resources to test programs, and the often highly visible profile of public facilities to demonstrate clean energy technologies and approaches that save energy

⁷² See <<http://www.climatechange.ca.gov/westcoast/index.html>>.

⁷³ See <<http://www.rggi.org/>>.

⁷⁴ See <<http://www.westgov.org/wga/initiatives/cdeac/index.htm>>.

⁷⁵ See <<http://www.gpisd.net/resource.html?id=61>>.

⁷⁶ See <<http://www.fe.doe.gov/programs/sequestration/partnerships/index.html>>.

⁷⁷ See <<http://www.ci.seattle.wa.us/mayor/climate/default.htm#what>>.

TABLE 4-1 State Actions on Climate Change

Several states are implementing a wide range of policies and measures to achieve the multiple benefits of minimizing their GHG emissions, encouraging the development of cleaner energy sources, and achieving air quality goals.

TYPE OF ACTION	PARTICIPATING STATES	NUMBER OF STATES
Individual State Initiatives		
GHG Emission Inventories	Alabama, Arizona, California, Colorado, Connecticut, Delaware, Florida, Georgia, Hawaii, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin	42
State Lead by Example Clean Energy Programs	Alabama, Arizona, California, Colorado, Connecticut, Delaware, Georgia, Hawaii, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oregon, Pennsylvania, Rhode Island, Texas, Vermont, Washington, West Virginia, Wisconsin	35
Climate Action Plans	Alabama, Arizona, California, Colorado, Connecticut, Delaware, Hawaii, Illinois, Iowa, Kentucky, Maine, Maryland, Massachusetts, Minnesota, Missouri, Montana, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Tennessee, Utah, Vermont, Washington, Wisconsin	29
Renewable Energy Portfolio Standards	Arizona, California, Colorado, Connecticut, Delaware, Hawaii, Illinois, Iowa, Maine, Maryland, Massachusetts, Minnesota, Montana, Nevada, New Jersey, New Mexico, New York, Pennsylvania, Rhode Island, Texas, Vermont, Washington, Wisconsin	23
Energy Efficiency Public Benefits Funds	Arizona, California, Connecticut, Illinois, Maine, Massachusetts, Michigan, Montana, New Hampshire, New Jersey, New York, Ohio, Oregon, Pennsylvania, Rhode Island, Texas, Vermont, Wisconsin	18
Renewable Energy Public Benefits Funds	Arizona, California, Connecticut, Delaware, Illinois, Massachusetts, Minnesota, Montana, New Jersey, New York, Ohio, Oregon, Pennsylvania, Rhode Island, Wisconsin	15
Climate Advisory Boards	Alaska, Arizona, California, Connecticut, Illinois, Montana, New Mexico, New York, North Carolina, Oregon, Utah, Vermont	12
GHG Emission Targets	Arizona, California, Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New Mexico, New York, Oregon, Rhode Island, Vermont	12
Vehicle GHG Emission Standards	California, Connecticut, Maine, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Rhode Island, Vermont, Washington	11
Energy Efficiency Portfolio Standards	California, Colorado, Connecticut, Hawaii, Illinois, Nevada, New Jersey, Pennsylvania, Texas, Vermont	10
Mandatory CO ₂ Reporting for Stationary Sources	Connecticut, Maine, Massachusetts, New Jersey, Wisconsin	5
Power Plant CO ₂ Emission Cap	Massachusetts, New Hampshire, Oregon, Washington	4
GHG Emission Registries	California, New Hampshire, Wisconsin	3
Baseload Power GHG Performance Standard	California	1
Statewide GHG Emission Cap	California	1
Regional Initiatives		
Western Governors' Association Clean and Diversified Energy Initiative	Alaska, Arizona, California, Colorado, Hawaii, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Texas, Utah, Washington, Wyoming	18
Eastern Climate Registry	Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont	10
Midwest GHG Registry	Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, Wisconsin	8

TABLE 4-1 (Continued) State Actions on Climate Change

TYPE OF ACTION	PARTICIPATING STATES	NUMBER OF STATES
Regional Initiatives (Continued)		
Regional Greenhouse Gas Initiative	Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Vermont (Pennsylvania and Rhode Island are observers)	8
New England Governors: Climate Change Action Plan	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	6
Powering the Plains	Iowa, Minnesota, North Dakota, South Dakota, Wisconsin	5
West Coast Governor's Global Warming Initiative	California, Oregon, Washington	3
Southwest Climate Change Initiative	Arizona, New Mexico	2

Note: This table includes completed actions. Other states may have initiatives in progress or being considered.

and reduce GHGs. This can take many forms: adopting energy efficiency savings goals for buildings; procuring energy-efficient equipment and green power for public facilities; implementing “green fleets” programs, purchasing alternative fuel vehicles, and reducing vehicle trips; and establishing financing mechanisms, providing technical assistance, and training staff to help ensure energy-saving goals are achieved. Currently, 35 states have some form of Lead by Example program. Some successes of these state efforts follow.

*New Hampshire's Building Energy Conservation Initiative*⁷⁸—Reducing energy costs in 10 state buildings through energy retrofits and building upgrades. Uses a “paid from savings” procedure, also known as Performance Contracting, in which energy savings pay for building retrofits and upgrades. Overall avoided energy costs now exceed \$200,000 annually.

*New Jersey's Green Power Purchasing Program*⁷⁹—Helping support the state goal of reducing GHGs to 3.5 percent below 1990 levels by 2005, in part, through an innovative aggregated green power purchasing program that supplies 500 million kWh of green power to more than 200 facilities statewide. The program has expanded green energy markets in the state and has increased private-sector green power purchases. The reduced CO₂ emissions are

equivalent to removing 32,500 cars from the road for one year.

Local Initiatives

Cities for Climate Protection Campaign

In addition to contributing to their state GHG initiatives, more than 150 U.S. cities and counties representing more than 50 million people are participating in the International Council for Local Environmental Initiatives' Cities for Climate Protection Campaign.⁸⁰ The program offers training and technical assistance to cities, towns, and counties for projects focused on reducing GHG emissions. Actions implemented by participating cities are reducing emissions by 20 Tg CO₂ Eq. annually.

Heat Island Reduction Initiative

Through its Heat Island Reduction Initiative (HIRI),⁸¹ EPA has been working with state and local officials, researchers, and industry and nonprofit groups to reduce summertime temperatures by promoting use of ENERGY STAR cool-roof products and increasing vegetative cover. HIRI has been hosting quarterly forums on heat island research and implementation activities, as well as supporting heat island policy workshops involving eight U.S. cities.

Private-Sector and NGO Initiatives

Several innovative efforts of private-sector and nonprofit initiatives demonstrate the impact that organizations can

have on climate change by making a commitment to a healthier environment.

Climate Savers

Climate Savers⁸² is an initiative organized by the World Wildlife Fund in 2000 to mobilize companies to cut CO₂ emissions. Collins, Sagawa and Lafarge have joined Johnson & Johnson, IBM, Nike, and Polaroid in participating. Each company has pledged to reduce its worldwide GHG emissions by 7 percent below 1990 levels by 2010. The program includes an independent verification process.

Ceres' Investor Network on Climate Risk

In 2002, Ceres launched the Sustainable Governance Project to raise global climate change as a significant risk to the long-term value of corporations and the viability of financial assets. In November 2003, Ceres organized the Institutional Investor Summit on Climate Risk and established the Investor Network on Climate Risk (INCR).⁸³ Through INCR, Ceres has mobilized some of the Nation's largest institutional investors to focus on companies' climate risk. INCR

⁷⁸ See <<http://www.nh.gov/oepp/programs/energy/beci.htm>>.

⁷⁹ See <<http://www.state.nj.us/dep/dsr/bscit/GreenPower.pdf>>.

⁸⁰ See <<http://www.iclei.org/index.php?id=800>>.

⁸¹ See <<http://www.epa.gov/heatisland/index.html>>.

⁸² See <<http://www.worldwildlife.org/climate/projects/climateSavers.cfm>>.

⁸³ See <<http://www.ceres.org/>>.

collaborates with investors and the financial community through briefings, meetings, and publication and distribution of reports. Ceres also convenes high-emitting companies in dialogues with investors and environmental groups, and coordinates the global warming shareholder campaign.

Green Power Market Development Group

The Green Power Market Development Group⁸⁴ is a collaboration between the World Resources Institute and 13 participating companies. NatureWorks, LLC, Starbucks, and Staples recently joined original members Alcoa, Delphi, Dow, DuPont, FedEx, Kinko's, General Motors, IBM, Interface, Johnson & Johnson, and Pitney Bowes. The group's goal is to develop corporate markets for 1,000 MW of new, cost-competitive green power by 2010. The group develops and publishes an ongoing series of white papers that focus on market development issues, including the design of innovative green power purchasing vehicles.

Chicago Climate Exchange

The Chicago Climate Exchange (CCX)⁸⁵ includes more than 25 member companies that agreed to reduce their GHG emissions by 1 percent per year from 2003 through 2006. Companies achieve this reduction target through internal reductions, emissions trading with other members, purchasing GHG offsets from qualifying projects, or a combination of these approaches. Continuous electronic trading of GHG emission allowances and offsets began on December 12, 2003. The tradable Carbon Financial Instruments employed in CCX are Exchange Allowances and Exchange Offsets. Exchange Allowances are issued on the basis of forest carbon sequestration and reductions in electricity use. Exchange Offsets are generated by qualifying mitigation projects and are registered with CCX by Exchange Participant Members.

Business Environmental Leadership Council

The Pew Center's Business Environmental Leadership Council⁸⁶ is a group of leading companies worldwide that are responding to the challenges posed by climate

change. Membership has grown to include 38 corporations, 27 of whom have set public GHG reduction targets.

PowerSwitch!

In February 2004, Austin Energy (Texas), Burlington Electric Department (Vermont), Florida Power and Light (Florida), Sacramento Municipal Utility District (California), and Waverley Light and Power (Iowa) joined the World Wildlife Fund's PowerSwitch! campaign.⁸⁷ Each of the companies agreed to call for binding limits on CO₂ emissions from the power sector. In addition, these companies are voluntarily reducing GHG emissions by committing to achieve at least one of three PowerSwitch! goals by 2020: (1) using renewable energy to generate 20 percent of power sold, (2) increasing energy efficiency by 15 percent, or (3) phasing out the least efficient half of energy generation (or production) from coal.

Climate RESOLVE

Sponsored by The Business Roundtable, Climate RESOLVE⁸⁸ seeks to encourage 100 percent of the Roundtable membership to undertake voluntary actions to control GHG emissions. Roundtable CEOs believe that motivated, forward-looking companies working in partnership with government can find many practical, cost-effective opportunities to improve energy efficiency and reduce, avoid, offset, or sequester GHG emissions—without the serious economic disruption caused by mandatory GHG controls. Approximately 70 percent of Roundtable companies from every sector of the economy have signed up for Climate RESOLVE.

LONG-TERM MEASURES

In addition to implementing policies and measures that reduce emissions intensity in the near term, the U.S. government is committed to investing in relevant R&D over the long term. These R&D efforts are the key to discovering breakthrough technologies that are needed for emission reductions beyond what is achievable at present. The long-term component of U.S. climate change strategy—discussed in detail in Chapter 8, Research and Systematic Obser-

vation—includes the following programs: Carbon Sequestration Regional Partnerships,⁸⁹ Generation IV Nuclear Energy Systems Initiative,⁹⁰ Nuclear Hydrogen Initiative,⁹¹ Advanced Fuel Cycle Initiative,⁹² Global Nuclear Energy Partnership,⁹³ Clean Automotive Technology,⁹⁴ Hydrogen Technology,⁹⁵ and High-Temperature Superconductivity.⁹⁶

INTERNATIONAL MEASURES

In addition to implementing a broad portfolio of domestic programs, the United States has committed to working globally with developed and developing countries on climate change issues. Because climate change is a global concern, international cooperation is necessary to make discernible progress. The United States has signed a number of bilateral agreements and participates in numerous multilateral efforts, including the Asia-Pacific Partnership and the Methane to Markets Partnership. Several federal agencies, including DOE, EPA, the U.S. Agency for International Development, and USDA, are engaged in technology transfer programs with developing and transitional countries to provide assistance in limiting GHG emissions. The international technology development collaborations are described in more detail in Chapter 8, Research and Systematic Observation, and those on technology transfer in Chapter 7, Financial Resources and Transfer of Technology.

⁸⁴ See <<http://www.thegreenpowergroup.org/us.cfm>>.

⁸⁵ See <<http://www.chicagoclimatex.com/>>.

⁸⁶ See <http://pewclimate.org/companies_leading_the_way_belc/>.

⁸⁷ See <http://powerswitch.panda.org/news_publications/news_detail.cfm?uxNewsID=13042>.

⁸⁸ See <<http://www.businessroundtable.org/TaskForces/TaskForce/issue.aspx?qs=6EC5BF159FF49514481138A6DF61851159169FEB56A3FB0AE>>.

⁸⁹ See <<http://www.fe.doe.gov/programs/sequestration/partnerships/index.html>>.

⁹⁰ See <<http://gen-iv.ne.doe.gov/> and <<http://www.ne.doe.gov/infosheets/genIV.pdf>>.

⁹¹ See <<http://www.ne.doe.gov/infosheets/hydrogen.pdf>>.

⁹² See <<http://www.ne.doe.gov/infosheets/afci.pdf>>.

⁹³ See <<http://www.gnep.energy.gov/>>.

⁹⁴ See <<http://www.epa.gov/otaq/technology/>>.

⁹⁵ See <<http://www.eere.energy.gov/hydrogenandfuelcells/>>.

⁹⁶ See <<http://www.oe.energy.gov/randd/supercon.htm>>.

TABLE 4-2 Summary of U.S. Actions to Reduce Greenhouse Gas Emissions (Tg CO₂ Eq.)¹

Policy or Measure	Objective and/or Activity Affected	GHG Affected	Type of Instrument	Status	Implementing Entities	Estimated Mitigation Impact for ¹		
						2002	2012	2020
Energy: Commercial and Residential²								
Commercial Building Integration (includes Rebuild America)	Realizes energy-saving opportunities provided by whole-building-system-design approach during new construction and major renovation of existing commercial buildings.	CO ₂	Research; Regulatory	Implemented	DOE	NA	0.5	3.1
Emerging Buildings Technologies*	Conducts R&D on building components and design tools, and issues standards and test procedures for a variety of appliances and equipment.	CO ₂	Information; Research	Implemented	DOE	0.0	4.4	25.4
ENERGY STAR for the Commercial Market	Promotes the improvement of energy performance in commercial buildings.	CO ₂	Voluntary Agreement	Implemented	EPA	35.2	64.2	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; Outreach	Implemented	EPA	0.2	7.3	44.0
ENERGY STAR-Labeled Products	Provides labels to distinguish energy-efficient products in the marketplace.	CO ₂	Voluntary; Outreach	Implemented	EPA/DOE	38.1	102.7	148.5
Residential Appliance Standards	Conducts analyses of and develops, reviews, and updates efficiency standards for most major household appliances and major commercial building technologies and equipment.	CO ₂	Regulatory	Implemented	DOE	NA	5.1	17.3
Residential Building Integration	Enables industry to adopt systems engineering approaches to the design and construction of new housing by funding, developing, demonstrating, and deploying housing that integrates energy efficiency technologies and practices.	CO ₂	Voluntary; Research; Education	Implemented	DOE	NA	3.8	9.5
State Energy Programs	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	0.0	2.5	2.6
Weatherization Assistance	Enables low-income families to permanently reduce their energy bills by making their homes more energy efficient.	CO ₂	Economic; Deployment	Implemented	DOE	1.1	3.9	6.0

¹ Estimates of mitigation impacts of programs are provided by the 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.

TABLE 4-2 (Continued) Summary of U.S. Actions to Reduce Greenhouse Gas Emissions (Tg CO₂ Eq.)¹

Policy or Measure	Objective and/or Activity Affected	GHG Affected	Type of Instrument	Status	Implementing Entities	Estimated Mitigation Impact for ¹		
						2002	2012	2020
Energy: Industrial²								
Best Practices Program	Offers industry the tools to improve plant energy efficiency, enhance environmental performance, and increase productivity.	All	Voluntary; Information	Implemented; Undergoing Revision	DOE	8.1	16.9	49.1
ENERGY STAR for Industry	Enables industrial companies to evaluate and cost-effectively reduce energy use.	CO ₂	Voluntary Agreement	Implemented	EPA	13.6	21.3	36.7
Industrial Assessment Centers	Assesses and provides recommendations to manufacturers by identifying opportunities to improve productivity, reduce waste, and save energy.	All	Information; Research	Implemented; Undergoing Revision	DOE	8.4	17.6	51.3
Industrial Technologies	Addresses the critical technology challenges partners face for developing materials and production processes.	All	Information; Research	Implemented; Undergoing Revision	DOE	8.4	17.6	51.3
Energy: Supply²								
Carbon Sequestration*	Develops new technologies for addressing cost-effective management of CO ₂ emissions from the production and use of fossil fuels.	CO ₂	Research	Implemented	DOE	0.0	30.3	34.0
Clean Energy Initiative; Green Power Partnership; Combined Heat and Power Partnership	Removes market barriers to increased penetration of cleaner, more efficient energy supply.	CO ₂	Voluntary; Education; Technical Assistance	Implemented	EPA	0.7	29.3	73.3
Distributed Energy Resources	Focuses on technology development and the elimination of regulatory and institutional barriers to the use of distributed energy resources.	All	Information; Research; Education; Regulatory	Implemented	DOE	12.1	23.8	57.2
Renewable Energy Commercialization: Wind; Solar; Geothermal; Biomass	Develops clean, competitive power technologies using renewable resources.	All	Research	Implemented	DOE	NA	5.2	153.5
Transportation²								
Aircraft Fuel Efficiency	Improves aircraft/engine technology and operational procedures, and enhances the airspace transportation system to reduce aviation's contribution to CO ₂ emissions.	CO ₂	Technical; Research	Implemented	DOT	NA	NA	NA
Biofuels and Biorefinery Systems	Fosters research on and development of advanced technologies that will transform the Nation's domestic biomass resources into affordable biofuels and high-value bioproducts.	All	Information; Research	Implemented	DOE	0.0	0.6	5.9

TABLE 4-2 (Continued) Summary of U.S. Actions to Reduce Greenhouse Gas Emissions (Tg CO₂ Eq.)¹

Policy or Measure	Objective and/or Activity Affected	GHG Affected	Type of Instrument	Status	Implementing Entities	Estimated Mitigation Impact for ¹		
						2002	2012	2020
Congestion Mitigation and Air Quality Improvement Program	Provides states with funds to reduce congestion and improve air quality through transportation control measures and other strategies.	CO ₂	Voluntary Agreement	Implemented	DOT	NA	NA	NA
Corporate Average Fuel Economy	Raises the fuel economy standard for minivans, pickup trucks, SUVs, and other light trucks from the current 8.8 kpl (20.7 mpg) to 9.4 kpl (22.2 mpg) by 2007.	CO ₂	Regulatory	Implemented	DOT	0.0	41.8	76.7
FreedomCAR and Fuel Partnership and Vehicle Technologies Program (includes Clean Cities)	Advances high-risk research needed to develop the necessary technologies, such as fuel cells and advanced hybrid propulsion systems, to provide a full range of affordable cars and light trucks that are free of foreign oil and harmful emissions—and that do not sacrifice freedom of mobility and freedom of vehicle choice.	CO ₂	Research	Implemented	DOE	0.0	11.5	72.0
Renewable Fuel Standard	Implements the Energy Policy Act 2005 requirement to increase the amount of renewable fuel used in transportation to 7.5 billion gallons by 2012.	CO ₂	Regulatory	New; Being Implemented	EPA	NA	NA	NA
SmartWay Transport Partnership	Accelerates development of fuel-saving technology and practices in transport and freight operations.	CO ₂	Voluntary Agreement; Technical Assistance; Information; Education; Outreach	Implemented	EPA	7.7	33.0	43.0
Industry (Non-CO₂)²								
Coalbed Methane Outreach Program	Reduces methane emissions from U.S. coal mining operations through cost-effective means.	CH ₄	Information; Education; Outreach	Implemented	EPA	6.2	10.6	12.1
Environmental Stewardship Initiative	Limits emissions of HFCs, PFCs, and SF ₆ in industrial applications.	High GWP	Voluntary Agreement	Implemented	EPA	4.8	35.6	54.3
HFC-23 Partnership	Encourages reduction of HFC-23 emissions through cost-effective practices and technologies.	HFC-23	Voluntary Agreement	Implemented	EPA	16.5	16.5	15.4
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	5.5	24.5
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 Agreement	Implemented	EPA	20.2	30.8	46.9

TABLE 4-2 (Continued) Summary of U.S. Actions to Reduce Greenhouse Gas Emissions (Tg CO₂ Eq.)¹

Policy or Measure	Objective and/or Activity Affected	GHG Affected	Type of Instrument	Status	Implementing Entities	Estimated Mitigation Impact for ¹		
						2002	2012	2020
Significant New Alternatives Program	Facilitates smooth transition away from ozone-depleting chemicals in industrial and consumer sectors.	High GWP	Regulatory; Information	Implemented	EPA	26.0	149.6	222.9
Voluntary Aluminum Industry Partnership	Encourages reduction of CF ₄ and C ₂ F ₆ where technically feasible and cost-effective.	PFCs	Voluntary Agreement	Implemented	EPA	6.6	10.3	10.3
Voluntary Code of Practice for HFC & PFC Fire Protection Agents	Minimizes nonfire 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 Agreement	Implemented	EPA	NA	NA	NA
Agriculture^{2,3}								
AgSTAR emissions at U.S. farms.	Promotes practices to reduce GHG emissions at U.S. farms.	CH ₄	Information; Education; Outreach	Implemented	EPA/USDA	NA	NA	NA
Environmental Quality Incentives Program; Conservation Innovation Grants	Under EQIP, NRCS 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.	All	Partnerships/ Financial Assistance	Implemented	USDA	0.0	26.1	26.1
Conservation Reserve Program	Encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to native grasses, wildlife plantings, trees, filter strips, and riparian buffers.	CO ₂	Technical/ Financial Assistance	Implemented	USDA	0.0	3.1	7.8
Conservation Security Program	Provides 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.	CO ₂ , CH ₄	Technical/ Financial Assistance	Implemented	USDA	NA	NA	NA
Commodity Credit Corporation Bioenergy Program**	Encourages bioenergy production through economic incentives to commodity producers.	CO ₂	Economic	Implemented	USDA	NA	NA	NA
Rural Development Renewable Energy Programs***	Provides economic incentives to commodity producers to install renewable energy systems.	CO ₂	Economic	Implemented	USDA	0.0	1.2	1.2
Forestry²								
Forest Land Enhancement Program	Provides assistance to nonindustrial private forest landowners for forest stewardship, with explicit carbon sequestration goals.	CO ₂	Technical/ Financial Assistance	Implemented	USDA	0.0	0.2	0.2

TABLE 4-2 (Continued) **Summary of U.S. Actions to Reduce Greenhouse Gas Emissions (Tg CO₂ Eq.)¹**

Policy or Measure	Objective and/or Activity Affected	GHG Affected	Type of Instrument	Status	Implementing Entities	Estimated Mitigation Impact for ¹		
						2002	2012	2020
Waste Management²								
Landfill Methane Outreach Program	Reduces methane emissions from U.S. landfills through cost-effective means.	CH ₄	Voluntary Agreements; Information; Education; Outreach	Implemented	EPA	14.3	24.6	30.8
Stringent Landfill Rule	Reduces methane/landfill gas emissions from U.S. landfills.	CH ₄	Regulatory	Implemented	EPA	8.7	9.5	9.9
WasteWise	Encourages recycling, source reduction, and other progressive integrated waste management activities for the purpose of reducing GHG emissions.	All	Voluntary Agreements; Technical Assistance; Information; Research	Implemented	EPA	10.3	20.9	33.0
Cross-Sectoral²								
Clean Energy-Environment State Partnership Program	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; Research	Implemented	EPA	7.3	7.3	7.3
Climate Leaders	Assists companies with developing long-term, comprehensive climate change strategies.	All	Voluntary Agreement	Implemented	EPA	NA	NA	NA
Climate VISION	Works with partners to measure and monitor emissions, find cost-effective solutions to reduce energy use and GHG emissions, accelerate R&D, and explore cross-sector efficiency gains to reduce emissions.	All	Voluntary	Implemented	DOE/EPA/USDA/DOT	NA	NA	NA
Federal Energy Management Program	Promotes energy efficiency and renewable energy use in federal buildings, facilities, and operations.	All	Economic; Information; Education	Implemented	DOE	0.0	2.2	3.7
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 Agreement	Implemented	DOE/EPA/USDA	NA	NA	NA

¹ Estimates of mitigation impacts of programs are provided by the 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 Estimates presented here reflect mitigation impacts due to GHG measures and policies implemented since 2002 in USDA's conservation and renewable energy programs.

NA: Not applicable for long-term, R&D, and umbrella programs.

* These are long-term research efforts discussed in Chapter 8. To allow for a conservative estimate of overlap between Chapters 4 and 5, estimated impacts from technologies expected to penetrate the market by 2012 are included in this table.

** This program ended in 2006.

***Although no additional renewable energy projects are planned under this program after 2006, renewable energy systems implemented under this program are expected to have GHG benefits through 2020. The estimates shown here reflect only wind energy projects implemented between 2002 and 2006.