

**U.S. Climate Action Report**

# 2010

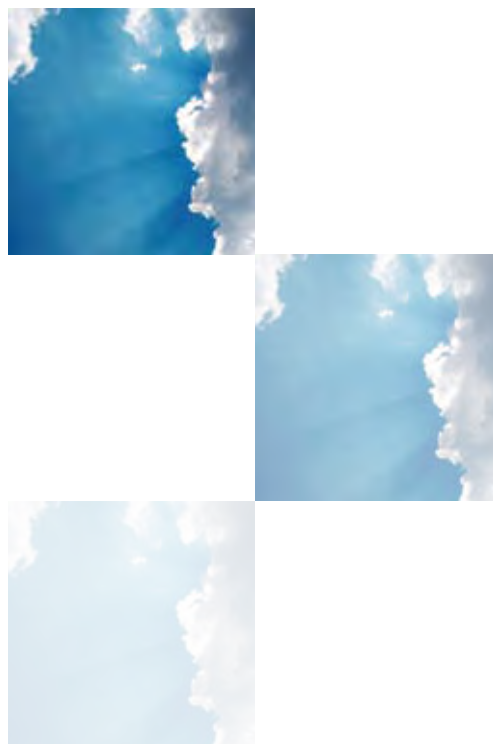
*Fifth National Communication  
of the United States of America  
Under the United Nations Framework  
Convention on Climate Change*



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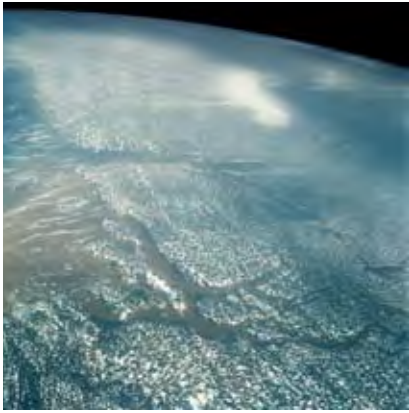
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## Acronyms and Abbreviations

<b>3D-VIEW</b>	three-dimensional Virtual Interactive Environmental Worlds	<b>BFI</b>	Biofuels Initiative
<b>AAVP</b>	ARM Aerial Vehicles Program	<b>BIE</b>	Bureau of Indian Education
<b>AAVSHTO</b>	American Association of State Highway Transportation Officials	<b>BLM</b>	Bureau of Land Management
<b>ac</b>	acre	<b>BOR</b>	Bureau of Reclamation
<b>ACRF</b>	Atmospheric Radiation Measurement Climate Research Facility	<b>BRDI</b>	Biomass Research and Development Initiative
<b>ADAGE</b>	Applied Dynamic Analysis of the Global Economy	<b>BTS</b>	Bureau of Transportation Statistics
<b>AEO</b>	<i>Annual Energy Outlook</i>	<b>Btu</b>	British thermal unit
<b>AERONET</b>	AErosol RObotic NETwork	<b>°C</b>	degree Centigrade
<b>AFCI</b>	Advanced Fuel Cycle Initiative	<b>C<sub>2</sub>F<sub>6</sub></b>	hexafluoroethane
<b>AGAGE</b>	Advanced Global Atmospheric Gases Experiment	<b>C<sub>4</sub>F<sub>10</sub></b>	perfluorobutane
<b>AIRS</b>	Atmospheric InfraRed Sounder	<b>C<sub>6</sub>F<sub>14</sub></b>	perfluorohexane
<b>ALU</b>	agriculture and land use	<b>C&amp;D</b>	commercialization and deployment
<b>AMS</b>	American Meteorological Society	<b>CAAFI</b>	Commercial Aviation Alternative Fuels Initiative
<b>ANL</b>	Argonne National Laboratory	<b>CAFE</b>	Corporate Average Fuel Economy
<b>AON</b>	Arctic Observing Network	<b>CALIPSO</b>	Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation
<b>APP</b>	Asia-Pacific Partnership on Clean Development and Climate	<b>CAR</b>	<i>U.S. Climate Action Report</i>
<b>ARM</b>	Atmospheric Radiation Measurement	<b>CATHALAC</b>	Water Center for the Humid Tropics of Latin America and the Caribbean
<b>ARPA-E</b>	Advanced Research and Projects Agency–Energy	<b>CBI</b>	Net-Zero Energy Commercial Building Initiative
<b>ARRA</b>	American Recovery and Reinvestment Act of 2009	<b>CBM</b>	coalbed methane
<b>ARS</b>	Agricultural Research Service	<b>CCCSTI</b>	Committee on Climate Change Science and Technology Integration
<b>A-Train</b>	Afternoon Train	<b>CCD</b>	Climate Change Division
<b>AZA</b>	Association of Zoos and Aquariums	<b>CCLI</b>	Course, Curriculum, and Laboratory Improvement
<b>BCF</b>	billion cubic feet	<b>CCPI</b>	Clean Coal Power Initiative
<b>BEA</b>	Bureau of Economic Analysis	<b>CCRI</b>	Climate Change Research Initiative
<b>BER</b>	Office of Biological and Environmental Research	<b>CCS</b>	carbon capture and sequestration
		<b>CCSP</b>	U.S. Climate Change Science Program



<b>CCTP</b>	Climate Change Technology Program	<b>GOP</b>	Conference of the Parties
<b>CDCP</b>	Clean Development and Climate Program	<b>CPO</b>	Climate Program Office
<b>CEA</b>	Council of Economic Advisers	<b>CPT</b>	Climate Process and Modeling Teams
<b>CENR</b>	Committee on Environment and Natural Resources	<b>CRC–URI</b>	The Coastal Resources Center at the University of Rhode Island
<b>CEQ</b>	Council on Environmental Quality	<b>CrIS</b>	Cross-track Infrared Sounder
<b>CERES</b>	Clouds and the Earth’s Radiant Energy System	<b>CRN</b>	Climate Reference Network
<b>CESN</b>	Climate Effects Science Network	<b>CRP</b>	Conservation Reserve Program
<b>CFC</b>	chlorofluorocarbon	<b>CSLF</b>	Carbon Sequestration Leadership Forum
<b>CFP</b>	Climate Friendly Parks	<b>CSP</b>	Conservation Stewardship Program
<b>CH<sub>4</sub></b>	methane	<b>CSREES</b>	Cooperative State Research, Education, and Extension Service
<b>CHE</b>	NSF Division of Chemistry	<b>CTA</b>	conservation technical assistance
<b>CHECK</b>	Climate Change Emission Calculator Kit	<b>CTI</b>	Climate Technology Initiative
<b>CHP</b>	combined heat and power	<b>CTI</b>	Coral Triangle Initiative
<b>CIFs</b>	Climate Investment Funds	<b>CTIC</b>	Conservation Technology Information Center
<b>CIG</b>	Climate Impacts Group	<b>DAAC</b>	Distributed Active Archive Center
<b>CIWG</b>	Communications Interagency Working Group	<b>DCA</b>	Development Credit Authority
<b>CLASS</b>	Comprehensive Large Array-data Stewardship System	<b>DEP</b>	Department of Environmental Protection
<b>CLD</b>	Climate and Large-scale Dynamics	<b>DERA</b>	Diesel Emissions Reduction Act
<b>CLIMAS</b>	Climate Assessment for the Southwest	<b>DMR</b>	NSF Division of Materials Research
<b>CLIP</b>	Climate Leadership In Parks	<b>DMS</b>	NSF Division of Mathematical Science
<b>CMAQ</b>	Congestion Mitigation and Air Quality	<b>DOC</b>	U.S. Department of Commerce
<b>CMG</b>	Collaboration in Mathematical Geosciences	<b>DOD</b>	U.S. Department of Defense
<b>CMOP</b>	Coalbed Methane Outreach Program	<b>DOE</b>	U.S. Department of Energy
<b>CNES</b>	Centre National d’Etudes Spatiales	<b>DOI</b>	U.S. Department of the Interior
<b>CNRS</b>	Centre Nationale de Recherche Scientifique	<b>DOS</b>	U.S. Department of State
<b>CO</b>	carbon monoxide	<b>DOT</b>	U.S. Department of Transportation
<b>CO<sub>2</sub></b>	carbon dioxide	<b>ECO-Asia</b>	Environmental Cooperation–Asia
<b>CO<sub>2</sub> Eq.</b>	carbon dioxide equivalents	<b>ECV</b>	essential climate variable
<b>COL</b>	combined license	<b>EDA</b>	Economic Development Administration
<b>CommEd</b>	Communications and Education	<b>EDG</b>	EOS Data Gateway
		<b>EECBG</b>	Energy Efficiency and Conservation Block Grant

<b>EEP</b>	Environmental Exports Program	<b>FRPP</b>	Farm and Ranchlands Protection Program
<b>EFRC</b>	Energy Frontier Research Center	<b>FSA</b>	Farm Service Agency
<b>EFRI</b>	Emerging Frontiers in Research and Innovation	<b>FTA</b>	Federal Transit Administration
<b>EGS</b>	enhanced geothermal systems	<b>FWS</b>	U.S. Fish and Wildlife Service
<b>EHE</b>	excessive heat event	<b>FY</b>	fiscal year
<b>EIA</b>	Energy Information Administration	<b>G8</b>	Group of Eight
<b>EIS</b>	Environmental Impact Statement	<b>GAW</b>	Global Atmospheric Watch
<b>EISA</b>	Energy Independence and Security Act of 2007	<b>GBEP</b>	Global Bioenergy Partnership
<b>EOS</b>	Earth Observing System	<b>GCCE</b>	Global Climate Change Education
<b>EOSDIS</b>	Earth Observing System Data and Information System	<b>GCCI</b>	<i>Global Climate Change Impacts in the United States</i>
<b>EPA</b>	U.S. Environmental Protection Agency	<b>GCEP</b>	Global Change Education Program
<b>EPAct</b>	Energy Policy Act of 2005	<b>GCOS</b>	Global Climate Observing System
<b>Eq.</b>	equivalents	<b>GCRA</b>	Global Change Research Act
<b>EQIP</b>	Environmental Quality Incentives Program	<b>GDA</b>	Global Development Alliance
<b>ESP</b>	early site permit	<b>GDP</b>	gross domestic product
<b>ESSEA</b>	Earth System Science Education Alliance	<b>GEF</b>	Global Environment Facility
<b>ETBC</b>	Emerging Topics in Biogeochemical Cycles	<b>Gen IV</b>	Generation IV Nuclear Energy Systems
<b>EUGENE</b>	Ecological Understanding as a Guideline for Evaluation of Nonformal Education	<b>GEO</b>	Intergovernmental Group on Earth Observations
<b>EUMETSAT</b>	European Organisation for the Exploitation of Meteorological Satellites	<b>GEOSS</b>	Global Earth Observation System of Systems
<b>Ex-Im</b>	Export-Import Bank	<b>Gg</b>	gigagram
<b>°F</b>	degree Fahrenheit	<b>GHG</b>	greenhouse gas
<b>FAA</b>	Federal Aviation Administration	<b>GIF</b>	Generation IV International Forum
<b>FCCA</b>	Forest, Climate & Community Alliance	<b>GIS</b>	geographic information system
<b>FCPF</b>	Forest Carbon Partnership Facility	<b>GLOBE</b>	Global Learning and Observations to Benefit the Environment
<b>FEMP</b>	Federal Energy Management Program	<b>GLOBEC</b>	Global Ocean Ecosystems Dynamics
<b>FEWS NET</b>	Famine Early Warning Systems Network	<b>GLOSS</b>	Global Sea Level Observing System
<b>FHA</b>	Federal Housing Administration	<b>GOES</b>	Geostationary Operational Environmental Satellite
<b>FHWA</b>	Federal Highway Administration	<b>GOOS</b>	Global Ocean Observing System
<b>FM</b>	frequency modulation	<b>GOSIC</b>	Global Observing System Information Center
		<b>GPS</b>	global positioning system

<b>GRACE</b>	Gravity Recovery and Climate Experiment	<b>IPHE</b>	International Partnership for the Hydrogen Economy
<b>GRACEnet</b>	Greenhouse Gas Reduction through Agricultural Carbon Enhancement Network	<b>IPY</b>	International Polar Year
<b>GRP</b>	Grassland Reserve Program	<b>IRENA</b>	International Renewable Energy Agency
<b>GRUAN</b>	GCOS Reference Upper-Air Network	<b>IRG</b>	International Resources Group
<b>GTOS</b>	Global Terrestrial Observing System	<b>IRI</b>	International Research Institute for Climate and Society
<b>GWP</b>	global warming potential	<b>ISE</b>	Informal Science Education
<b>ha</b>	hectare	<b>ITAP</b>	International Technical Assistance Program
<b>HCFC</b>	hydrochlorofluorocarbon	<b>ITEST</b>	Innovative Technology Experiences for Students and Teachers
<b>HD</b>	high definition	<b>ITP</b>	Industrial Technologies Program
<b>HFC</b>	hydrofluorocarbon	<b>IWGEO</b>	Interagency Working Group on Earth Observations
<b>HFC-23</b>	fluoroform	<b>JAXA</b>	Japanese Exploration Space Agency
<b>HFEs</b>	hydrofluorinated ethers	<b>K-12</b>	kindergarten through grade 12
<b>HIV/AIDS</b>	human immunodeficiency virus/ acquired immunodeficiency syndrome	<b>kg</b>	kilogram
<b>HSPF</b>	Hydrologic Simulation Program–Fortran	<b>km</b>	kilometer
<b>HUD</b>	U.S. Department of Housing and Urban Development	<b>km<sup>2</sup></b>	square kilometers
<b>HVAC</b>	heating, ventilation, and air conditioning	<b>kWh</b>	kilowatt-hour
<b>IAC</b>	Industrial Assessment Center	<b>LDCM</b>	Landsat Data Continuity Mission
<b>IASI</b>	Infrared Atmospheric Sounding Interferometer	<b>LIDAR</b>	light detection and ranging
<b>ICAA</b>	Initiative for Conservation in the Andean Amazon	<b>LMOP</b>	Landfill Methane Outreach Program
<b>ICO</b>	Integration and Coordination Office	<b>M2M</b>	Methane to Markets
<b>ICS</b>	Incident Command System	<b>MCC</b>	Millennium Challenge Corporation
<b>IDEA</b>	Integrated Data and Environmental Applications	<b>MEF</b>	Major Economies Forum on Energy and Climate
<b>IEA</b>	International Energy Agency	<b>MERITO</b>	Multicultural Education for Resource Issues Threatening Oceans
<b>IGEM</b>	Intertemporal General Equilibrium Model	<b>MetOp</b>	Meteorological Operational
<b>IGLO</b>	International Action on Global Warming	<b>mi</b>	mile
<b>in</b>	inch	<b>mi<sup>2</sup></b>	square miles
<b>IOOS</b>	Integrated Ocean Observing System	<b>MIT</b>	Massachusetts Institute of Technology
<b>IPCC</b>	Intergovernmental Panel on Climate Change	<b>mm</b>	millimeter
		<b>MMT</b>	million metric tons
		<b>MMTCO<sub>2</sub></b>	million metric tons of carbon dioxide

<b>MODIS</b>	Moderate Resolution Imaging Spectroradiometer	<b>NPOESS</b>	National Polar-orbiting Operational Environmental Satellite System
<b>MOU</b>	Memorandum of Understanding	<b>NPS</b>	National Park Service
<b>MPL</b>	Micro Pulse Lidar	<b>NRC</b>	National Research Council
<b>MPLNET</b>	Micro Pulse Lidar Network	<b>NRCS</b>	Natural Resources Conservation Service
<b>MPG</b>	miles per gallon	<b>NSF</b>	U.S. National Science Foundation
<b>MPO</b>	metropolitan planning organization	<b>NSTA</b>	National Science Teachers Association
<b>MSM</b>	Multi-Scale Modeling	<b>NSDL</b>	National STEM Education Distributed Learning
<b>MSW</b>	municipal solid waste	<b>NSTC</b>	National Science and Technology Council
<b>MW</b>	megawatt	<b>NTI</b>	National Transit Institute
<b>MWe</b>	megawatts electric	<b>NWCC</b>	National Water and Climate Center
<b>MWh</b>	megawatt-hour	<b>O<sub>3</sub></b>	ozone
<b>MY</b>	model year	<b>OAP</b>	Office of Atmospheric Programs
<b>N<sub>2</sub>O</b>	nitrous oxide	<b>OAS</b>	Organization of American States
<b>NACP</b>	North American Carbon Program	<b>OCO</b>	Orbiting Carbon Observatory
<b>NAS</b>	National Academies of Science	<b>OCS</b>	Outer Continental Shelf
<b>NASA</b>	National Aeronautics and Space Administration	<b>ODS</b>	ozone-depleting substance
<b>NAST</b>	National Assessment Synthesis Team	<b>OECC</b>	White House Office of Energy and Climate Change
<b>NCDC</b>	National Clean Diesel Campaign	<b>OECD</b>	Organisation for Economic Co-operation and Development
<b>NCDC</b>	National Climatic Data Center	<b>ONMS</b>	Office of National Marine Sanctuaries
<b>NEMS</b>	National Energy Modeling System	<b>OPEC</b>	Organization of the Petroleum Exporting Countries
<b>NEON</b>	National Ecological Observatory Network	<b>OPIC</b>	Overseas Private Investment Corporation
<b>NF<sub>3</sub></b>	nitrogen trifluoride	<b>OSTP</b>	Office of Science and Technology Policy
<b>NGO</b>	nongovernmental organization	<b>OSVW</b>	ocean surface vector winds
<b>NHTSA</b>	National Highway Traffic Safety Administration	<b>P2C2</b>	Paleo Perspectives on Climate Change
<b>NIDIS</b>	National Integrated Drought Information System	<b>PAA</b>	Price-Anderson Act
<b>NIFA</b>	National Institute of Food and Agriculture	<b>PaCIS</b>	Pacific Climate Information System
<b>NMVOG</b>	non-methane volatile organic compound	<b>PANGEA</b>	Partnerships for New GEOSS Applications
<b>NOAA</b>	National Oceanic and Atmospheric Administration	<b>PARTNER</b>	Partnership for Air Transportation Noise and Emissions Reduction
<b>NO<sub>x</sub></b>	oxides of nitrogen	<b>PES</b>	payment for ecosystem services
<b>NP</b>	nuclear power	<b>PFAN</b>	Private Financing Advisory Network

<b>PFC</b>	perfluorocarbon	<b>SAFETEA-LU</b>	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
<b>PHEV</b>	plug-in hybrid electric vehicle	<b>SAPs</b>	Synthesis and Assessment Products
<b>PIH</b>	plug-in hybrid	<b>SAR</b>	Second Assessment Report
<b>PL</b>	Public Law	<b>SCAN</b>	Soil Climate Analysis Network
<b>PM</b>	particulate matter	<b>S'COOL</b>	Students' Cloud Observations On-Line
<b>POES</b>	Polar Operational Environmental Satellites	<b>SeaWiFS</b>	Sea-viewing Wide Field-of-view Sensor
<b>PRICIP</b>	Pacific Region Integrated Climatology Information Products	<b>SEN</b>	Save Energy Now
<b>PTC</b>	production tax credit	<b>SEP</b>	State Energy Program
<b>QuickSCAT</b>	Quick Scatterometer	<b>SERVIR</b>	Regional Visualization and Monitoring System
<b>R&amp;D</b>	research and development	<b>SF<sub>6</sub></b>	sulfur hexafluoride
<b>RAMA</b>	Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction	<b>SFR</b>	Sodium Fast Reactor
<b>RANET</b>	Radio and Internet for the Communication of Hydro-Meteorological and Climate-Related Information for Development	<b>SGCR</b>	Subcommittee on Global Change Research
<b>RCMRD</b>	Regional Center for Mapping of Resources for Development	<b>SHADOZ</b>	Southern Hemisphere ADditional OZonesondes
<b>RD&amp;D</b>	research, development, and demonstration	<b>SNAP</b>	Significant New Alternatives Policy program
<b>REC</b>	renewable energy credit	<b>SNOTEL</b>	SNOpack TELEmetry
<b>REDD</b>	reducing emissions from deforestation and degradation	<b>SO<sub>2</sub></b>	sulfur dioxide
<b>REDI</b>	Renewables and Efficiency Deployment Initiative	<b>SOARS</b>	Significant Opportunities in Atmospheric Research and Science
<b>REEEP</b>	Renewable Energy and Energy Efficiency Partnership	<b>SORCE</b>	Solar Radiation and Climate Experiment
<b>REPI</b>	Renewable Energy Production Incentive	<b>SOS</b>	Science On a Sphere®
<b>RES</b>	renewable energy standard	<b>STAR</b>	Science To Achieve Results
<b>RFS</b>	renewable fuels standard	<b>STEM</b>	science, technology, engineering, and mathematics
<b>RGGI</b>	Regional Greenhouse Gas Initiative	<b>SUV</b>	sport utility vehicle
<b>RISA</b>	Regional Integrated Science and Assessments Program	<b>SWAT</b>	Soil and Water Assessment Tool
<b>RPS</b>	renewable portfolio standard	<b>SWiM</b>	System-Wide Monitoring
<b>S&amp;A</b>	synthesis and assessment	<b>T&amp;D</b>	transmission and distribution
		<b>TAO</b>	Tropical–Atmosphere–Ocean
		<b>TBtus</b>	trillion British thermal units
		<b>TFCA</b>	Tropical Forest Conservation Act
		<b>Tg</b>	teragram

<b>Tg CO<sub>2</sub> Eq.</b>	teragrams of carbon dioxide equivalents	<b>USDA</b>	U.S. Department of Agriculture
<b>TIGGER</b>	Transit Investment for Greenhouse Gas and Energy Reduction	<b>USDP</b>	U.S. Drought Portal
<b>TIST</b>	International Small Group and Tree Planting Program	<b>USFS</b>	U.S. Forest Service
<b>UBM</b>	Undergraduates in Biological and Mathematical Sciences	<b>USFWS</b>	U.S. Fish and Wildlife Service
<b>UN</b>	United Nations	<b>USGCRP</b>	U.S. Global Change Research Program
<b>UNEP</b>	United Nations Environment Programme	<b>USGEO</b>	U.S. Group on Earth Observation
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change	<b>USGS</b>	U.S. Geological Survey
<b>UNIFEM</b>	United Nations Development Fund for Women	<b>USTDA</b>	U.S. Trade and Development Agency
<b>UNPEPP</b>	University-National Park Energy Partnership Program	<b>VCOP</b>	Voluntary Code of Practice for the Reduction of Emissions of HFC & PFC Fire Protection Agents
<b>USAID</b>	U.S. Agency for International Development	<b>VHTR</b>	Very-High-Temperature Reactor
<b>USCRN</b>	U.S. Climate Reference Network	<b>WAP</b>	Weatherization Assistance Program
<b>US-CTC</b>	U.S. Climate Technology Cooperation	<b>WCI</b>	Western Climate Initiative
		<b>WHIP</b>	Wildlife Habitat Incentives Program
		<b>WMO</b>	World Meteorological Organization
		<b>WRP</b>	Wetland Reserve Program

# 1

## Executive Summary

“The threat from climate change is serious, it is urgent, and it is growing. Our generation’s response to this challenge will be judged by history, for if we fail to meet it—boldly, swiftly, and together—we risk consigning future generations to an irreversible catastrophe.”

*President Barack Obama  
September 22, 2009*

*United Nations Summit on Climate Change*

Throughout the United States, Americans are taking action to address the grave challenge of climate change, and to promote a sustainable and prosperous clean energy future. These efforts are occurring at all levels of government, in the private sector, and through the everyday decisions of individual citizens.

This *U.S. Climate Action Report 2010* (2010 CAR) sets out the major actions the U.S. government is taking at the federal level, highlights examples of state and local actions, and outlines U.S. efforts to assist other countries’ efforts to address climate change.

At the federal level, since assuming office in January 2009, President Obama has renewed the U.S. commitment to lead in combating climate change. The Obama administration, together with the U.S. Congress, has taken major steps to enhance the domestic effort to promote clean energy solutions and tackle climate change.

Through the American Recovery and Reinvestment Act (ARRA), signed into law in February 2009, the United States allocated over \$90 billion for invest-



ments in clean energy technologies to create green jobs, speed the transformation to a clean, diverse, and energy-independent economy, and help combat climate change.

In May 2009, President Obama announced a commitment to develop the first-ever joint fuel economy and carbon dioxide (CO<sub>2</sub>) tailpipe emission standards for cars and light-duty trucks in the United States. These standards will boost fuel efficiency on average 4.3 percent annually and approximately 21.5 percent over the term of the standards, starting in 2012 and ending in 2016.

In September 2009, the U.S. Environmental Protection Agency (EPA) announced its plan to collect greenhouse gas (GHG) emission estimates from facilities responsible for 82.5 percent of the GHG emissions across diverse sectors of the economy, including power generation and manufacturing.

In October 2009, the President issued an Executive Order requiring federal agencies to set and meet strict GHG reduction targets by 2020. President Obama also called for more aggressive efficiency standards for common household appliances and put in motion a program to open the outer continental shelf to renewable energy production.

In December 2009, following an extensive comment and review period, the EPA Administrator issued findings under the U.S. Clean Air Act that the current and projected GHG concentrations in the atmosphere threaten the health and welfare of current and future generations.

The United States is engaged in crafting new laws to provide a comprehensive long-term framework for combating climate change over the coming decades. In February 2009, President Obama announced his intent to work with Congress in seeking new legislation on energy and climate change that would establish a mandatory economy-wide cap on emissions, with emission reductions beginning in 2012 and becoming more stringent annually thereafter, leading to GHG reductions of approximately 83 percent below 2005 levels by 2050. In June 2009, the U.S. House of Representatives took a significant step toward realizing this goal by passing the American Clean Energy and Security Act. The legislation includes major new investments in clean energy technologies that will be needed to achieve a prosperous transformation to a low-carbon economy, help the United States adapt to the effects of climate change, and establish the United States as a leader in creating the skilled green jobs that will help drive economic growth in coming decades.

Leadership involves effective cooperation with countries from all regions of the world. Since entering office, the Obama administration has ramped up U.S.

engagement with other countries through the United Nations Framework Convention on Climate Change (UNFCCC) and through complementary efforts in support of a successful global climate agreement.

In April 2009, President Obama launched the Major Economies Forum on Energy and Climate (MEF), establishing an enhanced dialogue among 17 developed and developing economies representing 80 percent of global emissions to help support the multilateral negotiating process and devise new ways to advance the development and deployment of clean energy technologies. Leaders of these nations met in July 2009, and agreed on ways to further consensus on an enhanced future climate regime under the UNFCCC. These leaders also announced the establishment of a new Global Partnership to speed clean energy technology deployment. Experts from these countries have since developed action plans covering 10 key technologies. In December 2009 in Copenhagen, as part of this effort, the United States and other partners announced a new, five-year \$350-million Climate Renewables and Deployment Initiative.

In June 2009, the President announced a new Partnership on Clean Energy and Climate of the Americas to promote clean energy technologies across the Western Hemisphere. The United States has accelerated collaboration with key partners, such as China, India, the European Union, Canada, Brazil, Mexico, Russia, and others, to combat climate change, coordinate clean energy research and development, and support efforts to achieve a successful agreement under the UNFCCC.

In September, at the 2009 Group of Twenty (G-20) summit in Pittsburgh, Pennsylvania, President Obama joined other G-20 leaders in committing to phase out fossil fuel subsidies.

In December 2009, at the Fifteenth Conference of the Parties of the UNFCCC, as part of a Copenhagen Accord involving robust GHG mitigation contributions by developed and key developing countries, the Obama administration proposed a U.S. GHG emissions reduction target in the range of 17 percent below 2005 levels by 2020 and approximately 83 percent below 2005 levels by 2050, ultimately aligned with final U.S. legislation. In January 2010, the United States inscribed its near-term proposal—to reduce emissions in the range of 17 percent from 2005 levels by 2020—in the Copenhagen Accord, formally associating itself with the Accord.

The United States announced in Copenhagen that it would increase U.S. climate assistance to ensure a fast start to post-Copenhagen efforts, contributing its share to developed country financing approaching \$30 billion for 2010–2012. Also, in the context of meaningful mitigation actions and transparency on



implementation, developed countries committed to a goal of mobilizing \$100 billion globally by 2020 for countries in need, from various public- and private-sector sources. The fast-start effort will begin in 2010, with U.S. financing increased approximately three times that of 2009, including a substantial increase in adaptation financing for the most vulnerable countries and communities.

This 2010 CAR, submitted as a formal national communication, in accordance with Articles 4 and 12 of the UNFCCC, documents the actions the United States is taking to address climate change. This review accounts for current and proposed activities up to 2010. This report cites information and data available through 2009, except under very special circumstances, where more recent data were available. It explains how U.S. social, economic, and geographic circumstances affect U.S. GHG emissions, summarizes U.S. GHG emission trends from 1990 through 2007, identifies existing and planned U.S. policies and measures to reduce GHGs, and reports, wherever possible, measurable and verifiable emission reduction estimates for those policies and measures. The report also indicates future trends for U.S. GHG emissions, outlines the impacts of climate change on the United States and the adaptation measures the nation is taking to address those impacts, provides information on climate-related financial resources and technology transfer, details U.S. research and systematic observation efforts, and describes U.S. climate education, training, and outreach initiatives.

The activities in this report outline a set of initiatives in an ambitious, sustained effort that will be required to fully address climate change. The United States, in close cooperation with other nations of the world, is ready to build on its actions to date and assume a leadership role in this effort. The United States will continue to vigorously develop and build on its domestic and international efforts in coming months and years.

## NATIONAL CIRCUMSTANCES

Chapter 2 of this report outlines the national circumstances of the United States and how they affect U.S. GHG emissions. The United States is a large country with a diverse geography that encompasses a full range of tropical, temperate, and Arctic ecosystems, stretching across seven time zones, from the Atlantic seaboard to the Hawaiian Islands. The total U.S. land area is 3,548,112 square miles (mi<sup>2</sup>) (9,192,000 square kilometers [km<sup>2</sup>]); about 28 percent of that land is owned and managed by the federal government in a system of parks, forests, wilderness areas, wildlife refuges, and other public lands.

The United States is a federal republic, and its government is divided into three distinct branches: executive, legislative, and judicial. Each branch plays a distinct role in the creation, implementation, and adjudication of America's laws. In addition, the governments of U.S. states and localities are responsible for developing environmental and energy laws and policies that collectively have a substantial influence on the U.S. climate response.

As of 2009, the United States is the third most populous country in the world, with an estimated population of 308 million. From 1990 to 2009, the U.S. population grew by about 59 million, at an annual rate of about 1 percent. This growth rate is relatively high compared to the approximately 0.4 percent annual growth rates of Organisation of Economic Co-operation and Development (OECD) member countries.

The United States has the highest real gross domestic product (GDP) in the world. Between 1990 and 2008, U.S. GDP grew by over \$5.78 trillion (in constant 2008 dollars) or 66.9 percent, to reach \$14.4 trillion (2008 dollars). Per capita income on a purchasing power parity basis was \$46,716 in 2008—the fourth highest in the world behind Luxembourg, Norway, and Singapore.

The United States is the world's largest producer and consumer of energy. The nation currently consumes energy from petroleum, natural gas, coal, nuclear, conventional hydropower, and other renewable energy sources. For baseload electricity and most energy needs in the transportation sector, the fuels used most often are fossil fuels, accounting for approximately 79 percent of all U.S. energy consumption from 2005 through 2008. Petroleum remains the largest single source of U.S. energy consumption; in 2008 it accounted for 37.7 percent of total U.S. energy demand, down from 41 percent in 2005. Natural gas accounts for 24.4 percent, coal for 22.4 percent, nuclear for 8.1 percent, conventional hydro for 2 percent, and other renewables for 3 percent (U.S. DOE/EIA 2009d).

Annual U.S. energy consumption has been variable over the last decade, closely tracking economic growth rates and trends in energy efficiency in the residential, commercial, industrial, and transportation sectors. Between 2005 and 2007, total U.S. primary energy consumption grew by slightly over 1 percent. However, total primary energy consumption fell by 2.2 percent in 2008, as the economy weakened. Also, overall U.S. energy intensity has continually decreased, indicating an overall trend toward increasing energy efficiency in the economy. The decline of the U.S. economy's energy intensity has a direct effect on U.S. CO<sub>2</sub> emissions, 94 percent of which derive directly from the burning of fossil fuels according to 2007 data (U.S. EPA/OAP 2009).

The U.S. transportation system has evolved to meet the needs of a highly mobile, dispersed population and a large economy. Automobiles and light trucks dominate the passenger transportation system, and the highway share of passenger miles traveled by these vehicles in 2006 (the most recent year of available data) was 89 percent of total passenger miles. Air travel accounted for slightly over 10 percent, and mass transit and rail travel combined accounted for only about 1 percent of passenger miles traveled.

Many of the long-term trends identified in the 2006 *U.S. Climate Action Report* (2006 CAR) continue today, but recent events have significantly affected U.S. national circumstances. In particular, the economic slowdown in 2008 and early 2009 had a substantial impact on energy use and, correspondingly, GHG emissions. Technological change, energy efficiency improvements in transportation, buildings, and other sectors, private and public investment in low-carbon energy infrastructure, and a shift to less energy-intensive economic activity have continued to slow the growth of energy demand.

## GREENHOUSE GAS INVENTORY

Chapter 3 summarizes U.S. anthropogenic GHG emission trends from 1990 through 2007. The estimates presented in the report were calculated using methodologies consistent with those recommended by the Intergovernmental Panel on Climate Change (IPCC). A complete accounting of GHGs in the United States is referenced in Chapter 3 of this report in Figure 3-1 and Table 3-2. In 2007, total U.S. GHG emissions were 7,150.1 teragrams of carbon dioxide equivalents (Tg CO<sub>2</sub> Eq.). Overall, total U.S. emissions rose by 17 percent from 1990 through 2007. Over that same time period, the U.S. GDP increased by 65 percent and population increased by 21 percent. CO<sub>2</sub> accounted for approximately 85 percent of total U.S. GHG emissions in 2007.

As the largest source of U.S. GHG emissions, CO<sub>2</sub> from fossil fuel combustion has accounted for approximately 79 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 2007. The fundamental factors influencing this trend include general domestic economic growth over the last 17 years, and significant growth in emissions from transportation activities and electricity generation. Between 1990 and 2007, CO<sub>2</sub> emissions from fossil fuel combustion increased from 4,708.9 Tg CO<sub>2</sub> Eq. to 5,735.8 Tg CO<sub>2</sub> Eq., a 21.8 percent total increase over the 17-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 approximately 8 percent of total U.S. GHG emissions in 2007, with enteric fermentation (methane produced by livestock) being the largest source of CH<sub>4</sub> emissions. U.S. emissions of CH<sub>4</sub> declined by 5 percent from 1990 through 2007, mostly due to increased collection and combustion of landfill gas, as well as improvements in technology and management practices at natural gas plants.

Nitrous oxide (N<sub>2</sub>O) accounted for approximately 4.4 percent of total U.S. GHG emissions in 2007. 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 1 percent from 1990 to 2007, largely due to the installation of newer N<sub>2</sub>O control technologies in motor vehicles throughout the past decade.

Fluorinated substances—hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF<sub>6</sub>)—accounted for 2 percent of total U.S. GHG emissions in 2007. The increasing use of these compounds since 1995 as substitutes for ozone-depleting substances has been largely responsible for their upward emission trends.

Net CO<sub>2</sub> sequestration from land use, land-use change, and forestry increased by 221.1 Tg CO<sub>2</sub> Eq. (26 percent) from 1990 through 2007. This increase was primarily due to growth in the rate of net carbon accumulation in forest carbon stocks, particularly in above-ground and below-ground tree biomass.

## POLICIES AND MEASURES

Chapter 4 of this report outlines near-term policies and measures undertaken by the U.S. government to mitigate GHG emissions. In addition to the major new 2009 initiatives highlighted earlier in this chapter, the U.S. government is making important progress toward reducing GHG emissions through some 80 energy policies and measures that promote increased investment in end-use efficiency, clean energy development, and reductions in agricultural GHG emissions. The U.S. government is also committed to reducing emissions from the most potent GHGs; more than a dozen initiatives across five executive agencies target these potent gases. These activities form a foundation for a comprehensive approach for achieving a transformation in the way the United States will use energy over coming decades.

In addition, a large number of U.S. states and localities are implementing clean energy incentives and clean energy targets—from voluntary emission goals and green building standards to mandatory cap-and-trade laws.

## PROJECTED GREENHOUSE GAS EMISSIONS

Chapter 5 provides projections of U.S. GHG emissions through 2020 and beyond. These projec-

tions incorporate national estimates of population growth, economic growth, technology improvement, and normal weather patterns. Based on anticipated trends in technology development and adaptation, demand-side efficiency gains, and fuel switching, the projections represent a “business-as-usual” scenario that incorporates major policies in place as of March 31, 2009, including the Energy Independence and Security Act of 2007 (EISA) and ARRA, as well as a number of other federal and state measures outlined in Chapter 4. In this sense, the “business-as-usual” projections equal the “with measures” scenario called for under the UNFCCC Guidelines for Annex 1 Communications.

Despite the recent global economic turmoil, the U.S. economy is expected to recover and emissions are expected to grow in the long term in a business-as-usual/“with measures” case. Though absolute emissions are expected to grow in a “with measures” scenario, emissions per unit of GDP are expected to decline.

Projected GHG emissions under the “with measures” scenario presented in this report are significantly lower than emission estimates in the 2006 CAR. This shift is a result of changes in expectations regarding energy prices and economic growth and new policies taken since 2006, including EISA and ARRA, as well as various actions at the state level.

Projections are provided by gas and by sector from the present to 2020. Gases included in this report are CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs, and SF<sub>6</sub>. Sectors reported include electric power generation and residential, commercial, industrial, and transportation end use. Proposed or planned policies that had not been implemented as of March 31, 2009, as well as sections of existing legislation that require implementing regulations or funds that have not been appropriated, are not included in the projections. The projections include ARRA provisions, but do not include, for example, the vehicle fuel economy and emission standards announced by the President in May 2009.

The GHG emission projections in this chapter generally extend to 2020. Because of the extensive discussion of 2050 emission reduction goals in the United States and internationally, this chapter also includes a brief discussion of projected GHG emissions out to 2050.

Additional measures will be needed beyond those currently in place to ensure that the United States plays its part in the global effort to avoid the most damaging effects of climate change. The Obama administration supports the implementation of a market-based cap-and-trade program to spur growth in a low-carbon economy and reduce GHG emissions to approximately 83 percent below 2005 levels by

2050. In June 2009, the U.S. House of Representatives passed the landmark American Clean Energy and Security Act, which includes economy-wide GHG reduction goals of 3 percent below 2005 levels in 2012, 17 percent below 2005 levels in 2020, and 83 percent below 2005 levels in 2050.

As this report was finalized, the U.S. Senate was considering its own legislation, with similarly bold targets to promote clean energy and reduce GHG emissions. The target trajectories stipulated in those bills—aligned with the Obama administration’s goals and with the U.S. inscription in the Copenhagen Accord—are presented against a long-term business-as-usual/“with measures” reference scenario in Figure 5-1.

From 2005 through 2020, total GHG emissions are projected to rise by 4 percent under a “with measures” scenario, from 7,109 Tg CO<sub>2</sub> Eq. to 7,416 Tg CO<sub>2</sub> Eq., while the U.S. GDP is projected to grow by 40 percent. Over that period, CO<sub>2</sub> emissions in the baseline projection are estimated to increase by 1.5 percent, although CH<sub>4</sub>, N<sub>2</sub>O, and PFC emissions are expected to grow more rapidly by 8 percent, 5 percent, and 4 percent, respectively. A large portion of emissions growth is driven by HFCs, which are projected to more than double between 2005 and 2020, as they are more extensively used as a substitute for ozone-depleting substances. The relatively slow growth forecast for CO<sub>2</sub> emissions is attributable to increasing use of renewable energy and policies implemented to increase efficiency.

With additional mitigation measures, such as those that would be implemented under the American Clean Energy and Security Act of 2009, the United States would have a GHG reduction goal of 17 percent by 2020, though U.S. GDP is projected to grow by 40 percent in that time. Over that period, with additional mitigation measures, CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, and PFC emissions would decrease significantly, and HFCs—among the most potent of GHGs—would be subject to a targeted cap and phase-down process.

More rapid improvements in technologies that emit fewer GHGs, new GHG mitigation requirements, or more rapid adoption of voluntary GHG emission reduction programs could result in lower GHG emission levels than in the baseline scenario projection.

## 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 is involved in a wide array of climate assessments, research, and other activities to understand the potential impacts of climate change on the environment and the economy, and to develop methods and tools to enhance adaptation options. The U.S. government sponsors

and adheres to some of the world's most advanced scientific research on climate change.

Chapter 6 outlines a set of studies by the U.S. Global Change Research Program, *Global Climate Change Impacts in the United States*, released in July 2009, which highlight key vulnerabilities in the United States associated with climate change (Karl et al. 2009). These key vulnerabilities, shared by the United States and many nations around the world, include the potential for water scarcity, unreliable energy production and transmission, damage to transportation infrastructure, public health problems, damage to ecosystems, and catastrophic harm to coasts and coastal communities.

Through the creation of special funds and programs related to climate adaptation, the U.S. government is working to address these vulnerabilities. States and localities have a major role to play in vulnerability assessment and adaptation. Chapter 6 includes examples of these efforts. The United States is committed to establishing and maintaining climate adaptation assistance for both domestic and international communities.

## FINANCIAL RESOURCES AND TRANSFER OF TECHNOLOGY

Chapter 7 outlines U.S. government initiatives and partnerships and U.S. agency roles in climate-related international assistance and technology transfer. Chapter 7 also notes the U.S. offer of contributing to total developed country climate financing approaching \$30 billion by 2012, with a goal of mobilizing \$100 billion by 2020, in the context of robust mitigation efforts by all Parties to the UNFCCC.

The United States is committed to helping countries in need of addressing climate change, and is scaling up its efforts to promote clean energy, reduce emissions in the land-use sector, and adapt to climate change in a manner consistent with intellectual property rights. The fiscal year (FY) 2010 budget provides more than a threefold increase in bilateral and multilateral funding for climate-related activities, relative to the enacted funding provided in the previous fiscal year. It increases U.S. Agency for International Development (USAID) climate programs by 70 percent, with significant new investments in mitigation and adaptation strategies that will build on extensive USAID experience in promoting clean and climate-resilient development. It also provides first-ever contributions to multilateral climate funds, including \$375 million to the World Bank Climate Investment Funds, and \$50 million total to the UNFCCC Special Climate Change Fund and the UNFCCC Least Developed Country Fund. The President's FY 2011 budget, submitted to Congress in February 2010, proposes a further increase in core climate change funding of almost 40 percent, as well as substantial

increases in funding for activities in such areas as food security, water, and health that will have significant climate co-benefits.

These investments—combined with U.S.-based foundation grants, nongovernmental organization (NGO) resources, private-sector commercial sales, commercial lending, foreign direct investment, market-enabled GHG reductions, private equity investment, and dozens of already-existing government programs that distribute aid, fund clean energy research, and conserve natural resources—support a robust contribution by the United States in organizing and supporting the world's response to climate change.

The U.S. government leads or is involved in a number of bilateral and multilateral clean energy partnerships, including new partnerships established in 2009. The United States will join a number of other countries in the Climate Renewables and Efficiency Deployment Initiative (Climate REDI), which will channel \$350 million to fund programs over five years, including \$85 million in U.S. funding. The United States announced in Copenhagen that it will partner with other key donors to channel \$3.5 billion, including \$1 billion in U.S. funding, to reduce emissions from deforestation, land degradation, and other activities through 2012. The United States will also join member countries of the Arctic Council to advance efforts to reduce black carbon from sources leading to reduced albedo in Arctic polar ice. The United States has made combating climate change a central part of its bilateral and regional strategic relationships, and recent climate partnerships have followed from leader summits with China, India, and countries across the Western Hemisphere.

U.S. agencies are engaged in extensive cooperative activities at the technical level. The National Oceanic and Atmospheric Administration (NOAA), Department of Energy, EPA, and other agencies lead U.S. engagement in specific climate partnerships, such as the Global Earth Observation System of Systems, the Carbon Sequestration Leadership Forum, and the Methane to Markets Partnership. These agencies also have extensive bilateral relationships designed to further climate protection in their areas of responsibility.

Agencies that promote international trade, including the U.S. Trade and Development Agency, the U.S. Export-Import Bank, and the Overseas Private Investment Corporation, are also enhancing efforts to promote clean investments. These and other U.S. government efforts will be ramped up over time as part of a successful global agreement on climate change.

## RESEARCH AND SYSTEMATIC OBSERVATION

Chapter 8 describes 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 addressing the impacts of climate change. It outlines the lead role of the interagency U.S. Global Change Research Program (USGCRP, formerly known as the Climate Change Science Program) in U.S. climate research. The chapter describes U.S. efforts to collect scientific observations about climate, archive climate-related data, and provide access to the data. This chapter also details how the U.S. government is supporting clean energy technology and climate change mitigation technologies.

The essential capacities for research and observations are widely distributed across U.S. government agencies, and are brought together into a single interagency program through the USGCRP. Growing out of interagency activities and planning that began in 1988, the creation of the USGCRP energized cooperative interagency activities, with each agency bringing its strengths to the collaborative effort. The FY 2010 budget provides over \$2 billion for programs under the USGCRP—an increase of \$46 million, or about 3 percent, over the 2009 level (excluding ARRA funds) (OMB 2009). The Office of Science and Technology Policy and Office of Management and Budget work closely with the Integration and Coordination Office and the working groups to establish research priorities and funding plans to ensure the program is aligned with the Obama administration's priorities and reflects agency planning.

The USGCRP helps organize and analyze critical climate data, which form the foundation of climate science. Long-term, high-quality observations of the global environmental system are essential for defining the current state of the Earth's system, its history, and its variability. This task requires both space- and surface-based observation systems.

The United States has committed not only to improving the scientific understanding of global climate change, but also to accelerating the development and deployment of technologies to reduce GHG emissions.

These efforts are targeted at increasing energy end-use efficiency and supplying energy with greatly reduced GHG emissions to meet the nation's goals of reducing GHG emissions and stabilizing GHG atmospheric concentrations at a level that avoids dangerous human interference with the climate system. To address these challenges, the Obama administration and Congress are working together to spur a revolution in clean energy technologies. An example of that commitment is the creation of the Advanced Research and Projects Agency–Energy (ARPA-E). Modeled on the Defense Department's Defense Advanced Research Projects Agency, which produced the predecessor to the Internet, ARPA-E was brought to life in 2009 by Congress with funding from the federal stimulus bill for the purpose of overcoming the long-term, high-risk technological barriers to the development of clean energy technologies.

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

Chapter 9 outlines how U.S. climate change education, training, and outreach efforts have expanded significantly since the publication of the 2006 CAR. U.S. federal agencies—including USAID; the Departments of Agriculture, Energy, the Interior, and Transportation; EPA; the National Aeronautics and Space Administration; NOAA; and the National Science Foundation—work on a wide range of climate change education, training, and outreach programs. A Climate Change Education Interagency Working Group was formed in 2008 to coordinate these efforts and develop an integrated national approach to climate change. Efforts by industry, states, local governments, universities, schools, and NGOs are essential complements to more than 100 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.