

United States

TAKING
ACTION
ON
CLIMATE
CHANGE



October 1999

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EXECUTIVE SUMMARY

Climate change threatens the United States and all nations. To help address this threat, the United States is taking significant new steps to reduce greenhouse gas emissions. During the past year, President Clinton launched initiatives on bioenergy, wind and solar energy, and Federal energy efficiency. In addition, a growing number of state and local governments and private companies are stepping forward to address climate change with prudent, creative, cost-effective strategies to reduce greenhouse gas emissions. At the same time, the United States continues to invest more than \$1 billion per year in research and development on technologies that will help reduce greenhouse gas emissions. In short, from city council chambers to corporate boardrooms, the United States is mobilizing against global warming—the greatest environmental challenge of the 21st century.

New Initiatives

In 1999, the Clinton Administration launched four initiatives that will help reduce greenhouse gas emissions in the United States:

- **Bioenergy.** In August 1999, the President signed an Executive Order to accelerate the development of bio-based industries. The President set a goal of tripling U.S. use of bioenergy and bioproducts by 2010. This would reduce annual greenhouse gas emissions by an amount equal to as much as 100 million metric tons of carbon (MMTCE).
- **Federal energy.** In June 1999, President Clinton issued an Executive Order requiring each Federal agency to reduce greenhouse gas emissions from energy use in buildings by 30 percent below 1990 levels by 2010.

- **Wind Powering America.** This new U.S. Department of Energy (DOE) initiative seeks to supply 5 percent of U.S. electricity through wind technologies by 2020, which would avoid emissions of 35 MMTCE.
- **Brightfields.** DOE announced a program aimed at using former industrial sites contaminated with toxic waste for producing pollution-free solar energy.

These new Federal initiatives on climate are set forth in the first section of this report.

U.S. States, Localities, and Companies Moving Forward

In addition to actions at the Federal level, many states, cities, industries, and sectors of the U.S. economy are moving forward on their own to address climate change, understanding that the threat is real and prudent action is called for.

These actions are described in more detail in Parts II and III of this report.

Ongoing Federal Efforts

The foundation of President Clinton's environmentally and economically sound plan for reducing U.S. greenhouse gas emissions remains the Climate Change Technology Initiative (CCTI)—a vigorous five-year, \$6.3 billion program of tax incentives and investments focusing on energy efficiency and renewable energy technologies. Last year, in Fiscal Year 1999, President Clinton and Vice President Gore secured more than \$1 billion in CCTI funding. These CCTI investments already are yielding real results and real emissions reductions. For example:

- Federal *energy efficiency standards for equipment and appliances*, such as heating and cooling equipment, water heaters, lighting, refrigerators, clothes washers and dryers, and cooking equipment will avoid cumulative emissions of more than 225 MMTCE by 2010.
- Federally led voluntary programs, such as *ENERGY STAR*® labeling for high efficiency products and buildings, already have resulted in more than \$3 billion in technology investments by U.S. companies, consumers, and state and local organizations. These investments will deliver

emissions reductions of almost 40 MMTCE over the next decade.

- Federal efforts focused on *non-CO₂ greenhouse gases* have locked in emissions reductions of well over 100 MMTCE through 2010. In so doing, they are expected to maintain methane emissions at or below 1990 levels through 2010. Not counting applications to replace ozone-depleting substances, they will also maintain industrial emissions of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆) at or below 1990 levels through 2010.

Other CCTI investments have a more long-term R&D focus and can be expected to yield even greater reductions in the decade ahead. Among these are: the *Partnership for a New Generation of Vehicles*, a government-industry effort to develop cars that achieve up to three times the fuel efficiency of today's cars; the *Partnership for Advancing Technology in Housing*, which aims to improve the energy efficiency of new homes by more than 50 percent and to retrofit 15 million existing homes to make them 30 percent more energy efficient within a decade; and *research partnerships* for key renewable energy technologies such as wind, photovoltaics, geothermal, and biomass.

In addition to the CCTI, other important elements of the President's October 1997 plan include a proposal to restructure the electricity industry by introducing competition that will provide incentives for

energy efficiency; a wide range of industry consultations with key energy-intensive industry sectors to improve energy use and reduce emissions; a commitment to work with the U.S. Congress and industry on legislation to reward companies that take early action to reduce their emissions; reducing the Federal government's own greenhouse gas emissions; and a strong program of scientific research to further our understanding of human and naturally induced changes in the Earth's environment and assess the likely consequences of global warming.

These ongoing Federal programs and policies to address climate change are set forth in more detail in Part IV of this report.

Part of a Larger Three-Stage Plan

The programs and policies set forth in this report are part of the United States' longer-term response to the challenge of climate change. In 1993, following the U.S. ratification of the UN Framework Convention on Climate Change, President Clinton launched the Climate Change Action Plan (CCAP), emphasizing a series of win-win voluntary initiatives for reducing greenhouse gases. These efforts were expanded significantly in October 1997, prior to the Kyoto conference, when the President outlined his more comprehensive, three-stage plan for reducing U.S. emissions. The three stages of the plan are:

- **Stage 1: Priming the pump** through R&D investments and tax incentives

aimed at increasing energy efficiency and spurring the broader use of renewable energy; working with industry and others to promote sensible solutions; and employing market-based mechanisms to ensure cost-effective reductions. *All of the materials included in this report are part of Stage 1 of the President's plan.*

- **Stage 2: Review and evaluation** in preparation for a domestic emissions trading system. Under the President's plan, the United States will review its progress beginning around 2004 and evaluate next steps as it moves towards a market-based permit trading system for carbon emissions. Emissions trading will harness the power of the market to achieve a national greenhouse gas target at the lowest possible cost. The United States is using emissions trading successfully to reduce the pollution that causes acid rain, exceeding environmental objectives while reducing the costs to 50 percent below the expected level.
- **Stage 3: Binding targets through a domestic emissions trading program.** Beginning in 2008, an emissions trading program would be implemented to cut emissions in the major greenhouse gas-emitting sectors of the U.S. economy: buildings, transportation, industry, and electricity.

The President's three-stage plan recognizes the long-term nature of efforts to address climate change. It allows us to

monitor our progress and re-assess our success in reducing emissions, the state of scientific knowledge, and the response of the U.S. economy. The plan's graduated approach to emissions reduction will allow the United States to exploit the opportunities that exist for win-win reductions that both help the environment and save money for consumers, businesses, and governments.

1998 Emissions

In 1998, greenhouse gas emissions in the United States grew only slightly (0.4 percent) despite strong U.S. economic growth (3.9 percent). Although there were several one-time contributing factors (including mild weather that reduced the demand for heating fuel), the 1998 emissions figures are encouraging. Clearly, these numbers demonstrate that economic growth and emissions need not move in lockstep. The 1998 figures are consistent with a long-term movement in the U.S. economy toward

the lower-emitting service and high-technology sectors.

The Way Forward

At the same time, we realize that it is far too soon to conclude that the 1998 emissions figures represent a trend, and there is certainly no room for complacency. Reducing emissions will continue to be an uphill climb—both for the United States and the entire world.

In the long run, the President's balanced approach to the challenge of climate change will allow the United States to continue to grow our economy and protect the environment at the same time.

As President Clinton has said: "One of the big ideas the world has to abandon is the idea that the only way to build a modern prosperous economy is with the industrial energy use patterns of a former era. It is not true."

PART I: NEW FEDERAL INITIATIVES

Over the past year, the Clinton Administration introduced a series of new Federal initiatives to address the challenge of climate change. They include:

- **Executive Order on Bio-Based Products and Bioenergy**
- **Executive Order on Federal Energy Efficiency**
- **Wind Powering America Initiative**
- **Brightfields Initiative**

This section discusses each of these initiatives in turn.

Measuring Greenhouse Gas Emissions and Emissions Reductions

Greenhouse gas emissions can be expressed either in terms of metric tons of carbon equivalent (MTCE) or in metric tons of carbon dioxide equivalent. This report uses MTCE or million MTCE (MMTCE). To convert carbon equivalents to carbon dioxide equivalents, multiply by 3.67.

Because of the interaction effects of programs designed to reinforce each other, it would not be appropriate to

add together emissions reductions for all programs listed in this report to arrive at an estimate of total U.S. reductions. Furthermore, estimates from government agencies and industry sectors rely on different baselines and cannot be directly compared. There is a substantial amount of uncertainty associated with any of these projections because the estimates attempt to quantify projected technology adoption more than a decade into the future.

THE PRESIDENT'S NEW EXECUTIVE ORDER ON BIO-BASED PRODUCTS AND BIOENERGY

On August 12, 1999, President Clinton announced new steps to spur bio-based technologies that can help grow the U.S. economy, enhance U.S. energy security, and meet environmental challenges, including global warming. The President issued Executive Order 13134 coordinating Federal efforts to accelerate these 21st century technologies—which can convert sustainably grown crops, trees, and other “biomass” into fuels, power, and products. He also set a goal of tripling U.S. use of bioenergy and bioproducts by 2010. Meeting this goal could create \$15 to \$20 billion in new income for farmers and rural America, and reduce annual greenhouse gas emissions by an amount equal to as much as 100 million metric tons of carbon (MMTCE)—the equivalent of taking more than 70 million cars off the road.

What the Executive Order Does

Scientific advances in agriculture, forestry, and other biological sciences are making bioenergy and bioproducts technically feasible and economically viable. Recent reports and studies concluded that U.S. government support for research is essential to realizing the full economic

and environmental potential of bio-based industries. The new Executive Order:

- Establishes a permanent council consisting of the Secretaries of Energy and Agriculture, the Environmental Protection Agency Administrator, the Director of the National Science Foundation, and other agency heads

Biomass: Clean Renewable Energy for the 21st Century

The term *biomass* refers to trees, crops, and agricultural, forestry, and other organic waste materials that can be used to make fuels, chemicals, and electricity. Biomass is a clean and renewable source of energy. It can be used to fuel cars, power factories, and create a host of chemicals and other everyday products. Energy from biomass sources—mostly from wood and wood waste—currently accounts for about 3 percent of the total U.S. energy supply. Since biomass crops absorb carbon during growth, their use for

energy and other applications results in near-zero net carbon release. Thus, substituting sustainably grown biomass for fossil fuels can dramatically reduce greenhouse gas emissions that contribute to global warming, while also reducing emissions of nitrogen oxides (NO_x), sulfur oxides (SO_x), and other pollutants. In addition, the deep-rooted plants commonly used for biomass, such as poplar, willow, and switchgrass, are helpful in controlling erosion, filtering chemicals from water runoff, and slowing floodwaters.

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to develop a detailed research program to be presented as part of the annual Federal budget.

- Instructs the council to review major agency regulations, incentives, and programs to ensure that they are effective in promoting the use of bioproducts and bioenergy. The council's plan will be reviewed by an outside advisory group with representatives from bio-based industries, agriculture and forestry sectors, universities, and environmental groups.
- Directs the U.S. Department of Energy (DOE) and the U.S. Department of Agriculture (USDA) to establish a National Bio-based Products and Bioenergy Coordination Office to manage the preparation of interagency budgets and provide a convenient point of entry for anyone interested in Federal work in bio-based products and bioenergy.

The Executive Order also builds on the Administration's record of strong and consistent support for bio-based industries, as indicated by: (1) the electricity restructuring bill introduced by the Administration earlier in 1999 requiring that 7.5 percent of all U.S. electricity come from renewable resources by 2010; (2) Executive Order 13101, signed in September 1998, instructing Federal agencies to make use of bio-based products; (3) new proposed tax credits for bio-based electricity production; and (4) increased research funding for DOE,

USDA, and the National Science Foundation.

Bioenergy and Bioproducts Are Here Today

Clean bioenergy and bioproducts are very much here and now. Already DOE and USDA are participating in partnerships on a number of breakthrough bioenergy and bioproducts projects, including:

Biomass-to-Ethanol Demonstration

Projects. During the autumn of 1998, BC International Corporation broke ground in Jennings, Louisiana, for the first commercial plant to produce ethanol from the cellulose in agricultural waste—in this case, sugar cane bagasse. A number of other demonstration projects to convert municipal solid waste to ethanol are under development.

Biorefinery for Chemicals. Cargill Corporation, one of the largest privately held companies in the United States, built a prototype biorefinery in Blair, Nebraska. This new facility will use corn to produce a stream of chemical products and also a biodegradable polymer, polylactic acid, used in manufacturing films, fibers, rigid materials, and coatings.

Co-Firing Technologies. A number of projects are underway to explore ways to use biomass such as switchgrass and short-rotation wood crops like willows to make electricity by co-firing them with coal. Two of the most prominent studies—the Iowa Chariton Valley initiative and

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the New York Salix project—also will investigate the technical and economic aspects of biomass gasification, in which biomass is made into a fuel gas that can be used for heat or power production.

Biomass to Energy. In the United States, more than 270 landfill gas-to-energy projects use the gas from decomposing waste as an energy source.

Economic Potential of Using Biomass for Energy and Products

Using biomass for energy and products is not only good for the environment, it also promises real economic opportunities for farmers, the forest products industry, energy producers, and chemical manufacturers. In rural areas, a fast-growing bioenergy market will increase the demand for energy crops, agricultural and forest residues, and wastes of all types. By creating high-tech jobs and new economic opportunities, meeting the President's goal of tripling U.S. use of bioenergy and bio-products could add \$15 to \$20 billion in new income for farmers and many rural communities, ensuring that they are an integral part of a prosperous 21st century global economy. The President's Committee of Advisors on Science and Technology noted in a recent report, "Powerful Partnerships: The Federal Role in International Cooperation on Energy Innovation," that investments in bioenergy technologies, infrastructures, and markets can play a crucial role in helping the world meet its future energy needs in an environmentally sustainable way.

The Administration's Fiscal Year 2000 Budget on Biomass

The President's Fiscal Year 2000 budget request contains \$242 million for investments in biomass research, development, and deployment, including:

Advanced Biomass Power and Fuels—funding for DOE and USDA to continue developing, testing, and demonstrating high-yield, low-cost biomass feedstocks; processes for co-firing biomass with coal to produce electricity; advanced technologies for biomass gasification using paper industry by-products; and continued work on producing alternative fuels, such as cellulosic ethanol, from biomass.

National Biomass Partnership—funding for DOE, USDA, and other Federal agencies and their private partners to launch a national partnership to develop advanced integrated biomass technologies.

The President also proposed a package of ***biomass tax credits***, which would add an extension of five years to the current tax credit of 1.5 cents per kilowatt-hour for electricity produced from biomass. In addition, the proposal expands the types of biomass eligible for the credit to include certain forest-related, agricultural, and other resources. Finally, the package includes a 1.0 cent per kilowatt-hour tax credit for electricity produced by co-firing biomass in coal plants.

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On June 3, 1999, President Clinton issued Executive Order 13123 that will help meet the challenge of global warming by requiring each Federal agency to reduce greenhouse gas emissions from energy use in buildings by 30 percent below 1990 levels by 2010. This will reduce annual greenhouse gas emissions by 2.4 million metric tons of carbon equivalent (MMTCE)—the equivalent of taking 1.7 million cars off the road—and save U.S. taxpayers more than \$750 million a year. The order also will expand markets for renewable technologies, reduce air pollution, and serve as a powerful example to U.S. businesses and consumers who can reap substantial benefits from energy improvements.

Aggressive New Goals

The Federal government is the largest energy consumer in the United States. Its annual energy bill runs more than \$8 billion, including \$4 billion to heat, cool, and power 500,000 buildings. Federal agencies already have reduced energy consumption 17 percent per square foot relative to 1985 levels. The Executive Order builds on that progress, extending current energy efficiency goals and setting new targets for greenhouse gas reductions, renewable energy use, and water conservation.

New Greenhouse Gas Reduction Goal.

The order requires each Federal agency to reduce greenhouse gas emissions that result from energy use in its buildings by 30 percent below 1990 levels by 2010. This is the Federal government's first-ever goal tied to greenhouse gas reductions.

New Energy Efficiency Goal for

Facilities. The Executive Order requires each Federal agency to improve energy efficiency in its buildings by 35 percent relative to 1985 levels by 2010.

New Energy Efficiency Goal for Industrial and Laboratory Facilities.

The order requires each Federal agency to improve its energy efficiency in industrial and laboratory facilities by 25 percent relative to 1990 by 2010.

Expanded Use of Renewable Energy.

Building on the President's commitment to install 20,000 Federal solar energy systems by 2010, the order calls for Federal agencies to expand their investments in renewable energy through applications of solar, wind, geothermal, and biomass technologies at Federal facilities and through the purchase of electricity from renewable energy sources.

Water Conservation.

The order calls for Federal agencies to improve their efficiency in the use of water in order to reduce water consumption and associated energy use. The order requires the U. S. Department of Energy (DOE) to work with other Federal agencies to develop water consumption baselines and then set appropriate goals for water conservation.

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Fewer Exempt Facilities. Prior to the President's new Executive Order, a large number of facilities (accounting for 17 percent of energy use in buildings) were exempt from meeting Federal energy goals. Now all facilities are subject to those goals and requirements unless they meet new exemption criteria to be developed by DOE. In addition, each agency must report all exempt facilities in its annual report to the President and explain the rationale behind excluding them from Federal energy goals.

Cutting-Edge Tools and Strategies

The Executive Order calls for agencies to use a wide range of energy management tools and strategies to fulfill the new energy efficiency, renewable energy, and greenhouse gas reduction goals.

Alternative Financing. Financing options such as Energy Savings Performance Contracts (ESPCs) and utility energy efficiency service contracts offer Federal agencies powerful tools for leveraging private sector financing to fund cost-saving energy improvements at no net cost to taxpayers. Under ESPCs, private sector energy service companies finance the upfront cost of purchasing and installing new energy efficient equipment. The Federal government uses a portion of the savings it accrues through reduced energy bills to repay the energy service company over the life of the contract. Contractors then receive a predetermined share of the value of the energy savings generated

by their efforts and may be paid only if actual savings result from the reduced energy use. All additional savings go to the Federal government. The government benefits from new equipment, reduced energy costs, improved energy efficiency, reduced greenhouse gas emissions, and conservation of nonrenewable fuels.

To date, DOE and the U.S. Department of Defense (DoD) have made more than \$8 billion in ESPC contract authority available for all Federal agencies to fund energy improvements. In addition, many of these contracts are "Super ESPCs" that rely on the same principles as regular ESPCs but offer an umbrella contract to allow expedited service. The Executive Order calls for agencies to maximize their use of ESPCs and utility energy efficiency service contracts to realize energy and cost savings.

Life-Cycle Cost Analysis. Federal agencies need to consider the full cost of their investments, including energy, operation, and maintenance costs, not simply the purchase cost of projects or products. By taking all costs into account, agencies can save money and reduce energy use. To that end, the order requires agencies to consider life-cycle costs—that is, investment, capital, installation, energy, operating, maintenance, and disposal costs—over the life of the project or product.

ENERGY STAR® Labels and Other Energy Efficient Products. The order calls for agencies to purchase energy efficient products such as those with the

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ENERGY STAR label. Purchasing compact fluorescent light bulbs, highly efficient boilers, and other energy efficient products can save Federal agencies hundreds of millions of dollars.

ENERGY STAR BuildingSM Label.

Agencies shall strive to meet the ENERGY STAR Building criteria in their eligible facilities to the maximum extent practicable by the end of 2002. The label signifies that the building is in the top 25 percent of similar buildings with regard to energy efficiency.

Electricity from Renewable Energy and Energy Efficient Sources.

Given that more than 70 percent of the Federal government's costs for energy used in buildings comes from electricity, the Executive Order requires agencies to consider the source of their electricity and opt for cleaner, more efficient electricity generation. Specifically, agencies shall strive to minimize the greenhouse gas intensity of purchased electricity. In addition, agencies should adopt policies to increase the use of electricity from renewable energy sources.

Highly Efficient Energy Systems. The Executive Order calls for agencies to make greater use of highly efficient energy systems, including combined heat and power systems that use "waste" heat from industrial processes to supply power to other needs. These systems can offer tremendous energy and cost savings, as well as significant environmental benefits.

Off-Grid Electricity Generation. The Executive Order requires agencies to consider off-grid electricity opportunities that often provide energy and environmental benefits, while allowing agencies to avoid the costs of building new transmission lines or digging up existing lines. Off-grid options can be particularly effective in remote locations such as some U.S. national parks. Technologies range from solar outdoor lighting to small wind turbines and fuel cells.

Sustainable Building Design. In July 1998, a number of Federal agencies committed to constructing sustainably designed buildings. The June 1999 Executive Order requires all Federal agencies to apply sustainable design principles to the siting, design, and construction of new facilities, thereby saving energy and taxpayer dollars, and reducing pollution.

Strengthening Agency Accountability

The Executive Order provides a framework to hold agencies accountable for their progress in Federal energy management. The following new management strategies and reporting requirements will help ensure that all Federal agencies manage energy use wisely, reaping substantial fiscal and environmental benefits for years to come.

Annual Reports to the President and Annual Score Cards. Under the Executive Order, each Federal agency must submit an annual report to the

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President describing the agency's progress in meeting the goals. In addition, the Deputy Director for Management of the Office of Management Budget will evaluate each agency's performance and submit agency score cards to the President.

President's Management Council. The President's Management Council, which generally consists of deputy secretaries from all agencies, will monitor agency progress on Federal energy management and provide a high-level forum for identifying ways to accelerate improvements.

Agency Energy Teams. The Executive Order requires each agency to form a technical energy support team to ensure that energy management strategies are implemented across all facilities. The energy teams bring together legal, procurement, and other essential agency representatives to overcome barriers to realizing energy and cost savings.

New Public-Private Advisory Committee. The order calls for DOE to organize an advisory committee to bring together private and public sector experts who can advise agencies on ways to improve their energy management practices.

Concrete Steps, Concrete Savings

In conjunction with the signing of a new Executive Order to promote energy efficiency, President Clinton announced the Pentagon's intent to award **the Federal government's largest-ever Energy Saving Performance Contract (ESPC).**

Under this award, Viron Energy Services and Pepco Energy Services will upgrade the energy performance of 837 Federal buildings at no up-front cost to taxpayers. The 18-year service contract, covering five military installations in the Washington, DC, area, will reduce annual energy consumption by 17 percent. The reductions will reduce annual greenhouse gas emissions by 24,000 metric tons of carbon equivalent (MTCE)—equivalent to taking more than 19,000 cars off the road—and will save DoD more than \$219 million in energy and related costs.

Other examples of energy-saving actions that the Executive Order is designed to promote include:

Energy Efficient Procurement. The Defense Logistics Agency (DLA), which supplies almost 20 percent of all light bulbs purchased by the Federal government, teamed up with DOE to offer half-price compact fluorescent light bulbs to any Federal purchaser.

Last year, the DLA supplied 1.5 million bulbs to Federal purchasers. If the bulbs had all been compact fluorescents, savings over the life of the bulbs would have totaled \$7.5 million. Recently, DOE added compact fluorescents to the ENERGY STAR product-rating program, providing consumers with quality assurance when they purchase the bulbs. A compact fluorescent bulb can last up to five years, saving \$67 over its lifetime.

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Renewable Energy Projects. Some 18 Federal agencies—from the departments of Agriculture, Interior, and Transportation to the Smithsonian Institution and the U.S. Postal Service—recently received a combined \$1.5 million in DOE funding for more than 100 cost-effective renewable energy projects at government sites. The technologies include more than 50 new or renovated solar water heating systems, large and small photovoltaic (PV) systems, PV-powered lights, wind power,

and “solar walls” that preheat outside air for interior heating.

Buying Renewable Power. EPA’s Richmond, California, laboratory became the first major Federal facility to use 100 percent renewable energy. Initially, 60 percent of the power supplied will come from geo-thermal sources, and 40 percent will come from biomass. This green power purchase will produce environmental benefits equivalent to eliminating more than two million passenger car miles driven in California each year.

Prior Federal Energy Efficiency Efforts

The President’s June 1999 Executive Order builds upon previous efforts to improve Federal energy efficiency. The Energy Policy Act of 1992 established the goal of improving energy efficiency in Federal office buildings by 20 percent on an energy-per-square-foot basis by the year 2000, compared with a baseline year of 1985. In March 1994, President Clinton issued Executive Order 12902, which extended the energy efficiency goal to 30 percent below 1985 levels by 2005. The latest order extends these goals still further, while also tightening provisions on exempted facilities and setting forth the first-ever Federal goal tied specifically to greenhouse gas reductions.

ENERGY STAR Buildings. EPA retrofitted GSA’s Foley Square Federal Office Building in New York City to qualify for the ENERGY STAR Buildings Label. The building, which opened in 1994, has 1.2 million square feet and houses offices of the Federal Bureau of Investigation, Internal Revenue Service, and EPA. By deploying equipment and products that qualify the building for the ENERGY STAR label, Foley Square saves taxpayers \$1.3 million annually in energy costs.

WIND POWERING AMERICA INITIATIVE

Wind is an emissions-free energy technology with largely untapped potential to meet future U.S. energy needs while helping address the challenge of climate change. *Wind Powering America* is a new U.S. Department of Energy (DOE) initiative announced in June 1999 to supply 5 percent of U.S. electricity through wind technologies by 2020. Meeting this goal will avoid annual greenhouse gas emissions of over 30 million metric tons of carbon equivalent (MMTCE) in 2020. Mid-term program goals include:

- Doubling the number of states with more than 20 megawatts of wind capacity to 16 by 2005, and tripling that number to 24 by 2010.
- Increasing the contribution of wind turbines to Federal electricity use to 5 percent (1,000 megawatts) by 2010.

Accelerated R&D

Wind Powering America will seek to meet its goals through a robust program to accelerate the research, development, and deployment of wind technologies. The initiative will build partnerships with states and localities, educate the U.S. public on the benefits of wind power, and encourage Federal agencies and organizations to lead by example in the employment of wind technologies.

Wind Power Is Here and Now

A New "Crop" for Farmers. Since 1998 more than 400 megawatts of new wind generating capacity has been installed on farmlands in the Great Plains region of the United States, providing a substantial economic boost directly to farmers, landowners, and local communities while satisfying the growing demand for clean electricity. Wind farming creates construction and service jobs in rural regions, as well substantial tax revenues for local municipalities.

Remote Community Power. Kotzebue, Alaska, located north of the Arctic circle, is putting wind energy to work in reducing its dependence on diesel fuel for electric power. Shipment of diesel fuel to Kotzebue as well as many other Alaskan communities is expensive, seasonally limited, and environmentally risky. Kotzebue recently began operating a wind farm comprised of 10 rugged 66-kilowatt turbines that are reliably providing up to 10 percent of the community's power needs with an energy cost savings of about 40 percent.

Federal Opportunity. Three 225-kilowatt wind turbines are saving the U.S. Navy more than \$100,000 each year in diesel fuel costs for powering its station on San Clemente Island, 70 miles off the coast of Southern California. In addition, the turbines are helping the Navy respond to stringent local air pollution control mandates. With a near-perfect reliability record, the project is serving as a model for the way that wind energy can bring benefits to Federal facilities.

BRIGHTFIELDS INITIATIVE

Brightfields is a new initiative launched by the U.S. Department of Energy (DOE) in August 1999, aimed at using former industrial sites contaminated with toxic waste for producing pollution-free solar energy. This novel concept addresses three of the nation's greatest challenges: climate change, urban revitalization, and toxic waste cleanup.

From "Brownfields" to "Brightfields"

Many former industrial sites in U.S. urban areas are hard to redevelop because of a legacy of toxic waste contamination. This initiative will turn these "brownfields" into "brightfields" by placing clean energy systems, such as photovoltaic arrays, and high-tech solar manufacturing facilities on these sites.

Solar energy technologies, and photovoltaic systems in particular, are well-suited to brownfield sites. They require little maintenance and can stand directly on the ground without penetrating the surface or disturbing any existing contamination. The systems can be installed to function on or off the local power grid, depending on the needs of the site and existing infrastructure. They are especially attractive in urban areas with air quality concerns. With zero emissions, solar energy systems can offset emissions from other energy sources, particularly during peak hours when utilities often rely on older systems that pollute more heavily.

Brightfields also provide an opportunity for blighted urban neighborhoods to attract high-tech jobs and environmentally conscious businesses that are interested in supporting green investments or locating in environmentally friendly industrial parks.

Chicago First City to Use Brightfields Approach

The City of Chicago, working with DOE and Commonwealth Edison, developed an extensive plan that uses the brightfields approach to advance its economic development, climate change, air quality, and electricity reliability goals.

As a first step, municipal officials persuaded the Spire Corporation to manufacture solar panels at one of the city's brownfields, creating more than 100 new jobs. A solar energy system also will be installed, both to supply some of the company's electricity needs and to serve as a demonstration and educational site. In addition, the city and Commonwealth Edison committed \$8 million over the next five years to purchase and install solar energy systems at other brownfield sites, schools, office buildings, and municipal and commercial properties, and along transportation routes.

DOE has begun work with cities in California, Connecticut, Minnesota, New York, and Virginia to explore ways that brightfields can help communities address concerns about land use, economic development, energy, air quality, and climate change.

PART II: STATES AND LOCALITIES TAKING ACTION

Many U.S. states and communities are helping lead the fight against global warming. State and local governments, as regulators of many direct and indirect sources of greenhouse gas emissions and as managers of facilities that consume significant amounts of energy, are in a unique position to make a difference. Many are doing just that by stepping forward—both in partnership with the Federal government and on their own initiative—with innovative programs to reduce emissions. Their efforts are creating jobs and strengthening local economies, saving energy and money, and improving local air and environmental quality.

State and Local Success Stories

The following are just a few examples of the wide array of actions that states and localities are taking to address climate change:

The *State of New Jersey* committed to reduce its greenhouse gas emissions by 3.5 percent below 1990 levels by 2005. This amounts to a reduction equal to

5.7 million metric tons of carbon equivalent (MMTCE) from the state's business-as-usual projections. Strategies include improving commercial and industrial energy efficiency, using innovative technologies, preventing pollution, recycling, reducing solid waste, and sequestering carbon. One project, the Affordable Housing Initiative, offers grants to developers to design low-income housing that meets energy efficiency

U.S. Mayors Issue Statement on Global Warming

In September 1999, a group of more than 530 local officials in the United States issued a "Statement on Global Warming," expressing concern about the impacts of climate change on their communities and urging accelerated Federal efforts to assist them in reducing global warming pollution. Signatories included the mayors of Atlanta, Baltimore, Chicago, Cincinnati, Denver, Honolulu, Las Vegas, Madison, Milwaukee, Minneapolis, Newark, New Orleans, Portland, Salt Lake City, San Francisco, Seattle, St. Louis, and Tampa. The International Council for

Local Environmental Initiatives (ICLEI) coordinated issuance of the statement.

Sixty-six U.S. cities have joined ICLEI's *U.S. Cities for Climate Protection Campaign*. Participating cities agree to a set of milestones that includes preparing a baseline survey of emissions, setting a reduction target, preparing a local action plan, and implementing the plan. In 1998, the campaign avoided greenhouse gas emissions of approximately 1.3 million metric tons of carbon equivalent (MMTCE).

standards 30 percent better than current building codes. The state also established a Carbon Dioxide Bank working group and signed a letter of intent with the Netherlands that establishes a framework for developing joint initiatives to address global warming, including an emissions trading system.

In 1997, the *State of Oregon* enacted landmark legislation establishing a carbon dioxide standard for all new power plants of 25 megawatts or more. New natural gas-fired plants must emit 17 percent less carbon dioxide per kilowatt-hour than the most efficient gas-fired plants currently operating in the United States. The standard can be met by any combination of efficiency, co-generation, or offsets from off-site mitigation. The mitigation measures will offset 3.2 MMTCE over the next 100 years.

The *State of Wisconsin* is implementing energy efficient technologies and practices throughout state government, and encouraging consumers and businesses to do the same. The state's high-visibility public education campaign included retail store displays, newspaper and radio spots, brochures, and a toll-free call-in number. To date, Wisconsin has upgraded 53 million square feet in state government buildings, avoided annual greenhouse gas emissions of almost 30,000 metric tons of carbon equivalent (MTCE), and saved more than \$7 million in annual energy costs.

As part of an overall restructuring of the *State of California's* utility industry, the state established a Renewable Resource Trust Fund to collect \$540 million from investor-owned utilities to support existing and emerging renewable energy technologies. Municipal utilities and individual customers also may contribute to the fund. The fund is used to support production incentives, producer and consumer rebates, and an education program to help develop a consumer market for renewables. California also is collecting \$218 million from the state's investor-owned utilities for energy efficiency projects.

In the *State of North Carolina, Wake County Public Schools* embarked on an ambitious effort to upgrade the energy efficiency of the county's 120 school and administration buildings. By using a shared savings program in which individual schools receive a 10 percent share of their total annual energy savings, the school system involved the entire community in energy efficiency efforts. Measures already in place are avoiding more than 2,400 MTCE annually.

The city and county of *Denver, Colorado*, invested in lighting upgrades in 4.5 million square feet of office space, as well as multiple energy efficiency measures in nearly 2,000 additional facilities. The city's downtown district now has the highest number of buildings with the ENERGY STAR® label of any U.S. municipality. ENERGY STAR BuildingsSM is a U.S. Environmental Protection Agency

(EPA) program recognizing buildings that are in the top 25 percent of their class with regard to energy efficiency. The city also replaced incandescent light bulbs with high-efficiency red light emitting diodes in traffic signals at more than 1,200 intersections. All told, Denver's efforts avoid emissions of more than 1,900 MTCE each year.

In *San Diego, California*, the city government, San Diego County, and the San Diego Unified School District are focused on a concentrated effort to improve building energy efficiency. The city's Environmental Services Building, for example, became the first facility in the United States to receive EPA's ENERGY STAR Buildings label. The county recently installed energy efficient lighting in some 5 million square feet of office space in less than 18 months. Together, these efforts are reducing annual greenhouse gas emissions by more than 1,200 MTCE and saving \$5.6 million in annual energy costs.

The *New York State Energy Research and Development Authority (NYSERDA)* now offers to pay 50 percent of an applicant's consulting services for feasibility audits for energy upgrades in five of the state's electric distribution systems. NYSERDA will pay for an additional 25 percent of the audit costs of any applicant who has joined EPA's ENERGY STAR Buildings partnership.

Minneapolis and *St. Paul, Minnesota*, continued efforts toward fulfilling their pledge (made in 1993) to reduce their combined carbon dioxide emissions by 20 percent below 1988 levels by the year 2005. So far, the Twin Cities' efforts have focused largely on improving energy efficiency in municipal properties, which has saved more than \$877,000 in annual energy costs.

Low Income Weatherization and State Energy Grants

Two U.S. Department of Energy (DOE) programs specifically target energy efficiency investments at the state and local levels. The *Weatherization Assistance Program* delivers home energy efficiency services, such as insulation, to low-income U.S. households, reducing energy costs, improving health and safety, and reducing carbon emissions. In Fiscal Year 2000, this program will weatherize the homes of 66,000 low-income families, avoiding emissions of more than 760,000 metric tons of carbon equivalent (MTCE) and saving \$248 million. The *State Energy Program* has provided grant funds to carry out more than 8,700 projects since 1976. The program promotes the adoption of high-potential energy technologies developed under DOE energy efficiency and renewable energy research programs, flexibly addressing unique state needs and opportunities.

Soon, more than a dozen school districts in the *State of Iowa* will have installed nonpolluting wind turbines to produce electricity for classrooms. Forest City Community Schools, for example, began operating a 600-kilowatt wind turbine in January 1999 that is expected to provide 80 to 90 percent of the school's electrical needs.

Prince Georges County, Maryland, installed a methane recovery system at a landfill and uses the methane to provide heat, hot water, and electricity to a nearby correctional facility. Annual methane emissions were reduced by more than 250,000 MTCE, and energy revenues total nearly \$1.3 million.

The *University of Virginia* is making energy efficiency upgrades to more than 7 million square feet of facilities through lighting retrofits, building system improvements, heating pipe insulation, occupancy sensors, and other measures. The university invested \$4.3 million in energy efficiency steps, avoiding annual greenhouse gas emissions of more than 1,700 MTCE.

In 1999, *Santa Monica, California*, became the first major municipal government in the world to purchase renewable energy to provide all of its power needs (approximately 5 megawatts).

In 1994, the *State of Utah* established a partnership with the National Park Service to demonstrate the use of renewable energy and energy efficient technologies in the parks and monuments of Utah.

Renewable and energy efficiency projects have been initiated at four sites in the state, reducing annual greenhouse gas emissions by 185 MTCE, and saving \$140,500 per year in energy costs and fuel savings.

Working In Partnership with Federal Government

In addition to the Weatherization Assistance Program and the State Energy Program, the Federal government has numerous programs that provide support to state and local climate change efforts, including many of those discussed here. Among these programs are ENERGY STAR Buildings, WasteWi\$e, and a number of others set forth in the final section of this report.

One program, EPA's *State and Local Climate Change Program*, is a capacity-building initiative that provides states and communities with guidance and technical information in establishing greenhouse gas baseline emissions inventories and identifying options to reduce emissions. To date, 34 of 50 states have completed greenhouse gas emission inventories, and 25 states are producing action plans to identify options that reduce emissions. For example, Vermont's State Action Plan identified ways to reduce cumulative emissions by 21 percent, or almost 13 MMTCE by 2020. Vermont's policies also would reduce acid rain precursors by 24 percent, ground level ozone by 30 percent, and energy use by 16 percent.

Many U.S. businesses are stepping forward to assume leadership roles in addressing the challenge of climate change.

Growing Commitment to Greenhouse Gas Reductions

An increasing number of U.S. companies are committed to taking real actions to cut their greenhouse gas emissions. In the past six months:

DuPont announced three goals for 2010 related to climate change. The first is to reduce greenhouse gas emissions by 65 percent from a 1990 baseline; the second is to hold energy use flat at 1990 levels; and the third, to generate 10 percent of DuPont's energy from renewables. These goals build upon previous objectives announced for 2000.

Motorola led efforts in the semiconductor industry to reduce greenhouse gas emissions by pledging to reduce the company's perfluorocarbon (PFC) emissions by 50 percent relative to a 1995 baseline by 2010. The mitigation is made possible by reducing the use of PFCs or replacing them during the cleaning and etching stages of the manufacturing process. Motorola's target exceeds the goal for PFC reduction set by most of the other members of the semiconductor industry. (See "World Class Leadership.")

DuPont and Motorola are just the latest additions to the roster of U.S. corporations that understand the threat of global warming is real. In 1998, *United Technologies*—producers of Otis elevators,

Carrier air conditioners, Pratt & Whitney engines, and Sikorsky helicopters—announced a plan to cut emissions by improving energy efficiency 25 percent per unit of production by 2010. In addition, *IBM* announced a corporate-wide annual goal of improving energy efficiency by 4 percent. IBM also set a reduction target for PFCs; and by 2002, IBM will reduce its emissions of perfluoroethane by 40 percent per unit of production. Also, British Petroleum extended its commitment to reduce greenhouse gas emissions 10 percent below 1990 levels by 2010 to include its newly acquired U.S. subsidiaries, *Amoco* and *Arco*.

World Class Leadership

In April 1999, thanks to the leadership of Motorola and others, the global semiconductor industry agreed to reduce perfluorocarbon (PFC) emissions by 10 percent by 2010 relative to a 1990 baseline. Manufacturers in Europe, Japan, Korea, the United States, and Taiwan committed to aggressive action to reduce the use of PFCs in existing equipment and agreed to invest in major design changes for future low- or no-emitting manufacturing processes. Companies that accepted the World Semiconductor Council's reduction target for PFC emissions produce more than 90 percent of the world's semiconductors.

Real Actions, Real Reductions

In recent years, dozens of firms in a variety of industries have been moving forward with real actions to reduce their emissions of greenhouse gases and improve their energy efficiency. Examples include:

Alcan Ingot committed to reducing its PFC emissions by about 50 percent, relative to 1990 levels, by the year 2000 through the U.S. Environmental Protection Agency's (EPA) Voluntary Aluminum Industrial Partnership program. At Alcan's Sebree Aluminum Plant, the company reduced its PFC emissions by 63 percent over the past five years through the installation of computer-based systems that improve the flow of raw materials into aluminum smelting pots.

Applied Materials is addressing climate change aggressively by developing a technology that cleans semiconductor chemical vapor deposition chambers with minimal emissions of PFCs. The technology simultaneously improves productivity by reducing chamber clean time by up to 60 percent. A high-density, microwave-driven plasma discharge dissociates PFC molecules with an efficiency greater than 99 percent and consequently reduces greenhouse gas emissions by two orders of magnitude.

Panasonic is a leader in the manufacture and promotion of energy efficient ENERGY STAR® home electronic products. During Panasonic's first year of partnering with EPA, almost 97 percent of the company's unit sales qualified for the ENERGY STAR

label, compared with the industry average of 40 percent. Panasonic also aggressively promotes public awareness of energy efficiency. Because of the firm's efforts, EPA's ENERGY STAR public service announcement recently ran hourly on the large astrovision screen in Times Square, New York City.

Ricoh Corporation is a leader in the design and manufacture of energy efficient ENERGY STAR office equipment and in educating its own employees and the public about the environmental benefits of energy efficiency. Ricoh markets a wide range of ENERGY STAR digital printers, faxes, and copiers. The company also developed an exceptional web-based interactive educational tool on ENERGY STAR and the environment. The tool was intended initially for the Ricoh's sales staff and service technicians in the United States and Canada but is now used for public education as well. Ricoh expects to attract millions of web viewers by the end of 1999 and to expand the use of this educational tool to other countries.

ST Microelectronics improved energy efficiency and reduced PFC emissions in semiconductor manufacturing. The company benchmarked its energy use at production facilities and is implementing energy efficiency projects using wind turbine, photovoltaic, thermal solar, fuel cell, and cogeneration technologies that will reduce greenhouse gas emissions by a factor of 10 by 2010.

Texas Industries is pursuing a goal of zero waste in its cement and steel oper-

ations. To jumpstart the process of reaching this goal, the company developed a technology that uses a steel making by-product, slag, in the cement manufacturing process. The technology increases cement production by up to 15 percent, reduces greenhouse gas emissions by about 10 percent, and lowers conventional air pollutants by up to 40 percent.

Trigen is a corporate leader in promoting combined heat and power across the country, and the company has been successfully installing high-performing projects. For example, Trigen's Grays Ferry combined-cycle gas turbine cogeneration unit in Philadelphia replaced several old oil-fired district heating boilers. The project is designed to operate at 70 percent fuel efficiency, producing 150 megawatts of power and 1.4 million pounds of steam per hour. The district energy system provides heat to 70 percent of the downtown area's buildings and institutional facilities. The project is estimated to reduce emissions by approximately 90,000 metric tons of carbon equivalent (MTCE) annually. The cogeneration project at the Loctite Corporation in Rocky Hill, Connecticut, operates at 88 percent efficiency and is capable of generating 9.5 million kilowatts per year of electric energy. Annual emissions reductions are estimated at 750 MTCE per year.

TXU, one of the largest energy providers in the United States, is committed to reducing emissions of sulfur hexafluoride (SF₆) gas voluntarily in partnership with EPA's Climate Challenge and Emission

Reduction Partnership for Electric Power Systems program. TXU realized significant reductions in the use of SF₆ gas by introducing advanced leak detection equipment, initiating aggressive policies to identify equipment in need of repair, and implementing a strict inventory protocol that ensures all purchased SF₆ is fully and properly used.

Industry Sectors Move Forward

In addition to the semiconductor industry (see "World Class Leadership" on page 20), a number of other industry sectors

Corporations Speak Out for Action

In 1998, the new **Pew Center on Climate Change** launched a \$5 million campaign to build support for taking action on climate change. *Boeing, DuPont, Shell, Weyerhaeuser*, and some 17 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." In addition, the **Business Roundtable**, a group of CEOs from leading U.S. corporations, this year released a report advocating "the deployment of more energy-efficient and breakthrough technologies" and called on government and industry to work together to find answers to the challenges of climate change.

also are improving efficiency and reducing greenhouse gas emissions:

The **electric utility** sector entered into the *Climate Challenge* program in 1994 and agreed to reduce, avoid, or sequester greenhouse gas emissions voluntarily by 2000. Utility companies, together with the U.S. Department of Energy (DOE) and EPA, developed a workbook of reduction options that was widely circulated. Individual companies entered into agreements, and, as a result of their participation, utilities estimate emissions reductions of as much as 47 million metric tons of carbon equivalent (MMTCE) in 2000.

The **steel industry** is the fourth largest energy-consuming manufacturing subsector in the United States. The industry recently undertook a number of projects to increase energy efficiency and reduce waste. From 1994 to 1996 alone, the energy intensity of blast furnace iron making dropped by 4 percent. A comparable drop in carbon dioxide emissions accompanied the reduction in energy consumption. Nearly 80 percent of obsolete scrap from post-consumer products, such as discarded cars and appliances, is currently recycled; the steel industry is engaged in research to allow it to meet its goal of 100 percent recovery. Utilizing scrap steel greatly reduces the amount of energy required to make steel from virgin materials.

The **chemical industry** represents nearly 7 percent of total U.S. energy use. About

half of this sector's energy is used for feedstocks, while the remainder provides fuel, power, and steam. The Chemical Manufacturers Association (CMA) adopted its own Climate Action Program to reduce or avoid greenhouse gas emissions. A large portion of the industry reported emissions every year from 1992 through 1997; energy efficiency performance for those companies improved nearly 22 percent per pound of production with a corresponding drop in carbon dioxide emissions of 24 percent. The CMA awards companies for outstanding energy efficiency projects, thereby providing a model that other companies can use to reduce emissions and improve efficiency. The projects range from waste elimination and equipment innovations to new catalysts and process redesign. CMA intends to continue to implement its Energy Efficiency Continuous Improvement and Climate Action Programs vigorously in order to strengthen the industry's performance.

The **cement industry** emits carbon dioxide from the use of fossil fuels as well as from the calcination process in which limestone is heated. Companies representing more than 70 percent of U.S. cement production have joined EPA's Climate Wise program to take advantage of the latest methods of improving energy efficiency and reducing emissions. A spreadsheet-based workbook incorporates issues specific to the cement industry and enables companies to prepare an action plan and report the results of their efforts. The companies estimate that in 2000, annual emissions will be reduced by 8

percent below the business-as-usual projection and that annual savings will total \$2.3 million.

The *aluminum industry* is another energy-intensive sector with many opportunities to reduce its greenhouse gas emissions. The industry is investing in R&D, with a goal of a 15 percent reduction in energy use and concomitant decrease in carbon dioxide emis-

sions, as well as zero carbon dioxide emissions released from the smelting process. In addition, 11 of 12 U.S. primary aluminum manufacturers reduced their annual greenhouse gas emissions by 1.8 MMTCE annually and are committed to reducing PFC emissions by 45 percent to 1990 levels by 2000 through EPA's Voluntary Aluminum Industry Partnership.

Industry Consultations

An important component of the President's October 1997 plan to reduce U.S. greenhouse gas reductions is to build voluntary partnerships with energy-intensive industries to develop strategies to cut emissions. High-level Administration officials have met with top management of the aluminum, cement, forest products, gas pipelines, and steel industries, and publicly owned and investor-owned electric utilities. These consultations between

the Administration and industry leaders are focusing on the development of a common methodology on emissions baselines, measuring, monitoring, and reporting, as well as the identification of opportunities for the development and diffusion of less carbon-intensive technologies and practices. As part of these consultations, the Administration and industry officials discuss ways to ensure credit for businesses that take early actions to reduce emissions.

PART IV: ONGOING U.S. DOMESTIC PROGRAMS

In addition to efforts by U.S. states and localities, U.S. companies, and new Federal initiatives, there are literally dozens of win-win climate change programs and initiatives put into place by President Clinton since 1993. These new programs aim to develop and deploy energy efficient technologies and spur the development and broader use of renewable energy. These efforts have accelerated and expanded since the Kyoto climate change conference in 1997. Sustaining this commitment to reducing U.S. greenhouse gas emissions has been a focused effort by President Clinton to invest in the research, development, and deployment of energy efficiency technologies and renewable energy—an area whose budget in the U.S. Department of Energy (DOE) has exceeded \$800 million each and every year of the Clinton Administration.

The following survey highlights the most important of these investments, as well as a number of programs aimed at reducing or avoiding U.S. greenhouse gas emissions administered by the U.S. Environmental Protection Agency (EPA), the U.S. Department of Agriculture (USDA), and other agencies. Together, the programs cover the four major greenhouse gas-emitting sectors of the U.S. economy (buildings, transportation, industry, and electricity), carbon sequestration, agriculture and forestry, and a robust scientific research program.

As the other components of the President's strategy are implemented by industry partners, citizens, and the U.S. Congress, the Administration expects accelerated and greater energy efficiency, environmental, security, and economic benefits.

Buildings

The buildings sector is responsible for approximately 35 percent of U.S. greenhouse gas emissions. Most of the emis-

sions result from the electricity needed to run appliances and equipment in buildings, such as heating, ventilation, and air conditioning equipment. Studies show that many homes and businesses could reduce their energy use by about 30 percent using proven, cost-effective products, and investing in simple profitable building upgrades. A variety of DOE and EPA programs focus on developing and promoting the broader use of cleaner and more efficient building and appliance technologies. The programs include:

Partnership for Advancing Technology in Housing (PATH)

PATH is a partnership between the Federal government and the building industry to develop and deploy housing technologies to make new homes 50 percent more energy efficient and to make at least 15 million existing homes 30 percent more energy efficient within a decade. Meeting PATH's goals would reduce annual carbon emissions

in 2010 by an amount equal to nearly 24 million metric tons of carbon equivalent (MMTCE)—the amount produced by some 20 million cars—and would save consumers \$11 billion a year in energy costs. PATH has established five pilot communities in Denver, Los Angeles, Pittsburgh, and Tucson that are incorporating new housing technologies and advanced building concepts.

Energy Efficiency Standards for Equipment and Appliances

To save energy and reduce consumer utility bills, the U.S. government develops test procedures and national minimum energy efficiency standards for equipment and appliances, such as heating and cooling equipment, water heaters, lighting, refrigerators, clothes washers and dryers, and cooking equipment.

Climate Change Technology Initiative

The centerpiece of President Clinton's domestic climate change program is the Climate Change Technology Initiative (CCTI)—a package of targeted tax incentives and investments aimed at increasing energy efficiency and spurring broader use of renewable energy. The package amounts to an additional \$6.3 billion over five years (\$3.6 billion in tax cuts and \$2.7 billion in new investment), over and above what was already planned for climate change-related investments. The CCTI has been endorsed and supported by the President's Committee of Advisors on Science and Technology (PCAST). In 1997, PCAST produced a major analysis of energy R&D needs that provided the analytical underpinning for CCTI's package of investments. In Fiscal Year 1999, the President secured more than \$1 billion for CCTI investments—a 25 percent increase over the prior year. As of this writing, the Administration was engaged in negotiations to preserve these gains in the face of efforts by the U.S. Congress to scale back on investments in energy efficiency and renewables.

Most of CCTI's specific investment initiatives and programs are discussed within this section. Highlights of CCTI's proposed tax package include:

- **Tax credits for energy efficient homes.** Consumers would receive \$1,000-\$2,000 credit toward the purchase of a new energy efficient home; a 10-20 percent tax credit for the purchase of selected energy efficient products for their homes and buildings; and a \$1,000-\$2,000 credit for installing a rooftop solar system.
- **Tax credits for fuel-efficient cars.** The package includes tax credits ranging from \$1,000-\$4,000 for the purchase of a qualifying electric, fuel cell, or hybrid vehicle.
- **Tax credits for renewable energy.** The package extends the 1.5 cents per kilowatt hour tax credit for the production of electricity from wind and biomass; expands the biomass credit to cover additional sources of biomass; and adds a 1.0 cent per kilowatt hour tax credit for co-firing coal and biomass in power plants.

Through 1997, residential appliance standards avoided cumulative emissions of 37 MMTCE and saved consumers a cumulative \$13.3 billion. By 2010, the currently enacted standards will have avoided cumulative emissions of more than more than 225 MMTCE and saved consumers almost \$50 billion.

In the upcoming year, the U.S. government expects to publish standards for clothes washers, water heaters, fluorescent lamp ballasts, and central air conditioners. These standards, and the recently enacted standards for refrigerators and room air conditioners, are expected to have avoided cumulative emissions of almost 12 MMTCE through 2010.

ENERGY STAR® Partnerships

The ENERGY STAR partnership programs are designed to remove market barriers to the purchase of energy efficient products, services, and technologies in residential, commercial, and industrial buildings.

- The *ENERGY STAR Products* program allows manufactures of selected energy efficient products to promote their products with the ENERGY STAR label. This allows consumers to easily identify products that help the environment and save energy and money. More than 3,000 highly efficient ENERGY STAR product models, ranging from computers to refrigerators to central air-conditioning units, currently are available to consumers.

- The *ENERGY STAR BuildingsSM Partnership* encourages individual building owners, developers, and managers to install energy efficient lighting and undertake a five-stage strategy to capitalize on system interactions that maximize energy savings at minimum cost. To date, buildings representing more than 13 percent of U.S. commercial square footage have signed up for the program. Among them are the Empire State Building, World Trade Center, and Chicago's Sears Tower.

EPA estimates that by 2010 investments in ENERGY STAR technologies and services already in place today will reduce cumulative greenhouse gas emissions by 40 MMTCE and save consumers and businesses more than \$13 billion in energy costs.

Energy Efficiency in Schools

The energy to run the nation's 115,000 primary and secondary schools costs approximately \$5 billion annually—more than the cost of textbooks and computers combined. DOE and EPA have two programs that are working in coordination to improve energy efficiency in U.S. primary and secondary schools. DOE's *EnergySmart Schools* works in partnership with major companies, unions, nonprofits, and Federal, state, and local agencies to cut energy bills in schools so that the savings can be reinvested in students and their education. EPA's *ENERGY STAR Label for Schools* provides tools

for schools to evaluate their own energy use, find ways to reduce it, and meet indoor air quality standards. DOE estimates that a 25 percent reduction in schools' energy use will cut annual U.S. greenhouse gas emissions by 3 to 4 MMTCE.

New United States and European Community Agreement on ENERGY STAR Labeling

Later this year, the United States and the European Community are expected to sign an agreement making the ENERGY STAR label an international symbol for energy efficiency. The agreement is intended to unify voluntary energy efficiency labeling programs in two of the major global markets for office equipment. This coordinated effort will serve to increase global supply of energy efficient equipment and demand by establishing uniform criteria for energy efficiency in the United States and the European Union. In addition, the proposed agreement would lend greater authority to efforts by other countries to stimulate the market for energy efficient products and establish the ENERGY STAR program as the international symbol for energy efficiency. The agreement currently is awaiting EC approval.

Transportation

The transportation sector accounts for approximately 30 percent of U.S. annual greenhouse gas emissions (and 65 percent

of U.S. annual petroleum consumption). Reflecting the fact that more than three-fourths of total energy consumption in the transportation sector is used in cars and trucks, U.S. climate efforts in this area aim almost exclusively at reducing the consumption of oil (and oil by-products) in those vehicles.

Partnership for a New Generation of Vehicles

Partnership for a New Generation of Vehicles (PNGV) is a Federal government-industry effort that aims to develop attractive, affordable, family-size cars that meet all applicable safety and environmental standards while achieving up to three times the fuel efficiency of today's cars. Since 1993, the program has made great strides in developing lower-cost, lightweight materials, operational fuel cells, and advanced internal combustion engines for use in hybrid vehicles. The PNGV program aims to develop concept cars in 2000 and produce a production prototype mid-sized family car capable of 80 miles per gallon (mpg) by 2004. In Fiscal Year 1999, appropriations for PNGV-related work totaled more than \$240 million.

Light and Heavy Trucks

Similar government and industry efforts are aimed at developing cleaner, more efficient diesel engines for both light and heavy trucks.

- By 2002, DOE aims to develop **advanced diesel cycle engine technologies** for pickup trucks, vans,

and sport utility vehicles that achieve at least a 35 percent fuel efficiency improvement relative to current gasoline-fueled trucks while meeting strict emission standards.

- By 2004, DOE, in coordination with EPA and the U.S. Department of Defense, aims to develop **engine and vehicle technologies for heavy trucks** that will increase the fuel economy to 12 mpg from the current average of 5.3 mpg.

Breakthroughs on Concept Cars

A direct result of the Partnership for a New Generation of Vehicles (PNGV) is the development of “concept cars,” including hybrid vehicles that combine a traditional power source with battery storage and electric motors. On October 5, 1999, Ford presented to DOE the company’s P2000 concept car, which uses advanced materials to reduce the weight of a full-size vehicle by 40 percent. Combined with an advanced direct injection engine, the P2000 is projected to deliver 63 miles per gallon. In addition, General Motors and Daimler Chrysler displayed driveable vehicles powered by fuel cells. Concept cars that meet PNGV’s 80 mpg goal are expected to be unveiled in 2000.

Industry

Industry accounts for approximately one-third of U.S. annual carbon dioxide emissions (and 27 percent of U.S. energy consumption in 1997). A number of DOE and EPA programs focus on developing and promoting energy efficient technologies and practices in the nation’s most energy-intensive industries.

Industries of the Future

This DOE program works cooperatively with the nation’s most energy-intensive industries—such as aluminum, glass, chemicals, forest products, mining, petroleum refining, and steel—on research to develop technologies that increase energy and resource efficiency. Together, participating industries use more than 80 percent of all energy consumed in U.S. manufacturing. Promising collaborative efforts include improvements in the process of making steel, pulp and paper, and other energy-intensive products that could dramatically increase efficiency and lower greenhouse gas emissions. DOE estimates that participating industries will prevent emissions of more than 25 MMTCE by 2010 and realize \$4 billion in energy cost savings.

Climate Wise

This EPA program gives technical assistance to more than 530 individual manufacturing companies that have entered into partnership agreements with the Federal government to reduce green-

house gas emissions, increase productivity, and save money. Companies submit comprehensive action plans that identify specific steps they will undertake between the time they enter into the compact and 2000. By 2010, Climate Wise partners are projected to have avoided cumulative greenhouse gas emissions of nearly 14 MMTCE and saved \$2 billion through their participation in the program.

Methane Reduction Programs

The U.S. government administers a variety of industry-government voluntary partnerships that significantly reduce U.S. methane emissions from a variety of sources: The Landfill Methane Outreach Program, the Coalbed Methane Outreach Program, Natural GasStar, AgSTAR, and the Ruminant Livestock Efficiency Program (RLEP). These programs encourage emissions reductions either through the profitable collection and use of methane, as opposed to its release to the atmosphere, or, in the case of RLEP, through more efficient production in the livestock and dairy sectors. In 1998, participants in the programs reduced methane emissions by almost 5 MMTCE. EPA estimates that investments already made to reduce methane emissions by partners in these programs will reduce cumulative emissions by almost 70 MMTCE and save more than \$1 billion. By 2010, EPA expects that methane emissions will be stabilized at 1990 levels as a result of these voluntary partnerships.

HFC, PFC and SF₆ Emission Reduction Programs

Of all greenhouse gases, perfluorocarbons (PFCs), sulfur hexafluoride (SF₆), and several hydrofluorocarbons (HFCs) are the most potent because of their extreme stability in the atmosphere and strong absorption of radiation. PFCs, for example, commonly have atmospheric lifetimes on the order of thousands of years. The U.S. government administers a variety of industry-government voluntary partnerships that are reducing emissions of those gases substantially. The *Voluntary Aluminum Industrial Partnership (VAIP)* works with 11 of the nation's 12 primary aluminum producers to reduce PFC emissions while increasing the efficiency of primary aluminum production. The Federal government also administers a regulatory program through the Clean Air Act to help direct industry toward safe, new alternatives as manufacturers consider substitutes for ozone-depleting chlorofluorocarbons (CFCs) and halon compounds.

Investments already made by partners in voluntary programs will reduce cumulative emissions by more than 49 MMTCE over the lifetime of the projects. In addition, an estimated 54 MMTCE will have been prevented by 2000 through regulation. HFC and PFC emissions in applications to replace ozone-depleting substances are expected to be significantly below business-as-usual scenarios due to voluntary and regulatory initiatives. HFC, PFC and SF₆ emissions from other industrial

sources are expected to be at or below 1990 levels by 2010.

Industrial Combined Heat and Power Systems

DOE is developing new industrial combined heat and power (CHP) systems to capture thermal heat that otherwise would be wasted. CHP systems are expected to be 15 percent more energy efficient and 80 percent cleaner than conventional power systems and cut electricity costs by 10 percent. In addition, EPA and DOE are working to eliminate barriers to the rapid dissemination of combined heat and power technology.

Motor Challenge

Motor Challenge, Steam Challenge, Combined Heat and Power Challenge, and Compressed Air Challenge are a group of voluntary initiatives aimed at improving energy efficiency in U.S. manufacturing plants by breaking down market barriers to the development and diffusion of energy efficient technologies and practices. These four Federal programs offer industry a variety of technical assistance, tools, and information. By 2015, these initiatives are expected to reduce emissions by approximately 20 MMTCE and generate \$3 billion in annual cost savings.

WasteWi\$e

WasteWi\$e works with U.S. businesses; Federal, state, local, and tribal government agencies; and other institutions to reduce municipal solid waste. Presently, more

than 900 organizations are WasteWi\$e partners. Waste reduction activities reduce greenhouse gas emissions in several ways, including energy savings, increased carbon sequestration, and avoided methane emissions. In 1998 alone, the combined waste reduction results of WasteWi\$e partners prevented emissions of approximately 4.5 MMTCE—equal to the average annual emissions from electric power consumption from roughly 2.7 million households.

Electricity

Greenhouse gas emissions from the generation, transmission, and distribution of electricity account for 30 percent of U.S. annual greenhouse gas emissions. U.S. climate efforts in this area include improving the efficiency of electricity generation through substituting lower carbon and carbon-free fuels, reducing the demand for electricity through greater end use efficiency, and restructuring the electric power industry. These efforts are being accomplished through a combination of DOE and EPA voluntary partnerships and R&D efforts.

Electricity Restructuring

A core element of the President's climate change program involves restructuring the electricity industry in a manner that will reduce greenhouse gas emissions while cutting consumers' energy bills. The Administration's restructuring proposal includes a requirement that utilities open up their distribution and transmission wires to all qualified sellers; a renewable portfolio standard to increase the use of

electricity from renewable sources to at least 7.5 percent of sales by 2010; a \$3 billion per year Public Benefits Fund to spur greater investment in energy efficiency and renewable energy technologies; and a green labeling requirement to inform consumers about clean energy options. This plan is projected to reduce carbon emissions by roughly 40 to 60 MMTCE in 2010 while saving consumers at least \$20 billion per year on their electricity bills. The plan is now under consideration by the U.S. Congress.

Photovoltaic Energy Systems R&D

Over the past 20 years, Federal research and development has resulted in a 90 percent cost reduction in solar photovoltaics (PV). As a result, industrial manufacturing of PV modules more than doubled between 1994 and 1998, growing from 26 megawatts in 1994 to more than 53 megawatts in 1998. DOE now is accelerating its R&D of the next generation of photovoltaic cells; increasing manufacturing R&D; increasing research in buildings-integrated applications; and developing new, unconventional technologies.

- ***Million Solar Roofs.*** This initiative, announced by the President in June 1997, seeks to place solar energy systems on one million roofs by 2010. To date, commitments for 900,000 have been made, indicating the potential for widespread market penetration of solar technologies. The President's Climate Change Technology Initiative

includes \$120 million in proposed tax credits to support this program. Meeting the initiative's goals will reduce carbon emissions equivalent to the annual emissions from 850,000 cars by 2010.

Hydrogen Research Program

DOE currently is accelerating research on low-cost hydrogen production and storage—prerequisites to the widespread use of hydrogen as a fuel. Over the next five years, hydrogen is expected to make a significant penetration into several niche fuel markets, owing to the recent demonstration of low-cost, high-performance Proton Exchange Membrane (PEM) fuel cell systems by Daimler Chrysler, Ford, and other companies.

High Temperature Superconductivity

DOE supports industry-led projects to capitalize on recent breakthroughs in superconducting wire technology, aimed at developing super-efficient power equipment, such as advanced motors, power cables, and transformers. These technologies would allow more electricity to reach the consumer without increasing the use of fossil fuels.

Climate Challenge

This program is a joint voluntary effort between DOE and the electric utility industry to reduce, avoid, or sequester greenhouse gases. Utilities identify and implement cost-effective activities that are specified in agreements between the

Federal government and individual electric utilities. Under this program, the electric utility industry as a whole also has developed nine industry-wide initiatives to research, develop, and promote technologies and practices that lower greenhouse gas emissions. Currently, Climate Challenge's partner utilities number more than 600 and represent 71 percent of the 1990 U.S. carbon emissions from electricity generation. Utilities estimate that pledged Climate Challenge actions would reduce emissions by as much as 47 MMTCE in 2000.

Cleaner Coal and Natural Gas

DOE supports an aggressive R&D effort to develop next-generation technologies for the combustion and use of coal and natural gas. For example, research and development of new coal combustion technologies, such as integrated gasification combined-cycle and pressurized fluidized bed combustion, could lead to ultra-high efficiency coal plants with dramatically lower greenhouse gas emissions—as much as 75 MMTCE by 2030.

Nuclear Energy

Nuclear power plants provide approximately 20 percent of U.S. electricity and avoid greenhouse gas emissions of 150 MMTCE annually. Licenses for U.S. nuclear power plants will begin to expire in large numbers in 2010. To ensure that current nuclear plants can continue to deliver adequate and affordable energy supplies up to and beyond their initial

40-year license, DOE initiated the Nuclear Energy Plant Optimization (NEPO) program. NEPO supports collaborative R&D with industry, aimed at resolving open issues related to plant aging. It also supports the application of new technologies to improve plant economics, reliability, and availability.

Sequestration and Agriculture

R&D for Sequestration

DOE is pursuing research on sequestration technologies to separate and capture carbon dioxide from energy processes and combustion, disposal technologies for storing carbon dioxide in underground geological structures and in the deep ocean, and advanced concepts to transform carbon dioxide into either useful or environmentally benign products. In the post-2015 time period, this program has the potential to eliminate hundreds of millions of metric tons of greenhouse gases from the atmosphere.

Carbon Sequestration in Agriculture and Forestry

Natural carbon sinks will play a critical role in helping the world meet the challenge of climate change. Recently, focus has intensified on agriculture and forestry practices that can affect the ability of farmland and forests to sequester carbon and help mitigate the impacts of climate change. As understanding of these practices has increased, the U.S. government has begun to analyze the net carbon effects of various USDA conservation and

environmental programs and to determine how they can be enhanced and expanded to foster greater sequestration. In general, the programs assist farmers, ranchers, and other landowners in conserving and improving soil, water, and other natural resources associated with rural land. The programs include:

- ***Conservation Technical Assistance (CTA)*** helps farmers develop and implement conservation plans on farms and ranches. Practices that sequester carbon include cover crops, residue management, crop rotation, and buffer establishment.
- ***Conservation Reserve Program (CRP)*** provides rental payments and cost-sharing on 36.4 million acres for grass, shrub, or tree planting in exchange for retiring highly erodible or other environmentally sensitive cropland.
- ***Forestry Incentives Program (FIP)*** provides financial and technical assistance to encourage production of sawtimber and pulpwood on nonindustrial private forestlands, and the Stewardship Incentives Program (SIP) provides financial and technical assistance to expand tree planting and implement stewardship plans on private properties.

Scientific Research

The Administration is continuing its strong support (\$1.7 billion in Fiscal Year 1999 funding) for the U.S. Global Change Research Program (USGCRP), which seeks to provide a sound scientific understanding of the human and natural forces that influence the Earth's climate system. National and international policymakers use the information produced by USGCRP scientists to make informed decisions on global change issues.

Specific new research focuses include:

- ***Carbon Cycle Initiative***—a new multiagency initiative to improve understanding of the ways that carbon cycles between the atmosphere, oceans, and land.
- ***Soil Carbon Inventory***—expanded efforts to conduct a comprehensive scientific inventory of carbon stored in U.S. soils and develop methods to predict how various practices and policies would affect soil carbon levels.
- ***Consequences of Climate Change***—the first national assessment of the potential impacts of climate change on the United States.