



# 1 Executive Summary

The United States is pursuing a comprehensive strategy to address global climate change that is science-based, fosters breakthroughs in clean energy technologies, and encourages coordinated global action in support of the United Nations Framework Convention on Climate Change (UNFCCC).

The U.S. strategy integrates measures to address climate change into a broader agenda that promotes energy security, pollution reduction, and sustainable economic development. This integrated approach recognizes that actions to address climate change, including actions to mitigate greenhouse gas (GHG) emissions, will be more sustainable and successful if they produce multiple economic and environmental benefits.

The United States is committed to continued leadership on climate change. Promoting biofuels, advanced fossil fuel technologies, renewable sources of energy, and advanced nuclear technologies is a key component of U.S. climate-related efforts. Since 2001, the Nation has dedicated nearly \$29 billion to advance climate-related science, technology, international assistance, and incentive programs.

In 2002, President Bush announced plans to cut GHG intensity—emissions per unit of economic activity—by 18 percent by 2012. The Nation is on track to meet this goal. Dozens of federal programs, including partnerships, consumer information campaigns, incentives, and mandatory regulations, combined with state and local efforts, contribute to the ultimate objective of the UNFCCC: stabilizing atmospheric GHG concentrations at a level that would prevent dangerous human interference with the climate system. These coordinated actions are advancing the development and market uptake of cleaner, more efficient energy technologies, conservation, biological and geological sequestration, and adaptation to climate risks.

Recognizing the serious, long-term challenges of global climate change, the United States continues to work with nations around the world. Active bilateral and multilateral climate change initiatives, including the recently established Asia-Pacific Partnership on Clean Development and Climate, are promoting collaboration among key countries and with the private sector.

In this *U.S. Climate Action Report* (2006 CAR), the United States provides its fourth formal national communication under the UNFCCC, as specified under Articles 4 and 12 of the Convention. The 2006 CAR documents the climate change actions the Nation is taking to help achieve the UNFCCC's ultimate objective. This review was undertaken to account for activities up to and including 2006. It explains how U.S. social, economic, and geographic circumstances affect U.S. GHG emissions; summarizes U.S. GHG emission trends from 1990 through 2004; identifies existing and planned U.S. policies and measures to reduce GHGs; indicates future trends for U.S. GHG emissions; outlines impacts and adaptation measures; provides information on financial resources and technology transfer; details U.S. research and systematic observation efforts; and describes U.S. climate education, training, and outreach initiatives.

## NATIONAL CIRCUMSTANCES

Chapter 2 of this report outlines the national circumstances of the United States and how those circumstances affect U.S. GHG emissions. The United States is a vast and prosperous country with diverse topography, biota, climates, and land uses. The U.S. economy is large and vibrant, driven by a growing and geographically dispersed population. The United States has the highest real gross domestic product (GDP) in the world. U.S. GDP has experienced significant growth since 2000; by 2005 it increased by 13.4 percent to slightly over \$11.1 trillion (in constant 2000 dollars). The United States is the third most populous country in the world; from 2000 to 2005, the U.S. population grew by about 1 percent per year. In 2005, the U.S. population was an estimated 296.4 million people, an increase of about 15 million people since 2000, of whom 42 percent are immigrants.

The diversity of climate zones found throughout the United States results in both regional differences in energy use and impacts associated with climate change and variability. The United States possesses a broad mix of energy resources to produce power and meet other energy requirements. Petroleum remains the largest single source of energy consumed in the United States, accounting for 40 percent of total energy demand in 2005. Other major energy sources include natural gas at 23 percent, coal at 22 percent, nuclear at 8 percent, and renewables at 6 percent.

The United States has a highly developed transportation system that is designed to meet the needs of a mobile and dispersed population. This demand for mobility and the desire for larger and more affordable homes—along with other socioeconomic factors—are associated with the decentralizing trend observed in U.S. metropolitan areas. The sustained growth in new housing in the South and West, where most new homes have air conditioning, has increased residential electricity demand, as has the increase in housing size and the use of consumer elec-

tronics, such as computers and rechargeable tools.

These and other factors contribute to the United States being the world's largest producer and consumer of energy. Many of the long-term trends identified in the 2002 CAR continue today, but recent events have significantly affected U.S. national circumstances. In particular, the economic slowdown in 2001 and early 2002 had a major impact on energy use and, correspondingly, GHG emissions. As economic recovery took hold in 2002, energy demand also picked up, topping 100 quadrillion British thermal units in 2004. However, technological change, energy efficiency improvements in transportation, buildings, and other sectors, and a shift to less energy-intensive economic activity have continued to slow the growth of energy demand. As a result, while absolute energy use rose from 2000 to 2005, the amount of energy used per dollar of economic output—the energy intensity of the economy—fell by 11 percent.

## GREENHOUSE GAS INVENTORY

Chapter 3 summarizes U.S. anthropogenic GHG emission trends from 1990 through 2004 (the most recent submission to the UNFCCC). The estimates presented in the report were calculated using methodologies consistent with those recommended by the Intergovernmental Panel on Climate Change (IPCC).

Although the direct GHGs—carbon dioxide, methane, and nitrous oxide—occur naturally in the atmosphere, human activities have changed their atmospheric concentrations. In 2004, total U.S. GHG emissions were 7,074.4 teragrams of carbon dioxide equivalent (Tg CO<sub>2</sub> Eq.). Overall, total U.S. emissions rose by 15.8 percent from 1990 through 2004. Over that same time period, U.S. GDP increased by 51 percent (U.S. DOC/BEA 2006a).

Carbon dioxide (CO<sub>2</sub>) accounted for approximately 85 percent of total U.S. GHG emissions in 2004. As the largest source of U.S. GHG emissions, CO<sub>2</sub> from fossil fuel combustion has accounted for

approximately 80 percent of global warming potential-weighted emissions since 1990. Emissions of CO<sub>2</sub> from fossil fuel combustion increased at an average annual rate of 1.3 percent from 1990 through 2004. The fundamental factors influencing this trend include (1) general domestic economic growth over the last 14 years, and (2) significant growth in emissions from transportation activities and electricity generation. Between 1990 and 2004, CO<sub>2</sub> emissions from fossil fuel combustion increased from 4,696.6 Tg CO<sub>2</sub> Eq. to 5,656.6 Tg CO<sub>2</sub> Eq., a 20 percent total increase over the 14-year period. Historically, changes in emissions from fossil fuel combustion have been the dominant factor affecting U.S. emission trends.

Methane (CH<sub>4</sub>) accounted for 8 percent of total U.S. GHG emissions in 2004, with landfills being the largest anthropogenic source of CH<sub>4</sub> emissions. Overall, U.S. emissions of CH<sub>4</sub> declined by 10 percent from 1990 through 2004.

Nitrous oxide (N<sub>2</sub>O) accounted for approximately 5 percent of total U.S. GHG emissions in 2004. The main U.S. anthropogenic activities producing N<sub>2</sub>O are agricultural soil management and fuel combustion in motor vehicles. Overall, U.S. emissions of N<sub>2</sub>O declined by 2 percent from 1990 to 2004.

Halogenated substances—hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride—accounted for 2 percent of total U.S. GHG emissions in 2004. The increasing use of these compounds since 1995 as substitutes for ozone-depleting substances has been largely responsible for their upward emission trends.

## POLICIES AND MEASURES

The U.S. approach to climate change combines near-term GHG mitigation programs with substantial investments in the transformational technologies needed for even greater emission reductions in the future. Chapter 4 of this report outlines near-term policies and measures undertaken by the U.S. government to mitigate GHG emissions.

Meeting President Bush's commitment to reduce the GHG intensity of the U.S. economy by 18 percent by 2012<sup>1</sup> will prevent the release of more than 1,833 Tg CO<sub>2</sub> Eq. to the atmosphere, adding to the 255 Tg CO<sub>2</sub> Eq. avoided in 2002. The President's emissions intensity approach ensures a focus on policies and measures that reduce emissions while fostering a growing, prosperous economy. Over the same period from 2002 to 2012, while GHG intensity is declining, total gross GHG emissions are expected to rise by 11 percent to more than 7,709 Tg CO<sub>2</sub> Eq.

The United States has implemented a range of programs that are contributing to the achievement of this 18 percent intensity goal—including regulatory mandates, tax and other incentives, consumer and education campaigns, and voluntary actions. This report details near-term federal climate programs and policies that span the major sectors of the U.S. economy encompassing generation and use of energy in the commercial, residential, industrial, and transportation sectors, and management of agriculture, forestry, waste streams, and industrial by-products. A number of new initiatives have been introduced since 2002, and many are already achieving significant emission reductions.

Additionally, several fiscal and incentive-based policies are mitigating emissions. The Energy Policy Act of 2005 contains new tax rules that are helping to unleash substantial new capital investment, including purchases of cleaner, more efficient equipment and facilities. The Act also grants the U.S. Department of Energy (DOE) the authority to issue loan guarantees for a variety of early commercial projects that use advanced technologies that avoid, reduce, or sequester GHGs. Further, it authorizes DOE to indemnify against certain regulatory and litigation delays for the first six new nuclear plants, and offers production tax credits for 6,000 megawatts of new nuclear capacity.

A number of U.S. states and cities are implementing a range of voluntary, incen-

tive-based, and locally relevant mandatory measures. Many of these build on or partner with related federal programs and contribute to meeting the President's GHG intensity goal.

### PROJECTED GREENHOUSE GAS EMISSIONS

Chapter 5 of the 2006 CAR provides estimates of projected national GHG emissions. These projections are used to measure the effectiveness of the emission reduction programs and progress toward achieving the targets established under the Global Climate Change policy announced by President Bush in February 2002. Based on the latest forecasts of CO<sub>2</sub> and non-CO<sub>2</sub> GHG emissions, which reflect current economic conditions and include the effects of federal climate programs, the United States is projected to exceed the President's goal of reducing GHG intensity by 18 percent from 2002 to 2012. In absolute terms, the intensity goal corresponds to a reduction in GHG emissions of 367 Tg CO<sub>2</sub> Eq. in 2012 and more than 1,833 Tg CO<sub>2</sub> Eq. in cumulative GHG reductions between 2002 and 2012, relative to projected emissions under *Business As Usual* conditions. From 2002 through 2012, GHG emissions are expected to rise by 11 percent to 7,709 Tg CO<sub>2</sub> Eq.

This chapter also contains inventory data for 2000 and emission projections to 2020 for the United States. These projections reflect national estimates of GHG emissions, considering population growth, long-term economic growth potential, historical rates of technology improvement, normal weather patterns, and reductions due to implemented policies and measures.

### IMPACTS AND ADAPTATION

Chapter 6 of this report highlights actions taken in the United States to better understand and respond to vulnerabilities and impacts associated with climate change. The U.S. government has made considerable scientific progress in under-

standing the nature of climate change and its potential effects. It is involved in a wide array of climate assessments, research, and other activities to understand the potential impacts of climate change and climate variability on the environment and the economy, and to develop methods and tools to enhance adaptation options. Attention is also being focused at the local and state levels as well.

Chapter 6 also presents a selection of sector- and region-specific adaptation projects that illustrate the variety and scale of approaches used within the United States. These activities inform decision-making processes at all levels—local, national, and international—and help to increase societal resilience to climate changes.

Since 2002, U.S. research has led to new insights into the impacts of climate change and variability on key physical processes (e.g., snowpack, streamflow, extreme events) that have implications for a range of socioeconomic sectors. In addition to participation in national and international assessment processes, the United States is engaged in national efforts to reduce uncertainty regarding climate change impacts. The U.S. government is providing practical scientific information and tools to help decision makers plan for potential changes in climate. These activities address the Nation's needs for sound scientific information that decision makers can use to develop a better understanding of climate change impacts and vulnerabilities, as well as to improve the design and implementation of adaptation measures.

### FINANCIAL RESOURCES AND TRANSFER OF TECHNOLOGY

Cooperation with other countries to address climate change continues to be a high priority for the United States. Chapter 7 outlines U.S. agency roles in international assistance and technology transfer. U.S. financial flows to developing and

<sup>1</sup> At the time this commitment was made in February 2002, U.S. GHG emissions intensity was expected to improve by 14 percent from 2002 to 2012 under a *Business As Usual* reference case. The President's goal, therefore, was expected to improve GHG intensity by 4 percentage points over the expected 14 percent.

transition economies that support the diffusion of climate-related technologies include official development assistance and official aid, government-based project financing, foundation grants, nongovernmental organization (NGO) resources, private-sector commercial sales, commercial lending, foreign direct investment, and private equity investment.

Adaptation to climate variability and change is an important component of U.S. financial and technical cooperation to address climate change. U.S. government agencies are involved in collaborative efforts to develop and support the many different scientific and technical activities needed to promote adaptation, including Earth observations, research and modeling, and pilot projects. A number of U.S. government agencies also provide financial resources and transfer of technology to address development and climate change. These programs apply a variety of approaches in locations around the globe. Capacity building and institution building are fundamental to the success and sustainability of these development efforts.

The United States provides substantial assistance resources through bilateral and multilateral avenues. Between 2001 and 2006, U.S. funding for climate change in developing countries totaled approximately \$1.4 billion, including \$209 million to the Global Environment Facility (GEF) in support of climate change projects (out of a total GEF contribution of approximately \$680 million). The United States is the largest contributor to both the UNFCCC and multilateral development banks, the latter of which undertake a range of international energy investment and adaptation activities. Though these resources are a relatively small share of overall climate-related investment flows, they are important in promoting the policy and institutional environment necessary to generate recipient countries' investments in cleaner and more efficient technologies.

Since 2002, the United States has established and participated in a range of new

international partnerships to contribute to the ultimate objective of the UNFCCC and promote sustainable development. These include the Asia-Pacific Partnership on Clean Development and Climate, the Methane to Markets Partnership, the Carbon Sequestration Leadership Forum, the International Partnership for a Hydrogen Economy, the Generation IV International Forum, the President's Initiative Against Illegal Logging, and the Group on Earth Observations. The United States also participates in the Renewable Energy and Energy Efficiency Partnership, the Global Bioenergy Partnership, and the Renewable Energy Policy Network for the 21st Century. Private-sector involvement is a key aspect of these partnerships, and each of the partnerships includes countries from all regions of the world, contributing to the development, deployment, and transfer of technology across the globe. Additionally, the United States has established bilateral climate partnerships, encompassing more than 450 individual activities, with 15 countries and regional organizations.

## RESEARCH AND SYSTEMATIC OBSERVATION

Chapter 8 outlines how the United States is laying a strong scientific and technological foundation to reduce uncertainties, clarify risks and benefits, and develop effective mitigation options for climate change that complements U.S. efforts to slow the pace of growth of GHG emissions. In 2002, President Bush established a cabinet-level Committee on Climate Change Science and Technology Integration (CCCSTI), to provide guidance for investments in climate change science and technology, with funding of approximately \$4.5 billion annually. CCCSTI coordinates two multi-agency programs—the Climate Change Science Program (CCSP), led by the U.S. Department of Commerce, and the Climate Change Technology Program (CCTP), led by DOE. These two coordinated programs address issues at the intersection of science and technology, such as

the evaluation of approaches to sequestration, anthropogenic GHG emissions monitoring, global Earth observations, and energy technology development and market penetration scenarios.

The United States funds a significant portion of the world's climate change research. Climate change and climate variability play important roles in shaping the environment, infrastructure, economy, and other aspects of life in all countries, and decision makers must be able to make informed decisions regarding these changes. U.S. global change research and global observations are facilitating decision makers' access to better and more reliable information.

CCSP facilitates the creation and application of knowledge of the Earth's global environment through research, observations, decision support, and communication. The program has developed a strategic plan in consultation with thousands of individuals in the research community, and its efforts provide a sound scientific basis for national and international decision making. CCSP is organized around five goals: (1) improving knowledge of climate history and variability, (2) improving the ability to quantify factors that affect climate, (3) reducing uncertainty in climate projections, (4) improving understanding of the sensitivity and adaptability of ecosystems and human systems to climate change, and (5) exploring options to manage risks.

The United States conducts technology research, development, demonstration, and deployment through the multi-agency CCTP. The program provides an interagency coordinating mechanism for climate technology research and development funding. This effort will lead to more cost-effective methods of reducing emissions and will facilitate more rapid development and commercialization of advanced technologies and best practices to help meet the long-term U.S. goal of reducing, and eventually reversing, GHG emissions. CCTP's strategic vision has six

complementary goals: (1) reducing emissions from energy use and infrastructure, (2) reducing emissions from energy supply, (3) capturing and sequestering CO<sub>2</sub>, (4) reducing emissions of other GHGs, (5) measuring and monitoring emissions, and (6) bolstering the contributions of basic science.

Long-term, high-quality observations of the global environmental system are essential for understanding and evaluating Earth system processes and for providing sound information to decision makers. The United States contributes to the development and operation of global observing systems that combine data streams from both research and operational observing platforms to provide a comprehensive measure of climate system variability and climate change. The United States supports multiple oceanic, atmospheric, terrestrial, and space-based systems, working with international partners to enhance observations and improve data quality and availability.

In developing the CCSP roadmap, the United States recognized the need for enhanced observations and the importance

of international cooperation in this area. To address key environmental data needs, the United States hosted the first Earth Observation Summit, in July 2003. At the third Earth Observation Summit, in Brussels in 2005, nearly 60 countries adopted a 10-year plan for implementing a Global Earth Observation System of Systems (GEOSS), which addresses multiple environmental data needs, including climate, weather, biodiversity, natural disasters, and water and energy resource management (GEO 2005).

### **EDUCATION, TRAINING, AND OUTREACH**

Chapter 9 outlines how U.S. climate change education, training, and outreach efforts have continued to evolve. U.S. federal agencies—including the Agency for International Development; the Departments of Agriculture, Energy, the Interior, and Transportation; the Environmental Protection Agency; the National Aeronautics and Space Administration; the National Oceanic and Atmospheric Administration; and the National Science Foundation—work on a wide range of ed-

ucation, training, and outreach programs on the issues of U.S. climate change science, impacts, and mitigation. Each of these programs helps build the foundation for understanding and taking broad action to reduce the risks of climate change. The CCSP includes a communications working group that serves to provide policymakers and the public with information on the issue of global climate change and CCSP's efforts and accomplishments in this area.

Capacity building and training form an integral part of many federal agencies' international efforts on climate change. Efforts by industry, states, local governments, universities, schools, and NGOs are essential complements to federal programs that educate industry and the public regarding climate change. The combined efforts of the U.S. federal, state, and local governments and private entities are ensuring that the American public is better informed about climate change and more aware of the impact the Nation's choices may have on the sustainability of the planet.