



Chapter 4

Policies and Measures

In the past decade, the United States has made significant progress in reducing greenhouse gas emissions. In 2000 alone, U.S. climate change programs reduced the growth in greenhouse gas emissions by 242 teragrams of carbon dioxide equivalent¹ (Tg CO₂ Eq.) (see Table 4-1 at the end of this chapter). They have also significantly helped the United States reduce carbon intensity, which is the amount of CO₂ emitted per unit of gross domestic product .

While many policies and measures developed in the 1990s continue to achieve their goals, recent changes in the economy and in energy markets, coupled with the introduction of new science and technology, create a need to re-evaluate existing climate change programs to ensure they effectively meet future economic, climate, and other environmental

¹ Emissions are expressed in units of CO₂ equivalents for consistency in international reporting under the United Nations Framework Convention on Climate Change. One teragram is equal to one million metric tons.

goals. Our experience with greenhouse gas emissions highlights the importance of creating climate policy within the context of the overall economy, changing energy markets, technology development and deployment, and R&D priorities. Because global warming is a long-term problem, solutions need to be long lasting.

The U.S. government is currently pursuing a broad range of strategies to reduce net emissions of greenhouse gases. In addition, businesses, state and local governments, and nongovernmental organizations (NGOs) are addressing global climate change by improving the measurement and reporting of greenhouse gas emission reductions; by voluntarily reducing emissions, including using emission trading systems; and by sequestering carbon through tree planting and forest preservation, restoration, conversion of eroding cropland to permanent cover, and soil management.

NATIONAL POLICYMAKING PROCESS

Shortly after taking office in January 2001, President Bush directed a Cabinet-level review of U.S. climate change policy and programs. The President established working groups and requested them to develop innovative approaches that would:

- be consistent with the goal of stabilizing greenhouse gas concentrations in the atmosphere;
- be sufficiently flexible to allow for new findings;
- support continued economic growth and prosperity;
- provide market-based incentives;
- incorporate technological advances; and
- promote global participation.

Members of the Cabinet, the Vice President, and senior White House staff extensively reviewed and discussed climate science, existing technologies to reduce greenhouse gases and sequester carbon, current U.S. programs and policies, and innovative options for addressing concentrations of greenhouse gases in the atmosphere. They were assisted

by a number of scientific, technical, and policy experts from the federal government, national laboratories, universities, NGOs, and the private sector. To obtain the most recent information and a balanced view of the current state of climate change science, the Cabinet group asked the National Academy of Sciences (NAS) to issue a report addressing areas of scientific consensus and significant gaps in our climate change knowledge (NRC 2001a). Appendix D of this report presents key questions posed by the Committee on the Science of Climate Change, along with the U.S. National Research Council's responses.

On June 11, 2001, the President issued the interim report of the Cabinet-level review (EOP 2001). Based on the NAS report (NRC 2001a) and the Cabinet's findings, President Bush directed the Department of Commerce, working with other federal agencies, to set priorities for additional investments

in climate change research, to review such investments, and to maximize coordination among federal agencies to advance the science of climate change. The President is committed to fully funding all priority research areas that the review finds are underfunded or need to be accelerated relative to other research. Such areas could include the carbon and global water cycles and climate modeling.

The President further directed the Secretaries of Commerce and Energy, working with other federal agencies, to develop a National Climate Change Technology Initiative with the following major objectives:

- Evaluate the current state of U.S. climate change technology R&D and make recommendations for improvements.
- Develop opportunities to enhance private–public partnerships in applied R&D to expedite innovative

U.S. Strategies in Key Sectors to Reduce Net Emissions of Greenhouse Gases

The U.S. government is currently pursuing a broad range of strategies to reduce net emissions of greenhouse gases.

Electricity

Federal programs promote greenhouse gas reductions through the development of cleaner, more efficient technologies for electricity generation and transmission. The government also supports the development of renewable resources, such as solar energy, wind power, geothermal energy, hydropower, bioenergy, and hydrogen fuels.

Transportation

Federal programs promote development of fuel-efficient motor vehicles and trucks, research and development options for producing cleaner fuels, and implementation of programs to reduce the number of vehicle miles traveled.

Industry

Federal programs implement partnership programs with industry to reduce emissions of carbon dioxide (CO₂) and other greenhouse gases, promote source reduction and recycling, and increase the use of combined heat and power.

Buildings

Federal voluntary partnership programs promote energy efficiency in the nation's commercial, residential, and government buildings (including schools) by offering technical assistance as well as the labeling of efficient products, new homes, and office buildings.

Agriculture and Forestry

The U.S. government implements conservation programs that have the benefit of reducing agricultural emissions, sequestering carbon in soils, and offsetting overall greenhouse gas emissions.

Federal Government

The U.S. government has taken steps to reduce greenhouse gas emissions from energy use in federal buildings and in the federal transportation fleet.

Highlights of U.S. Climate Change Programs

Many U.S. climate change programs have been highly successful at stimulating participation and achieving measurable energy and cost savings, as well as reducing greenhouse gas emissions.*

- Minimum efficiency standards on residential appliances have saved consumers nearly \$25 billion through 1999, avoiding cumulative emissions by an amount equal to almost 180 Tg CO₂ Eq. Four pending appliance standards (clothes washers, fluorescent light ballasts, water heaters, and central air conditioners) are projected to save consumers up to \$10 billion and reduce cumulative emissions by as much as 80 Tg CO₂ Eq. through 2010.
- The ENERGY STAR® program promotes energy efficiency in U.S. homes and commercial buildings. It has reduced greenhouse gas emissions by more than 55 Tg CO₂ Eq. in 2000 alone, and is projected to increase this amount to about 160 Tg CO₂ Eq. a year by 2010.
- Public-private partnership programs have contributed to the decline in methane emissions since 1990, and are expected to hold emissions at or below 1990 levels through 2010 and beyond. Partners in the methane programs have reduced methane emissions by about 35 Tg CO₂ Eq. in 2000 and are projected to reduce emissions by 55 Tg CO₂ Eq. annually by 2010.
- Programs designed to halt the growth in emissions of the most potent greenhouse gases—the “high global warming potential (GWP) gases”—are achieving significant progress. These programs reduced high-GWP emissions by more than 70 Tg CO₂ Eq. in 2000 and are projected to reduce emissions by more than 280 Tg CO₂ Eq. annually by 2010.
- Federal, state, and local outreach has allocated nearly \$10 million in grants and other awards since 1992 for 41 state greenhouse gas emission inventories, 27 state action plans, 16 demonstration projects, and 32 educational and outreach programs. Across the nation, 110 cities and counties, representing approximately 44 million people, are developing inventories and implementing climate change action plans.

* There is uncertainty in any attempt to project future emission levels and program impacts from what would have happened in the absence of these programs. These projections represent a best estimate. They are also based on the assumption that programs will continue to be funded at current funding levels.

and cost-effective approaches to reduce greenhouse gas emissions and the buildup of greenhouse gas concentrations in the atmosphere.

- Make recommendations for funding demonstration projects for cutting-edge technologies.
- Provide guidance on strengthening basic research at universities and national laboratories, including the development of the advanced mitigation technologies that offer the greatest promise for low-cost reductions of greenhouse gas emissions and global warming potential.
- Make recommendations to enhance coordination across federal agencies, and among the federal government, universities, and the private sector.
- Make recommendations for developing improved technologies for

measuring and monitoring gross and net greenhouse gas emissions.

Simultaneous with the President's climate change policy development is the implementation of the May 2001 *National Energy Policy* (NEPD Group 2001).² Developed under the leadership of Vice President Cheney, the *National Energy Policy* is a long-term, comprehensive strategy to advance the development of new, environmentally friendly technologies to increase energy supplies and encourage cleaner, more efficient energy use.

The *National Energy Policy* identified a number of major energy challenges and contains 105 specific recommendations for dealing with them, many of which affect greenhouse gas emissions. For example, it promotes energy efficiency by calling for the intelligent use of

new technologies and information dissemination; confronts our increasing dependency on foreign sources of energy by calling for increased domestic production with advanced technologies; and addresses our increasing reliance on natural gas by paving the way for a greater balance among many energy sources, including renewable energy but also traditional sources, such as hydropower and nuclear energy. In addition, the *National Energy Policy* initiated a comprehensive technology review to re-prioritize energy R&D. The review, which is currently underway, is critically evaluating the research, development, demonstration, and deployment portfolio for energy efficiency, renewable energy, and alternative energy technologies as they apply to the buildings, transportation, industry, power generation, and government sectors.

FEDERAL POLICIES AND MEASURES

The United States recognizes that climate change is a serious problem, and has devoted significant resources to climate change programs and activities (Table 4-2). This section summarizes the progress of existing federal climate change programs, including new policies and measures not described in the 1997 *U.S. Climate Action Report* (CAR), and actions described in the 1997 CAR that are no longer ongoing (U.S. DOS 1997). Many of these programs have evolved substantially since the 1997 CAR, which is reflected in individual program descriptions. Although originally focused on important early reductions by the year 2000, the programs are building emission reductions that grow over time and provide even larger benefits in later years. In addition, the Cabinet-level climate change working group is continuing its review and is developing other approaches to reduce greenhouse gas emissions, including those that tap the power of the markets, help realize the promise of technology, and ensure the broadest possible global participation.

² Available at <http://www.whitehouse.gov/energy>

TABLE 4-2 Summary of Federal Climate Change Expenditures: 1999–2001
(Millions of Dollars)

Since the 1997 *U.S. Climate Action Report*, the United States has reassessed ongoing activities for their direct and indirect impacts on greenhouse emissions. This table summarizes the funding across a portion of these activities, which includes a range of research and development on energy efficiency and renewable energy, as well as setting efficiency standards.

Types of Programs	FY 1999	FY 2000	FY 2001 Estimate
Directly Related Programs & Policies	1,009	1,095	1,239
Other Climate-Related Programs	685	698	946
Total	1,694	1,793	2,185

Note: Funding for the U.S. Global Change Research Program, International Assistance, and the Global Environment Facility is described in later chapters and is not included in this total.

Source: OMB 2001.

Federal partnership programs promote improved energy efficiency and increased use of renewable energy technologies in the nation's commercial, residential, and government buildings (including schools) by offering technical assistance as well as the labeling of efficient products, efficient new homes, and efficient buildings. The U.S. government is implementing a number of partnership programs with industry to reduce CO₂ emissions, increase the use of combined heat and power, and promote the development of cleaner, more efficient technologies for electricity generation and transmission. The federal government is also supporting renewable resources, such as solar energy, wind power, geothermal energy, hydropower, bioenergy, and hydrogen fuels. In addition, the U.S. government's commitment to advanced research and development in the areas of energy efficiency, renewable energy, alternative energy technologies, and nuclear energy will play a central role in an effective long-term response to climate change.

Energy: Residential and Commercial

Residential and commercial buildings account for approximately 35 percent of U.S. CO₂ emissions from energy use. Electricity consumption for lighting, heating, cooling, and operating appliances accounts for the majority of these emissions. Many commercial buildings

and new homes could effectively operate with 30 percent less energy if owners made investments in energy-efficient products, technologies, and best management practices. Federal partnership programs promote these investments through a market-based approach, using labeling to clearly identify which products, practices, new homes, and buildings are energy efficient. The United States also funds significant research on developing highly efficient building equipment and appliances. Following are descriptions of some of the key policies and measures in this area.

ENERGY STAR® for the Commercial Market

This program has evolved substantially since the last CAR. Its major focus now is on promoting high-performing (high-efficiency) buildings and providing decision makers throughout an organization with the information they need to undertake effective building improvement projects. While the partnership continues to work with more than 5,500 organizations across the country, this program also introduced a system in 1999 that allows the benchmarking of building energy performance against the national stock of buildings. As recommended in the *National Energy Policy*, this system is being expanded to represent additional major U.S. building types, such as schools (K–12), grocery stores, hotels,

hospitals, and warehouses. By the end of 2001, more than 75 percent of U.S. building stock could use this system. The national building energy performance rating system also allows for recognizing the highest-performing buildings, which can earn the ENERGY STAR® label. EPA estimates that ENERGY STAR® in the commercial building sector provided 23 Tg CO₂ Eq. reductions in 2000, and projects it will provide 62 Tg CO₂ Eq. reductions by 2010.

Commercial Buildings Integration

This program continues to work to realize energy-saving opportunities provided by the whole-building approach during the construction and major renovation of existing commercial buildings. The program 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, the Department of Energy (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. The program consists of *Updating State Building Codes and Partnerships for Commercial Buildings and Facilities*, and is supported by a number of DOE programs, such as *Commercial Building R&D*.

ENERGY STAR® for the Residential Market

This program has expanded significantly since the last CAR when it was focused on new home construction. It now also provides guidance for homeowners on designing efficiency into kitchen, additions, and whole-home improvement projects and works with major retailers and other organizations to help educate the public. In addition, it offers a Web-based audit tool and a home energy benchmark tool to help the homeowner implement a project and monitor progress. Builders have

constructed more than 55,000 ENERGY STAR®-labeled new homes in the United States, at a pace that has doubled each year. These homes are averaging energy savings of about 35 percent better than the model energy code. The Environmental Protection Agency's (EPA's) ENERGY STAR®-labeled homes and home improvement effort are expected to provide about 20 Tg CO₂ Eq. in emission reductions in 2010.

Community Energy Program: Rebuild America

This program continues to help communities, towns, and cities save energy, create jobs, promote growth, and protect the environment through improved energy efficiency and sustainable building design and operation. The centerpiece of this newly consolidated program is *Rebuild America*—a program that assists states and communities in developing and implementing environmentally and economically sound activities through smarter energy use. The program provides one-stop shopping for information and assistance on how to plan, finance, implement, and manage retrofit projects to improve energy efficiency. As of May 2001, *Rebuild America* formed 340 partnerships committed to performing energy retrofits, which are complete or underway on approximately 550 million square feet of building space in the 50 states and two U.S. territories.

Residential Building Integration: Building America

This program represents the consolidation of a number of initiatives. It works with industry to jointly fund, develop, demonstrate, and deploy housing that integrates energy-efficiency technologies and practices. The *Energy Partnerships for Affordable Housing* consolidates the formerly separate systems engineering programs of *Building America*, *Industrialized Housing*, *Passive Solar Buildings*, *Indoor Air Quality*, and existing building research into a comprehensive program. Systems integration research and development activities analyze building com-

ponents and systems and integrate them so that the overall building performance is greater than the sum of its parts. *Building America* is a private–public partnership that provides energy solutions for production housing and combines the knowledge and resources of industry leaders with DOE's technical capabilities to act as a catalyst for change in the home building industry.

ENERGY STAR®-Labeled Products

The strategy of this program has evolved substantially since the last CAR, not only with the addition of new products to the ENERGY STAR® family, but also with expanded outreach to consumers in partnership with their local utility or similar organization. The ENERGY STAR® label has been expanded to more than 30 product categories and, as recommended in the President's *National Energy Policy*, EPA and DOE are currently working to expand the program to additional products and appliances. ENERGY STAR® works in partnership with utilities representing about 50 percent of U.S. energy customers. The ENERGY STAR® label is now recognized by more than 40 percent of U.S. consumers, who have purchased over 600 million ENERGY STAR® products. Due to the increased penetration of these energy-efficient products, EPA estimates that 33 Tg CO₂ Eq. of emissions were avoided in 2000 and projects that 75 Tg CO₂ Eq. will be reduced in 2010.

Building Equipment, Materials, and Tools

This program conducts R&D on building components and design tools and issues standards and test procedures for a variety of appliances and equipment. Sample building components that increase the energy efficiency of buildings and improve building performance include innovative lighting, advanced space conditioning and refrigeration, and fuel cells. The program also conducts R&D on building envelope technologies, such as advanced windows, coatings, and insulation. It is improving analytical tools that effectively integrate all elements

affecting building energy use and help building designers, owners, and operators develop the best design strategies for new and existing buildings.

Additional Policies and Measures

Additional ongoing policies and measures in the residential and commercial sector include *Residential Appliance Standards*, *State and Community Assistance (State Energy Program, Weatherization Assistance Program, Community Energy Grants, Information Outreach)*, *Heat Island Reduction Initiative*, and *Economic Incentives/Tax Credits*. Appendix B provides detailed descriptions of policies and measures.

Two policies and measures listed as new initiatives in the 1997 CAR no longer appear as separate programs. *Expand Markets for Next-Generation Lighting Products* and *Construction of Energy-Efficient Buildings* have been incorporated into other existing climate programs at DOE and EPA.

Energy: Industrial

About 27 percent of U.S. CO₂ emissions result from industrial activities. The primary source of these emissions is the burning of carbon-based fuels, either on site in manufacturing plants or through the purchase of generated electricity. Many manufacturing processes use more energy than is necessary. The following programs help to improve industrial productivity by lowering energy costs, providing innovative manufacturing methods, and reducing waste and emissions.

Industries of the Future

This program continues to work in partnership with the nation's most energy-intensive industries, enhancing their long-term competitiveness and accelerating research, development, and deployment of technologies that increase energy and resource efficiency. Led by DOE, the program's strategy is being implemented in nine energy- and waste-intensive industries. Two key elements of the strategy include: (1) an industry-driven report outlining each industry's vision for the future, and (2) a

technology roadmap to identify the technologies that will be needed to reach that industry's goals.

Best Practices Program

This program offers industry the tools to improve plant energy efficiency, enhance environmental performance, and increase productivity. Selected best-of-class large demonstration plants are showcased across the country, while other program activities encourage the replication of those best practices in still greater numbers of large plants.

ENERGY STAR® for Industry

This new initiative integrates and builds upon the *Climate Wise* program and offers a more comprehensive partnership for industrial companies. ENERGY STAR® will enable industrial companies to evaluate and cost-effectively reduce their energy use. Through established energy performance benchmarks, strategies for improving energy performance, technical assistance, and recognition for accomplishing reductions in energy, the partnership will contribute to a reduction in energy use for the U.S. industrial sector. EPA estimates that awareness focused by *Climate Wise* reduced emissions by 11 Tg CO₂ Eq. in 2000, and projects that ENERGY STAR®'s industrial partnerships will provide 16 Tg CO₂ Eq. reductions in 2010.

Additional Policies and Measures

Additional ongoing policies and measures in the industrial sector include *Industrial Assessment Centers*, *Enabling Technologies*, and *Financial Assistance: NICE*³. Appendix B provides detailed descriptions of policies and measures.

Energy: Supply

Electricity generation is responsible for about 41 percent of CO₂ emissions in the United States. Federal programs promote greenhouse gas reductions through the development of cleaner, more efficient technologies for electricity generation and transmission. The U.S. government is also supporting renewable resources, such as solar

energy, wind power, geothermal energy, hydropower, bioenergy, and hydrogen fuels, as well as traditional nonemitting sources, such as nuclear energy. DOE's development programs have been very successful in reducing technology implementation costs. The cost of producing photovoltaic modules has decreased by 50 percent since 1991, and the cost of wind power has decreased by 85 percent since 1980. Commercial success has been achieved for both of these areas in certain applications.

Renewable Energy Commercialization

This program consists of several programs to develop clean, competitive renewable energy technologies, including wind, solar, geothermal, and biomass. Renewable technologies use naturally occurring energy sources to produce electricity, heat, fuel, or a combination of these energy types. The program also works to achieve tax incentives for renewable energy production and use. Some individual highlights follow.

Wind Energy. Use of wind energy is growing rapidly. Technologies under development by DOE and its partners can enable a twenty-fold or more expansion of usable wind resources and make wind energy viable without federal incentives. DOE will continue developing next-generation wind turbines able to produce power at 3.0 cents per kilowatt-hour in good wind regions, with the goal of having such turbines commercially available from U.S. manufacturers in 2004.

Solar Energy. Over the past 20 years, federal R&D has resulted in an 80 percent cost reduction in solar photovoltaics.

Geothermal Energy. The *Annual Energy Outlook 2002* estimates geothermal energy will provide 5,300 megawatts of generating capacity by 2020 (U.S. DOE 2001a). However, geothermal could provide 25,000–50,000 megawatts from currently identified

hydrothermal resources if the technology existed to develop those resources at a reasonable cost. DOE's R&D program is working in partnership with U.S. industry to establish geothermal energy as an economically competitive contributor to the U.S. energy supply.

Biopower. DOE is 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.

Climate Challenge

This program is a joint, voluntary effort of the electric utility industry and DOE to reduce, avoid, or sequester greenhouse gases. Established as a Foundation Action under the 1993 *Climate Change Action Plan*, electric utilities developed Participation Accords with DOE to identify and implement cost-effective activities (EOP 1993). The program has now grown to include participation by over 650 utilities accounting for more than 70 percent of the sector's MWh production and CO₂ emissions. The Bush Administration and its industry partners are now considering successor efforts, building upon the experience and learning gained in the this program and in related industry-wide efforts.

Distributed Energy Resources

Distributed energy resources (DER) describe a variety of smaller electricity-generating options well suited for placement in homes, offices, and factories or near these facilities. The program focuses on technology development and the elimination of regulatory and institutional barriers to the use of DER, including interconnection to the utility grid and environmental siting and permitting. Distributed systems include combined cooling, heating, and power systems; biomass-based generators; combustion turbines; concentrating solar power and photovoltaic systems; fuel cells; microturbines; engines/generator sets; and wind turbine storage and

control technologies. The program partners with industry to apply a wide array of technologies and integration strategies for on-site use, as well as for grid-enhancing systems. Successful deployment of DER technologies affects the industrial, commercial, institutional, and residential sectors of the U.S. economy—in effect, all aspects of the energy value chain.

High-Temperature Superconductivity

High-temperature superconductors conduct electricity with high efficiency when cooled to liquid nitrogen temperatures. This program supports industry-led projects to capitalize on recent breakthroughs in superconducting wire technology, aimed at developing such devices as advanced motors, power cables, and transformers. These technologies would allow more electricity to reach consumers and perform useful work with no increase in fossil CO₂ emissions.

Hydrogen Program

This program's mission is to advance and support the development of cost-competitive hydrogen technologies and systems that will reduce the environmental impacts of energy use and enable the penetration of renewable energy into the U.S. energy mix. The program has four strategies to carry out its objective: (1) expand the use of hydrogen fuels in the near term by working with industry, including hydrogen producers, to improve efficiency, lower emissions, and lower the cost of technologies that produce hydrogen from natural gas for distributed filling stations; (2) work with fuel cell manufacturers to develop hydrogen-based electricity storage and generation systems that will enhance the introduction and penetration of distributed, renewables-based utility systems; (3) coordinate with the Department of Defense and DOE's Office of Transportation Technologies to demonstrate safe and cost-effective fueling systems for hydrogen vehicles in urban non-attainment areas and to provide

onboard hydrogen storage systems; and (4) work with the national laboratories to lower the cost of technologies that produce hydrogen directly from sunlight and water.

Clean Energy Initiative

Through its new Clean Energy Initiative that has resulted from the President's *National Energy Policy*, EPA is promoting a variety of technologies, practices, and policies with the goal of reducing greenhouse gas emissions associated with the energy supply sector. The initiative has a three-pronged strategy: (1) expand markets for renewable energy; (2) work with state and local governments to develop policies that favor clean energy; and (3) facilitate combined heat and power and other clean "distributed generation" technologies in targeted sectors. Within this initiative, the United States has launched two new partnership programs—the *Green Power Partnership* and the *Combined Heat and Power Partnership*. EPA projects these efforts will spur new investments that will avoid about 30 Tg CO₂ Eq. emissions in 2010.

Nuclear Energy

The *Nuclear Energy Plant Optimization* program is working to further improve the efficiency and reliability of existing nuclear power plants, up to and beyond the end of their original operating licenses. It works to resolve open issues related to plant aging and applies new technologies to improve plant reliability, availability, and productivity, while maintaining high levels of safety. DOE also supports *Next-Generation Nuclear Energy Systems* through two programs: the *Nuclear Energy Research Initiative* (NERI) and the *Generation IV Initiative*. NERI funds small-scale research efforts on promising advanced nuclear energy system concepts, in areas that will promote novel next-generation, proliferation-resistant reactor designs, advanced nuclear fuel development, and fundamental nuclear science. The *Generation IV Initiative* is currently preparing a technology roadmap that will set forth a plan for large-scale research, development, and demonstration of promising advanced reactor con-

cepts. Research and development will be conducted to increase fuel lifetime, establish or improve material compatibility, improve safety performance, reduce system cost, effectively incorporate passive safety features, enhance system reliability, and achieve a high degree of proliferation resistance.

Carbon Sequestration

Carbon sequestration is one of the potentially lowest-cost approaches for reducing CO₂ emissions. This DOE program develops the applied science and demonstrates new technologies for addressing cost-effective, ecologically sound management of CO₂ emissions from the production and use of fossil fuels through capture, reuse, and sequestration. Its goal is to make sequestration options available by 2015. The program's technical objectives include reducing the cost of carbon sequestration and capture from energy production activities; establishing the technical, environmental, and economic feasibility of carbon sequestration using a variety of storage sites and fossil energy systems; determining the environmental acceptability of large-scale CO₂ storage; and developing technologies that produce valuable commodities from CO₂ reuse.

Additional Policies and Measures

Additional ongoing policies and measures in the energy supply sector include the *Hydropower Program*, *International Programs*, and *Economic Incentives/Tax Credits*. Appendix B provides detailed descriptions of policies and measures.

The program to *Promote Seasonal Gas Use for the Control of Nitrogen Oxides*, which was projected in the 1997 CAR to have no reductions in 2010 below baseline forecasts, is no longer included. *ENERGY STAR® Transformers* has been incorporated into ENERGY STAR®-labeled products.

Transportation

Cars, trucks, buses, aircraft, and other parts of the nation's transportation system are responsible for about one-third of U.S. CO₂ emissions. Emissions from transportation are growing rapidly as Americans drive more and

use less fuel-efficient sport-utility and other large vehicles. The United States is currently promoting the development of fuel-efficient motor vehicles and trucks, researching options for producing cleaner fuels, and implementing programs to reduce the number of vehicle miles traveled. Furthermore, many communities are developing innovative ways to reduce congestion and transportation energy needs by improving highway designs and urban planning, and by encouraging mass transit.

FreedomCAR Research Partnership

This new public-private partnership with the nation's automobile manufacturers promotes the development of hydrogen as a primary fuel for cars and trucks. It will focus on the long-term research needed to develop hydrogen from domestic renewable sources and technologies that utilize hydrogen, such as fuel cells. *FreedomCAR* replaces and builds on the *Partnership for a New Generation of Vehicles* (PNGV) program. The transition of vehicles from gasoline to hydrogen is viewed as critical to reducing both CO₂ emissions and U.S. reliance on foreign oil. *FreedomCAR* will focus on technologies to enable mass production of affordable hydrogen-powered fuel cell vehicles and the hydrogen-supply infrastructure to support them. It also will support selected interim technologies that have the potential to dramatically reduce oil consumption and environmental impacts in the nearer term, and/or are applicable to fuel cell and hybrid approaches—e.g., batteries, electronics, and motors.

Innovative Vehicle Technologies and Alternative Fuels

DOE funds research, development, and deployment of technologies that can significantly alter current trends in oil consumption. Commercialization of innovative vehicle technologies and alternative fuels is the nation's best strategy for reducing its reliance on oil. These advanced technologies could also result in dramatic reductions of criteria pollutants and greenhouse gas emissions from the transportation sector. DOE's *Vehicle Systems R&D*

funds research and development for advanced power-train-technology (direct-injection) engines, hybrid-electric drive systems, advanced batteries, fuel cells, and lightweight materials for alternative fuels (including ethanol from biomass, natural gas, methanol, electricity, and biodiesel). The *Clean Cities* program works to deploy alternative-fuel vehicles and build supporting infrastructure, including community networks. And the *Biofuels Program* researches, develops, demonstrates, and facilitates the commercialization of biomass-based, environmentally sound, cost-competitive U.S. technologies to develop clean fuels for transportation.

EPA Voluntary Initiatives

EPA supports a number of voluntary initiatives designed to reduce emissions of greenhouse gases and criteria pollutants from the transportation sector.³ Although many of these EPA initiatives generally fall under broader existing interagency transportation programs, EPA's efforts greatly increase the adoption in the market of the transportation strategies that have the potential to significantly reduce emissions of greenhouse gases. In addition to the initiatives and brief descriptions that follow, EPA is working with existing programs to further reduce greenhouse gas emissions and criteria pollutants in areas including congestion mitigation, transit demand-management strategies, and alternative transportation.

Commuter Options Programs.

Commuter Choice Leadership Initiative is a voluntary employer-adopted program that increases commuter flexibility by expanding mode options, using flexible scheduling, and increasing work location choices. *Parking Cash-Out* offers employees the option to receive taxable income in lieu of free or subsidized parking, and *Transit Check* offers nontaxable transit benefits, currently up to \$100 monthly. EPA estimates emission reductions of 3.5 Tg CO₂ Eq. in 2000 and projects reductions of 14 Tg CO₂ Eq. in 2010 from these and other *Commuter Options* programs.

Smart Growth and Brownfields Policies.

These programs, such as the *Air-Brownfields Pilot Program*, demonstrate the extent to which brownfields redevelopment and local land use policies can reduce the growth rate of vehicle miles traveled. EPA estimates reductions of 2.7 Tg CO₂ Eq. in 2000 and projects almost 11 Tg CO₂ Eq. will be avoided in 2010 from these policies.

Ground Freight Transportation Initiative.

This voluntary program is aimed at reducing emissions from the freight sector through the implementation of advanced management practices and efficient technologies. EPA projects this program will reduce emissions by 18 Tg CO₂ Eq. in 2010.

Clean Automotive Technology. This program includes research activities and partnerships with the automotive industry to develop advanced clean, fuel-efficient automotive technology. EPA is collaborating with its industry partners to transfer the unique efficient hybrid engine and power-train components, originally developed for passenger car applications, to meet the more demanding size, performance, durability and towing requirements of sport-utility and urban-delivery vehicle applications, while being practical and affordable with ultra-low emissions and ultra-high fuel efficiency. The successful technology development under this program has laid the foundation for cost-effective commercialization of high-fuel-economy/low-emission vehicles for delivery to market, with an aim toward putting a pilot fleet of vehicles on the road by the end of the decade.

DOT Emission-Reducing Initiatives

The U.S. Department of Transportation (DOT) provides funding for and oversees transportation projects and programs that are implemented by the states and metropolitan areas across the country. Although these activities are not designed specifically as climate

³ These initiatives replace the *Transportation Partners Programs*.

programs, highway funds are used for projects that may have significant ancillary benefits for reducing greenhouse gas emissions, such as transit and pedestrian improvements, bikeways, ride-sharing programs, and other transportation demand-management projects, as well as system improvements on the road network. It is very difficult to estimate the amount of greenhouse gas emission reductions from these programs, since project selection is left to the individual states and metropolitan areas, and reductions will vary among projects. Some significant DOT programs that are likely to have ancillary greenhouse gas benefits follow.

Transit Programs. Funded at about \$6.8 billion per year, these programs will likely reduce greenhouse gas emissions by carrying more people per gallon of fuel consumed than those driving alone in their automobiles.

Congestion Mitigation and Air Quality Improvement. This program is targeted at reducing criteria pollutants and provides about \$1.35 billion per year to the states to fund new transit services, bicycle and pedestrian improvements, alternative fuel projects, and traffic flow improvements that will likely reduce greenhouse gases as well.

Additional Policies and Measures

Appendix B describes *Transportation Enhancements*, the *Transportation and Community System Preservation Pilot Program*, and *Corporate Average Fuel Economy Standards*. The *Fuel Economy Labels for Tires* program, which was listed in the 1997 CAR, was never implemented and is no longer included.

Industry (Non-CO₂)

Although CO₂ accounts for the largest share of U.S. greenhouse gas emissions, non-CO₂ greenhouse gases have significantly higher global warming potentials. For example, over a 100-year time horizon, methane is more than 20 times more effective than CO₂ at trapping heat in the atmosphere, nitrous oxide is about 300 times more effective,

and hydrofluorocarbons (HFCs) are 100 to 12,000 times more effective. In addition, perfluorocarbons (PFCs) and sulfur hexafluoride (SF₆) also have extremely long atmospheric lifetimes.

Methane and Industry

U.S. industry works in concert with the federal government through a variety of voluntary partnerships that are directed toward eliminating market barriers to the profitable collection and use of methane that otherwise would be released to the atmosphere. Collectively, EPA projects these programs will hold methane emissions below 1990 levels through and beyond 2010.

Natural Gas STAR. Since its launch in 1993, *Natural Gas STAR* has been a successful means of limiting methane emissions. In 2000, it was expanded to the processing sector and included companies representing 40 percent of U.S. natural gas production, 72 percent of transmission company pipeline miles, 49 percent of distribution company service connections, and 23 percent of processing throughput. EPA estimates the program reduced methane emissions by 15 Tg CO₂ Eq. in 2000. Because of the program's expanded reach, EPA projects the estimated reduction for 2010 reported in the 1997 CAR will increase from 15 to 22 Tg CO₂ Eq.

Coalbed Methane Outreach Program.

The fraction of coal mine methane from degasification systems that is captured and used grew from 25 percent in 1990 to more than 85 percent in 1999. Begun 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 ventilation air. EPA estimates that CMOP reduced 7 Tg CO₂ Eq. in 2000. Due to unanticipated mine closures, EPA projects that the program's reduction in 2010 will be reduced slightly from that reported in the 1997 submission, from 11 to 10 Tg CO₂ Eq. However, CMOP's anticipated success in reducing ventilation air

methane over the next few years may lead to an upward revision in the projected reductions for 2010 and beyond.

HFC, PFC, SF₆ Environmental Stewardship

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 HFCs, PFCs and SF₆, which 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.

Significant New Alternatives Program.

This program continued to facilitate the smooth transition away from ozone-depleting chemicals in major industrial and consumer sectors, while minimizing risks to human health and the environment. Hundreds of alternatives determined to reduce overall risks have been listed as substitutes for ozone-depleting chemicals. By limiting use of global warming gases in specific applications where safe alternatives are available, the program reduced emissions by an estimated 50 Tg CO₂ Eq. in 2000 and is projected to reduce emissions by 162 Tg CO₂ Eq. in 2010.

HFC-23 Partnership. 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 HCFC-22. Despite a 35 percent increase in production since 1990, EPA estimates that total emissions are below 1990 levels—a reduction of 17 Tg CO₂ Eq., compared to business as usual. EPA projects reductions of 27 Tg CO₂ Eq. for 2010.

Partnership with Aluminum Producers.

This partnership continued to reduce CF₄ and C₂F₆ where cost-effective

technologies and practices are technically feasible. It met its overall goal for 2000, with emissions reduced by about 50 percent relative to 1990 levels on an emissions per unit of product basis. EPA estimates that the partnership reduced emissions by 8 Tg CO₂ Eq. in 2000 and projects reductions of 10 Tg CO₂ Eq. in 2010.

Environmental Stewardship Initiative.

This initiative was a new action proposed as part of the 1997 CAR, based on new opportunities to reduce emissions of high-GWP gases. Its initial objective was to limit emissions of HFCs, PFCs, and SF₆ in three industrial applications: semiconductor production, electric power distribution, and magnesium production. Additional sectors are being assessed for the availability of cost-effective emission reduction opportunities and are being added to this initiative. EPA's current projections are that the programs will reduce emissions by 94 Tg CO₂ Eq. in 2010. Because resource constraints delayed implementation of the electric power system and magnesium partnerships, EPA's estimate of the total 2000 reduction is 3 Tg CO₂ Eq. less than was expected in 1997.

Agriculture

The U.S. government maintains a broad portfolio of research and outreach programs aimed at enhancing the overall environmental performance of U.S. agriculture, including reducing greenhouse gas emissions and increasing carbon sinks.

AgSTAR and RLEP

The U.S. government also implements programs targeting greenhouse gas emissions from agriculture. Specific practices aimed at directly reducing greenhouse gas emissions are developed, tested, and promoted through outreach programs. These programs, including AgSTAR and the *Ruminant Livestock Efficiency Program* (RLEP), have focused on reducing methane emissions. Although the overall impact of AgSTAR and RLEP on greenhouse gas

emissions has been small on a national scale, program stakeholders in the agricultural community have demonstrated that the practices can reduce greenhouse gas emissions and increase productivity. The practices being tested under AgSTAR and RLEP can be incorporated into U.S. Department of Agriculture (USDA) broad conservation programs.

Nutrient Management Tools

Efforts to reduce nitrous oxide emissions focus on improving the efficiency of fertilizer use. For example, in 1996 USDA's Natural Resources Conservation Service began collaborating with partners on two nutrient management tools that can improve the efficiency of farm-level fertilizer use. The project's goal is to construct a database of such information and make it available to producers. These tools will enable farmers to develop nutrient management plans and detailed crop nutrient budgets, and to assess the impact of management practices on nitrous oxide emissions.

Conservation Programs

Several conservation programs are providing significant benefits in reducing greenhouse gas emissions and increasing carbon sequestration in agricultural soils.

Conservation Reserve Program. This USDA program cost-effectively assists farm owners and operators in conserving and improving soil, water, air, and wildlife resources by removing environmentally sensitive land from agricultural production and keeping it under long-term, resource-conserving cover. Currently, USDA estimates that the program removes 34 million acres of environmentally sensitive cropland from production and generates long-term environmental benefits, including the offset of about 56 Tg CO₂ Eq. each year. Projections indicate that total enrollment in the program will reach the maximum authorized level of slightly over 36 million acres by the end of 2002.

Changing Management Practices.

USDA also offers conservation programs that are aimed at changing management practices rather than removing land from production. For example, the *Environmental Quality Incentive Program* provides technical, educational, and financial assistance to landowners who face serious natural resource challenges. It helps producers make beneficial and cost-effective changes to cropping and grazing systems; improve manure, nutrient, and pest management; and implement conservation measures to improve soil, water, and related natural resources. Similarly, *Conservation and Technical Assistance* supports locally led, voluntary conservation through unique partnerships. The program provides technical assistance to farmers for planning and implementing soil- and water-conservation practices.

Conservation Compliance Plans.

In addition to direct assistance programs, USDA farm program "conservation compliance" eligibility policy protects existing wetlands on agricultural land and requires that excess erosion on highly erodible agricultural land be controlled through implementation of a conservation plan. The ancillary benefits of this policy to greenhouse gas mitigation include increased soil carbon sequestration on working agricultural land and preservation of soil carbon associated with wetlands.

Bio-based Products and Bioenergy

The goal of this USDA-DOE collaborative research program is to triple the nation's use of bio-based products and bioenergy. One of the objectives is to use renewable agricultural and forestry biomass for a range of products, including biofuels, as an offset to CO₂ emissions.

Additional Policies and Measures

Appendix B describes two additional programs: the *USDA Commodity Credit Corporation's Bioenergy Program* and the *Conservation Reserve Program Biomass Project*.

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.

Forest Stewardship

USDA's *Forest Stewardship Program* and *Stewardship Incentive Program* provide technical and financial assistance to non-industrial, private forest owners. About 147 million hectares (363 million acres) of U.S. forests are nonindustrial, private forestlands and provide many ecological and economic benefits and values. These forests provide about 60 percent of our nation's timber supply, with increases expected in the future. The acceleration of tree planting on nonindustrial, private forestlands and marginal agricultural lands can help meet resource needs and provide important ancillary benefits that improve environmental quality—e.g., wildlife habitat, soil conservation, water quality protection and improvement, and recreation. Additionally, tree planting and forest management increase the uptake of CO₂ and the storage of carbon in living biomass, soils, litter, and long-life wood products. Both programs are managed

by USDA's Forest Service in cooperation with state forestry agencies.

National Fire Plan

The recently completed National Fire Plan will improve fire management on forested lands, especially in the western parts of the United States. The effort is designed to foster a proactive, collaborative, and community-based approach to reducing risks from wildland fires, using hazardous fuels reduction, integrated vegetation management, and traditional firefighting strategies. While the initiative recognizes that fire is part of natural ecosystems, it will have long-term benefits in reducing greenhouse gas emissions because the risks of catastrophic forest fires will be lower. In addition, the initiative will generate a great volume of small-diameter, woody materials as part of hazardous fuel-reduction activities. Some of these materials have the potential to be used for biomass electric power and composite structural building products.

Waste Management

The U.S. government's waste management programs work to reduce municipal solid waste and greenhouse gas emissions through energy savings,

increased carbon sequestration, and avoided methane emissions from landfill gas—the largest contributor to U.S. anthropogenic methane emissions.

Climate and Waste Program

This program was introduced to encourage recycling and source reduction for the purpose of reducing greenhouse gas emissions. EPA is implementing a number of targeted efforts within this program to achieve its goals. *WasteWise* continues to work with organizations to reduce solid waste. New initiatives, including extended product responsibility and biomass waste, further waste reduction efforts through voluntary or negotiated agreements with product manufacturers, and market development activities for recycled-content and bio-based products. Since the last CAR, the *Pay-As-You-Throw Initiative* was launched to provide information and education on community-based programs that provide cost incentives for residential waste reduction. EPA is also continuing to conduct supporting outreach, technical assistance, and research efforts on the linkages between climate change and waste management to complement these activities. Reductions in 2000 are estimated by EPA at 8 Tg CO₂ Eq. and are projected to increase to 20 Tg CO₂ Eq. in 2010.

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. Since the last CAR, implementation of the rule began at the state level in 1998. Preliminary 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. Methane reductions in 2000 are estimated by EPA at 15 Tg CO₂ Eq. The current EPA projection for 2010 is 33 Tg CO₂ Eq., although the preliminary data suggest that reductions from the more stringent rule may be even greater over the next decade.

Agriculture and Forestry: Opportunities and Challenges

The array of conservation issues has grown with changes in the structure of agriculture and in farm and forest management practices, and with greater public concern about a wider range of issues, including greenhouse gas emissions and carbon sequestration, and energy production and conservation. The agriculture and forestry sectors have been responsive to this concern, and progress has been made in each of these areas.

Today, U.S. forests and forest products are sequestering a significant quantity of carbon every year, equivalent to roughly 15 percent of overall U.S. emissions. Carbon sequestration in agricultural soils is offsetting an additional 2 percent of U.S. greenhouse gas emissions. Given appropriate economic incentives, much of the vast landscape managed by farmers and forest landowners could be managed to store additional carbon, produce biomass and biofuels to replace fossil fuels, and reduce energy use. The challenge is to identify and implement low-cost opportunities to increase carbon storage in soils, provide low-cost tools for enhanced farm and forest management, and ensure that the production of energy raw materials is environmentally beneficial. Realizing these opportunities will take a number of efforts, including an adequate system for measuring the carbon storage and greenhouse gas emissions from agriculture and forests.

For more information about the Administration's effort to formulate a longer-term view of the nation's agriculture and food system, see *Food and Agricultural Policy: Taking Stock for the New Century*, which is available at www.usda.gov (USDA/NRCS 2001).

More comprehensive data will be available by the next CAR submission.

Landfill Methane Outreach Program

This program continues to encourage landfills not regulated by the *Landfill Rule* to capture and use their landfill gas emissions. Capturing and using landfill gas reduces methane emissions directly and reduces CO₂ emissions indirectly through the utilization of landfill gas as a source of energy, thereby displacing the use of fossil fuels. Since the last CAR, the *Landfill Methane Outreach Program* (LMOP) continues to work with landfill owners, state energy and environmental agencies, utilities and other energy suppliers, industry, and other stakeholders to lower the barriers to landfill gas-to-energy projects. LMOP has developed a range of tools to help landfill operators overcome barriers to project development, including feasibility analyses, software for evaluation project economics, profiles of hundreds of candidate landfills across the country, a project development handbook, and energy end user analyses. Due to these efforts, the number of landfill gas-to-energy projects has grown from less than 100 in the early 1990s to almost 320 projects by the end of 2000. EPA estimates that LMOP reduced greenhouse gas emissions from landfills by about 11 Tg CO₂ Eq. in 2000 and projects reductions of 22 Tg CO₂ Eq. in 2010.

Cross-sectoral

The federal government has taken the lead to reduce greenhouse gas emissions from energy use in federal buildings and transportation fleets by:

- requiring federal agencies, through Executive Order 13221, to purchase products that use no more than one watt in standby mode;
- directing the heads of executive departments and agencies to take appropriate actions to conserve energy use at their facilities, review existing operating and administrative processes and conservation programs, and identify and implement ways to reduce energy use;
- requiring all federal agencies to take steps to cut greenhouse gas emissions from energy use in buildings by 30 percent below 1990 levels by 2010;
- directing federal agencies in Washington, D.C., to offer their employees up to \$100 a month in transit and van pool benefits; and
- requiring federal agencies to implement strategies to reduce their fleets' annual petroleum consumption by 20 percent relative to 1990 consumption levels and to use alternative fuels a majority of the time.

Federal Energy Management Program

This program reduces energy use in federal buildings, facilities, and operations by advancing energy efficiency and water conservation, promoting the use of renewable energy, and managing 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.

State and Local Climate Change Outreach Program

This EPA program continues to provide technical and financial assistance to states and localities to conduct greenhouse gas inventories, to develop state and city action plans to reduce greenhouse gas emissions, to study the impacts of climate change, and to demonstrate innovative mitigation policies or outreach programs. New or developing projects include estimates of forest carbon storage for each state, a spreadsheet tool to facilitate state inventory updates, a software tool to examine the air quality benefits of greenhouse gas mitigation, a study of the health benefits of greenhouse gas mitigation, and a working group on voluntary state greenhouse gas registries. To date, 41 states and Puerto Rico have initiated or completed inventories, and 27 states and Puerto Rico have completed or are developing action plans. While the program's primary purpose is to build climate change capacity

and expertise at the state and local levels, EPA estimates that the program reduced greenhouse gas emissions by about 6 Tg CO₂ Eq. in 2000.

NONFEDERAL POLICIES AND MEASURES

All federal climate initiatives are conducted in cooperation with private-sector parties. The private sector's support is essential for the success of emission reduction policies. Businesses, state and local governments, and NGOs are also moving forward to address global climate change—through programs to improve the measurement and reporting of emission reductions; through voluntary programs, including emissions trading programs; and through sequestration programs.

State Initiatives

In 2000, the National Governors Association reaffirmed its position on global climate change policy. At the domestic level, the governors recommended that the federal government continue its climate research, including regional climate research, to improve scientific understanding of global climate change. The governors also recommended taking steps that are cost-effective and offer other social and economic benefits beyond reducing greenhouse gas emissions. In particular, the governors supported voluntary partnerships to reduce greenhouse gas emissions while achieving other economic and environmental goals.

NEG-ECP 2001 Climate Change Action Plan

The New England Governors and Eastern Canadian Premiers (NEG-ECP) adopted a Resolution accepting the goals of the *NEG-ECP 2001 Climate Change Action Plan*. The plan sets an overall goal for reducing greenhouse gases in New England States and Eastern Canadian Provinces to 1990 emission levels by 2010, and to 10 percent below 1990 emissions by 2020. The plan's long-term goal is to reduce regional greenhouse gas emissions sufficiently to eliminate any dangerous

threat to the climate (75–85 percent below current levels).

Massachusetts Regulation of Electric Utility Emissions

In April 2001, the governor of Massachusetts released a regulation requiring additional controls on Massachusetts electric utility sources, making the state the first in the nation to adopt binding reduction requirements for CO₂. The new regulation sets a cap on total emissions and creates an emission standard that will require CO₂ reductions of about 10 percent below the current average emission rate. The regulation allows companies to buy carbon credits to meet their reduction requirements.

New York and Maryland Executive Orders

The governors of New York and Maryland issued Executive Orders requiring state facilities to: (1) purchase a percentage of energy from green sources; (2) evaluate energy efficiency in state building design and maintenance; and (3) purchase ENERGY STAR®-labeled products when available. Both states are developing comprehensive action plans to reduce greenhouse gas emissions.

New Jersey Executive Order

The State of New Jersey issued an Executive Order to reduce the state's annual greenhouse gas emissions to 3.5 percent below 1990 levels by 2005, using "no regrets" measures that are readily available and that pay for themselves within the short term. The potential emission reductions are based on policies and technologies identified in the *New Jersey Sustainability Greenhouse Gas Action Plan* (NJ 2000). Approximately two-thirds of the reductions will be achieved through energy efficiency and innovative energy technologies in residential, commercial, and industrial buildings. The remainder will come from energy conservation and innovative technologies in the transportation sector, waste management improvements, and natural resource conservation.

Other State Initiatives

California, Maine, New Hampshire, New Jersey, Wisconsin, and Texas are developing *voluntary registries for greenhouse gas emissions*. In addition, 12 states have established *renewable portfolio standards*, and 19 out of 24 states have included *public benefit charges* (also called *system benefit charges*) as a component of their electricity restructuring policy to support continued investment in energy efficiency and renewable energy. Approximately \$11 billion, for the period 1998–2012, is expected to be available nationwide through public benefit fund programs. Greenhouse gas *emission inventories* have been completed in 37 states, with four more in progress; and 19 states completed *action plans* to reduce greenhouse gas emissions, with 8 more in progress.

Local Initiatives

A total of 110 U.S. cities and counties, representing nearly 44 million people, are participating in the International Council for Local Environmental Initiatives' *Cities for Climate Protection Campaign*. This program offers training and technical assistance to cities, towns, and counties for projects focusing on reducing emissions. Actions implemented through the campaign are reducing emissions by over 7 Tg CO₂ Eq. each year. Also, in June 2000, the U.S. Conference of Mayors passed a resolution recognizing the seriousness of global warming and calling for increased cooperation between cities and the federal government in taking action to address the challenge.

Private-Sector and NGO Initiatives

Following are some highlights of private-sector and NGO efforts that are demonstrative of leadership by example.

Green Power Market Development Group

In May 2000 a number of private corporations not directly involved with the electric utility industry organized the *Green Power Market Development*

Group to support the development of green U.S. energy markets. Together, the Group's 11 members—Alcoa, Cargill-Dow, Delphi, DuPont, General Motors, IBM, Interface, Johnson & Johnson, Kinko's, Oracle, and Pitney Bowes—account for about 7 percent of U.S. industrial energy use. They are working with the World Resources Institute and Business for Social Responsibility to purchase 1,000 megawatts of new green energy capacity and otherwise provide support to the development of green energy markets. The Group believes that such markets are essential to provide competitively priced energy that also protects the Earth's climate and reduces conventional air pollutants. The members are exploring a variety of green energy purchase opportunities to identify those that are cost-competitive. This is a long-term process, with companies hoping to support market development over a 10-year period.

Business Environmental Leadership Council

The U.S. business community, many times in partnership with environmental NGOs, is moving forward on climate change in many other ways. For example, the Pew Center on Climate Change launched a \$5 million campaign in 1998 to build support for taking action on climate change. Boeing, DuPont, Shell, Weyerhaeuser, and 32 other major corporations joined the Center's *Business Environmental Leadership Council*, agreeing that "enough is known about the science and environmental impacts of climate change for us to take actions to address its consequences."

Climate Savers

Johnson & Johnson, IBM, Polaroid, and Nike have joined this new partnership to help business voluntarily lower energy consumption and reduce greenhouse gas emissions. In joining *Climate Savers*, partners make specific commitments to reduce their emissions and participate in an independent verification process.

Partnership for Climate Action

Seven companies, including BP, DuPont, and Shell International joined Environmental Defense in the creation of the *Partnership for Climate Action*. Each company has set a firm target for greenhouse gas reductions and has agreed to measure and publicly report its emissions.

Voluntary Reporting of Greenhouse Gases

Under this program, provided by section 1605(b) of the Energy Policy Act of 1992, more than 200 companies have voluntarily reported to DOE more than 1,715 voluntary projects to reduce, avoid, or sequester greenhouse gas emissions.

Auto Manufacturers' Initiatives

U.S. auto manufacturers have announced production plans for hybrid gas and electric vehicles in 2003 or 2004 and have pledged to increase their sport-utility vehicles' fuel economy by 25 percent by 2005.

TABLE 4-1 Summary of Actions to Reduce Greenhouse Gas Emissions

Name of Policy or Measure	Objective and/or Activity Affected	GHG Affected	Type of Instrument	Status	Implementing Entity/Entities	Estimated Mitigation Impact for 2000 (Tg CO ₂ Eq.)
ENERGY: COMMERCIAL AND RESIDENTIAL						56.8
ENERGY STAR® for the Commercial Market	Promotes the improvement of energy performance in commercial buildings.	CO ₂	Voluntary	Implemented	EPA	
Commercial Buildings Integration: Updating State Buildings Codes; Partnerships for Commercial Buildings and Facilities	Realizes energy-saving opportunities provided by whole-building approach during construction and major renovation of existing commercial buildings.	CO ₂	Research, regulatory	Implemented	DOE	
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	
Community Energy Program: Rebuild America	Helps communities, towns and cities save energy, create jobs, promote growth, and protect the environment through improved energy efficiency and sustainable building design and operation.	CO ₂	Voluntary, information, education	Implemented	DOE	
Residential Building Integration: Building America	Funds, develops, demonstrates, and deploys housing that integrates energy-efficiency technologies and practices.	CO ₂	Voluntary, research, education	Implemented	DOE	
ENERGY STAR®-Labeled Products	Label distinguishes energy-efficient products in the marketplace.	CO ₂	Voluntary, outreach	Implemented	EPA/DOE	
Building Equipment, Materials, and Tools: Superwindow Collaborative; Lighting Partnerships; Partnerships for Commercial Buildings and Facilities; Collaborative Research and Development	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	
Residential Appliance Standards	Reviews and updates efficiency standards for most major household appliances.	CO ₂	Regulatory	Implemented	DOE	
State and Community Assistance: State Energy Program; Weatherization Assistance Program; Community Energy Grants; Information Outreach	Provides funding for state and communities to provide local energy-efficiency programs, including services to low-income families; to implement sustainable building design and operation; and to adopt a systematic approach to marketing and communication objectives.	CO ₂	Economic, information	Implemented	DOE	
Heat Island Reduction Initiative	Reverses the effects of urban heat islands by encouraging the use of mitigation strategies.	CO ₂	Voluntary, information, research	Implemented	EPA	
Economic Incentives/ Tax Credits	Provides tax credits to residential solar energy systems.	CO ₂	Economic	Proposed		

TABLE 4-1 (continued) Summary of Actions to Reduce Greenhouse Gas Emissions

Name of Policy or Measure	Objective and/or Activity Affected	GHG Affected	Type of Instrument	Status	Implementing Entity/Entities	Estimated Mitigation Impact for 2000 (Tg CO ₂ Eq.)
ENERGY: INDUSTRIAL						27.9
Industries of the Future	Helps nine key energy-intensive industries reduce their energy consumption while remaining competitive and economically strong.	All	Voluntary, information	Implemented	DOE	
Best Practices Program	Offers industry tools to improve plant energy efficiency, enhance environmental performance, and increase productivity.	All	Voluntary, information	Implemented	DOE	
ENERGY STAR® for Industry (Climate Wise)	Enables industrial companies to evaluate and cost-effectively reduce their energy use.	CO ₂	Voluntary	Implemented	EPA	
Industrial Assessment Centers	Assesses and provides recommendations to manufacturers in identifying opportunities to improve productivity, reduce waste, and save energy.	All	Information, research	Implemented	DOE	
Enabling Technologies	Addresses the critical technology challenges partners face for developing materials and production processes.	All	Information, research	Implemented	DOE	
Financial Assistance: NICE ³	Provides funding to state and industry partnerships for projects that develop and demonstrate advances in energy efficiency and clean production technologies.	All	Research	Implemented	DOE	
ENERGY: SUPPLY						14.7
Renewable Energy Commercialization: Wind; Solar; Geothermal; Biopower	Develops clean, competitive power technologies using renewable resources.	All	Research, regulatory	Implemented	DOE	
Climate Challenge	Promotes efforts to reduce, avoid, or sequester greenhouse gases from electric utilities.	All	Voluntary	Implemented	DOE	
Distributed Energy Resources (DER)	Focuses on technology development and the elimination of regulatory and institutional barriers to the use of DER.	All	Information, research, education, regulatory	Implemented	DOE	
High-Temperature Superconductivity	Advances R&D of high-temperature superconducting power equipment for energy transmission, distribution, and industrial use.	All	Research	Implemented	DOE	
Hydrogen Program	Enhances and supports the development of cost-competitive hydrogen technologies and systems to reduce the environmental impacts of their use.	All	Research, education	Implemented	DOE	

TABLE 4-1 (continued) Summary of Actions to Reduce Greenhouse Gas Emissions

Name of Policy or Measure	Objective and/or Activity Affected	GHG Affected	Type of Instrument	Status	Implementing Entity/Entities	Estimated Mitigation Impact for 2000 (Tg CO ₂ Eq.)
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	
Nuclear Energy Plant Optimization	Recognizes the importance of existing nuclear plants in reducing greenhouse gas emissions.	CO ₂	Information, technical assistance	Implemented	DOE	
Development of Next-Generation Nuclear Energy Systems: Nuclear Energy Research Initiative; Generation IV Initiative	Supports research, development, and demonstration of an advanced nuclear energy system concept.	CO ₂	Research, technical assistance	Implemented	DOE	
Support Deployment of New Nuclear Power Plants in the United States	Ensures the availability of near-term nuclear energy options that can be in operation in the U.S. by 2010.	CO ₂	Information	Implemented	DOE	
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	
Hydropower Program	Improves the technical, societal, and environmental benefits of hydropower.	All	Information, research	Implemented	DOE	
International Programs	Accelerates the international development and deployment of clean energy technologies.	All	Information, technical assistance	Implemented	DOE	
Economic Incentives/ Tax Credits	Provides tax credits to electricity generated from wind- and biomass-based generators.	CO ₂	Economic	Proposed		

TABLE 4-1 (continued) Summary of Actions to Reduce Greenhouse Gas Emissions

Name of Policy or Measure	Objective and/or Activity Affected	GHG Affected	Type of Instrument	Status	Implementing Entity/Entities	Estimated Mitigation Impact for 2000 (Tg CO ₂ Eq.) 8.4
TRANSPORTATION						
FreedomCAR Research Partnership	Promotes the development of hydrogen as a primary fuel for cars and trucks.	CO ₂	Research, information	Implemented	DOE	
Vehicle Systems R&D	Promotes the development of cleaner, more efficient passenger vehicles.	CO ₂	Research, information	Implemented	DOE	
Clean Cities	Supports public–private partnerships to deploy alternative-fuel vehicles and builds supporting infrastructure, including community networks.	All	Voluntary, information	Implemented	DOE	
Biofuels Program	Researches, develops, demonstrates, and facilitates the commercialization of biomass-based, environmentally sound fuels for transportation.	All	Information, research	Implemented	DOE	
Commuter Options Programs	Reduces single-occupant-vehicle commuting by providing incentives and alternative modes, timing, and locations for work.	CO ₂	Voluntary agreements, tax incentives, information, education, outreach	Implemented	EPA/DOT	
Smart Growth and Brownfields Policies	Reduces motorized trips and trip distance by promoting more efficient location choice.	CO ₂	Technical assistance, outreach	Implemented	EPA	
Ground Freight Transportation Initiative	Increases efficient management practices for ground freight.	CO ₂	Voluntary/negotiated agreements	Adopted	EPA	
Clean Automotive Technology	Develops advanced clean and fuel-efficient automotive technology.	CO ₂	Voluntary, research	Implemented	EPA	
DOT Emission-Reducing Initiatives	Provides funding mechanisms for alternative modes to personal motorized vehicles.	CO ₂	Funding mechanisms	Implemented	DOT	

TABLE 4-1 (continued) Summary of Actions to Reduce Greenhouse Gas Emissions

Name of Policy or Measure	Objective and/or Activity Affected	GHG Affected	Type of Instrument	Status	Implementing Entity/Entities	Estimated Mitigation Impact for 2000 (Tg CO ₂ Eq.)
INDUSTRY (NON-CO₂)						88.7
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	
Coalbed Methane Outreach Program	Reduces methane emissions from U.S. coal mining operations through cost-effective means.	CH ₄	Information, education, outreach	Implemented	EPA	
Significant New Alternatives Program	Facilitates smooth transition away from ozone-depleting chemicals in industrial and consumer sectors.	High GWP	Regulatory, information	Implemented	EPA	
HFC-23 Partnership	Encourages reduction of HFC-23 emissions through cost-effective practices or technologies.	High GWP	Voluntary agreement	Implemented	EPA	
Partnership with Aluminum Producers	Encourages reduction of CF ₄ and C ₂ F ₆ where technically feasible and cost-effective.	PFCs	Voluntary agreement	Implemented	EPA	
Environmental Stewardship Initiative	Limits emissions of HFCs, PFCs, and SF ₆ in industrial applications.	High GWP	Voluntary agreement	Implemented	EPA	
AGRICULTURE						
Agricultural Outreach Programs: AgSTAR; RLEP	Promotes practices to reduce GHG emissions at U.S. farms.	CH ₄	Information, education, outreach	Implemented	EPA/USDA	
Nutrient Management Tools	Aims to reduce nitrous oxide emissions through improving by efficiency of fertilizer nitrogen.	N ₂ O	Technical assistance, information	Implemented	EPA/USDA	
USDA CCC Bioenergy Program	Encourages bioenergy production through economic incentives to commodity producers.	CO ₂	Economic	Implemented	USDA	
Conservation Reserve Program: Biomass Project	Encourages land-use changes to increase the amount of feedstock available for biomass projects.	CO ₂ N ₂ O	Economic	Implemented (pilot phase)	USDA	
FORESTRY						
Forest Stewardship	Sequesters carbon in trees, forest soils, forest litter, and understudy plants.	CO ₂	Technical/financial assistance	Implemented	USDA	

TABLE 4-1 (continued) Summary of Actions to Reduce Greenhouse Gas Emissions

Name of Policy or Measure	Objective and/or Activity Affected	GHG Affected	Type of Instrument	Status	Implementing Entity/Entities	Estimated Mitigation Impact for 2000 (Tg CO ₂ Eq.)
WASTE MANAGEMENT						39.2
Climate and Waste Program	Encourages recycling, source reduction, and other progressive integrated waste management activities to reduce GHG emissions.	All	Voluntary agreements, technical assistance, information, research	Implemented	EPA	
Stringent Landfill Rule	Reduces methane/landfill gas emissions from U.S. landfills.	CH ₄	Regulatory	Implemented	EPA	
Landfill Methane Outreach Program	Reduces methane emissions from U.S. landfills through cost-effective means.	CH ₄	Voluntary agreements, information, education, outreach	Implemented	EPA	
CROSS-SECTORAL						6.2
Federal Energy Management Program	Promotes energy efficiency and renewable energy use in federal buildings, facilities, and operations.	All	Economic, information, education	Implemented	DOE	
State and Local Climate Change Outreach Program	Assists key state and local decision makers in maintaining and improving economic and environmental assets given climate change.	All	Information, education, research	Implemented	EPA	
TOTAL						241.9