UNITED
NATIONS

UNFCCC Framework Convention on Climate Change

Distr.
GENERAL

FCCC/IDR.3/USA
21 September 2004

ENGLISH ONLY

UNITED STATES OF AMERICA

Report on the in-depth review of the third national communication of the United States of America

Review team:

Abdelkrim Ben Mohamed (Niger)
Marna van der Merve (South Africa)
Naoki Matsuo (Japan)
Maria Virdis (International Energy Agency)
Katia Simeonova (UNFCCC secretariat, coordinator)

I. INTRODUCTION AND NATIONAL CIRCUMSTANCES RELEVANT TO GREENHOUSE GAS EMISSIONS AND REMOVALS

A. Introduction

1. The secretariat of the United Nations Framework Convention on Climate Change (UNFCCC) received the third national communication of the United States of America under the Framework Convention on Climate Change, entitled *U.S. Climate Action Report – 2002* (hereinafter referred to as CAR3) on 28 May 2002. An in-depth review of CAR3 was carried out from February 2003 to December 2003, including a visit to Washington D.C. from 24 to 28 February 2003. The review team comprised Mr. Abdelkrim Ben Mohamed (Niger), Ms. Marna van der Merve (South Africa), Mr. Naoki Matsuo (Japan), Ms. Maria Virdis International Energy Agency (IEA) and Ms. Katia Simeonova (UNFCCC secretariat, coordinator).

2. During the country visit, the review team had a number of meetings and discussions on the main issues addressed in the CAR3. During these meetings with officials and experts from the governmental Administration, staff of the United States Congress, and business and environmental non-governmental organizations (NGOs), the team was provided with a great deal of additional and background data and analyses, which supported the information reported in the CAR3. The review team was also provided with information on the new climate change initiatives launched after the publication of the CAR3 to advance further climate change objectives; in particular, the recent presidential initiatives.

B. National circumstances

3. The United States is one of the largest countries in the world, with a total area of 9,159,115 km^2 stretching over seven time zones. It has a diverse topography, featuring deserts, lakes, mountains, plains and forests. The Federal Government owns around 21 per cent of the total land area, and uses it mainly for national parks and military purposes. Around 5 per cent of the total area is occupied by urban and rural residential areas; the rest is made up of forests (28 per cent), grassland, pasture and range land (26 per cent) and arable land (20 per cent). The climate is mainly temperate, but there is also a wide range of more extreme climatic conditions, representative of all major climate types. The country is at risk from many weather-related phenomena, such as hurricanes and other tropical storms, tornadoes and severe flooding.

4. With a population of 288.4 million in 2002, the United States ranked as the third most populous country in the world. The population growth rate in the 1990s was relatively high – slightly more than 1 per cent – with one third of the growth coming from immigration and the rest from natural increase. The average population density is relatively low, although it varies widely in different parts of the country. The population is ageing, average household size is declining and the average size of housing units has been increasing, with implications on the demand for energy and transportation.

5. The economy of the United States is by far the largest in the world. In 2002 the gross domestic product (GDP) totalled USD 10.4 trillion, three times as much as the GDP of the second largest economy, that of Japan. The economy saw major changes in the 1990s, mainly resulting from technological revolution and technical innovation, where the United States leads the way. These changes were reflected in a shift in the composition of the economy towards services, mainly financial services, and away from manufacturing industry. Within the industry sector, energy-intensive subsectors have grown more slowly than the other subsectors. Still, nine of the energy-intensive subsectors continued to account for around two thirds of industrial energy consumption: petroleum refining, chemicals, forest products, agriculture, steel, mining, aluminium, metal-casting and glass. Agriculture accounted for less than 2 per cent of GDP, but in absolute terms its output is immense. Notwithstanding these changes, the United States economy remains exceptionally diverse and self-sufficient in most raw materials, except for crude oil. In 2001, exports of goods and services accounted for 10.3 per cent of GDP, and imports of goods and services for 13.8 per cent of GDP.

6. Economic growth in the United States in the 1990s was unprecedented (table 1): after some decline in 1991, the GDP grew by 37 per cent between 1991 and 2002, an annual average of 3 per cent. This growth was driven by a steady increase in productivity due, in part, to the technological revolution and computerization. Growth slowed down in 2000 and 2001, which was mainly attributed to the collapse in value of high-technology stocks and the aftermath of the terrorist attack of 11 September 2001. This slowdown further worsened the United States' current account deficit, which reached a new record of 5 per cent of GDP in 2002.

7. The United States is richly endowed with energy resources, primarily fossil fuels such as coal, natural gas and oil, but also uranium ore and renewable energy. The net energy imports are dominated by oil and, to lesser extent, natural gas, which in 2000 accounted for 22 per cent and 4 per cent of the total primary energy supply (TPES) respectively. The TPES relies heavily on fossil fuels: in 2000 oil and oil products accounted for 38 per cent, followed by natural gas (23 per cent) and coal (22 per cent). Nuclear energy accounted for 9 per cent, and combustible renewables, hydro and non-traditional renewables made up the remaining 8 per cent. The TPES grew steadily from 1,926 Mtoe in 1990 to 2,304 Mtoe in 2000, which represented a 20 per cent growth, or average annual growth of 1.8 per cent. The structure of the TPES did not change noticeably in the 1990s, except for some increased use of nuclear energy.

8. The electricity sector has undergone major changes towards deregulation and liberalization, initiated by the 1992 Energy Policy Act, which opened the wholesale electricity market to competition. This led to a transition from vertically integrated monopolies, such as utilities, to a competitive market, and a sizeable growth of non-utility power generation capacity and related growth in electricity produced by non-utility generators from 7 per cent in 1990 to 21 per cent in 2000. The retail markets have been slow to follow. Market liberalization has not greatly influenced the fuel mix for electricity generation: in 2000, coal continued to be the fuel of choice for electricity generation, accounting for more than 50 per cent of electricity produced, followed by nuclear power (20 per cent), natural gas (15 per cent), conventional hydropower (10 per cent) and oil products (3 per cent), with other fuels and renewables making up the remainder. There was some increase in the share of natural gas as compared to coal and oil products, chiefly in response to the difference in prices and a more favourable regulatory framework, and a small increase in the share of nuclear power, stemming from increased utilization of existing capacity.

Table 1. Main macro-economic indicators and GHG emissions

	1990	2000	Percentage change between 1990 and 2000
Population (millions)[a)]	249.98	275.42	10.18
Gross domestic product – GDP (billions of USD of 1995)	6 520.50	8 955.10	37.34
Total primary energy supply – TPES (Mtoe)	1 927.57	2 303.81	19.52
Electricity consumption (TWh)	2922.57	3 857.28	31.98
GHG emissions (Gg CO_2 equivalent)[b]	6 130 724	7 001 225	14.20
GHG emissions per capita (Mg CO_2 equivalent)	25.52	25.42	–0.04
GHG emissions per GDP unit (kg CO_2 equivalent per USD of 1995)	0.94	0.78	–17.02

[a] The population and energy data are from the International Energy Agency database. The greenhouse gas (GHG) emission data are from the United States 2002 National Inventory Report (NIR).

[b] Without accounting for emissions and removals from land-use change and forestry (LUCF).

9. The final energy consumption (FEC) grew at the same rate as the TPES: 20 per cent between 1990 and 2000, or 1.8 per cent annually, reaching 1,571 Mtoe in 2000. The transport sector was by far the largest energy end-use sector, accounting for 39 per cent of the FEC in 2000, followed by industry, including non-energy use (31 per cent). Other sectors, including residential, commercial and public services, and agriculture, made up the remaining 30 per cent. Between 1990 and 2000 energy consumption increased by 26 per cent, with industry being the fastest-growing sector. This growth was underpinned by some industrial subsectors that almost doubled, or in some cases more than doubled, their energy consumption, such as chemical and petrochemical; non-ferrous metals; transport equipment; food and tobacco; paper, pulp and printing; and wood and wood products. Transport grew by 22 per cent and ranked second, followed by the residential and commercial sectors with 17 per cent growth for the same period. Structural changes in the economy (referred to in paragraph 5) and energy efficiency gains in many sectors, with the notable exception of transport, resulted in an energy intensity decrease of 15 per cent between 1990 and 2000, or 1.6 per cent annually.

C. Institutional framework and recent developments in climate policies

10. The United States is a Federal Republic with three independent branches of government: Executive, the Presidency and affiliated offices; Legislative, the United States Congress comprising a Senate and a House of Representatives; and Judiciary, the Supreme Court and auxiliary federal courts. The Federal Government oversees matters related to foreign affairs, national defence, maintenance of the currency and regulation of interstate commerce. All other matters fall into the competencies of the 50 states, or of city and county governments.

11. As noted in the second in-depth review report the political and institutional system of the United States makes climate change policy-making complex and difficult. Climate change actions are developed by the presidential Administration, but the funding for these actions has to be approved by the Congress, on the basis of proposals by a large number of committees with diverse and competing policy mandates. Difficulties also arise from the possibility provided by the political system for the individual states to adopt policies that can differ from the national policies and, particularly for climate change, that could go beyond the federal level policies: for example, introducing innovative instruments, such as renewable portfolio standards and emissions trading. Differences in the design and implementation of these instruments may affect efficiency.

12. The national climate policy of the United States continued to be developed through a cooperative inter-agency process, including more than 20 agencies of the Federal Government and several offices linked to the Executive Office of the President. A new high-level management structure was set up in November 2002 to coordinate climate change science and technological development. This was partly in response to the outcome of the 2001 Cabinet-level review of climate change policy. The Office of the President heads this structure, while the Cabinet Committee on Climate Change Science and Technology Integration and associated working group is entrusted with coordination of federal research on global climate change and advanced energy technologies. The working group develops policy recommendations for the President and oversees two programmes: the Climate Change Science Program (CCSP) and the Climate Change Technology Program (CCTP). Several agencies, including the Department of Energy (DOE), the Environmental Protection Agency (EPA), the Department of Transport (DOT) and the Department of Agriculture (USDA) continued to be involved in the implementation of domestic climate policies and programmes, while actively participating in the new high-level management structure.

13. The United States ratified the UNFCCC on 15 October 1992, and in response launched the Climate Change Action Plan (CCAP) in October 1993. Although the stabilization "aim" of UNFCCC Article 4.2(a) and (b) is not legally binding, the previous Administration established a domestic goal of stabilizing GHG emissions at the 1990 level by the year 2000. This goal was not met: the total emissions of the United States in 2000 exceeded the 1990 level by 14 per cent. The review team was informed that several factors contributed to these increased emission levels, such as the economic growth being higher than expected, energy prices lower than expected, and reduced funding for several governmental programmes, including those envisaged in the 1993 CCAP and energy efficiency measures.

14. The United States signed the Kyoto Protocol on 12 November 1998, which provided for a reduction in GHG emissions by 7 per cent from 1990 levels by 2008–2012. However, the Kyoto Protocol has never been submitted to the Senate for advice and consent needed for ratification. In March 2001, President Bush announced that he would not proceed with the ratification of the Protocol because of the perceived damage to the economy of the United States, the lack of commitments by the developing countries, and lack of scientific bases for targets. In June 2001, the Administration released an interim report of the Cabinet-level climate change working group and President Bush unveiled three initiatives: the Climate Change Research Initiative (CCRI), the National Climate Change Technology Initiative (NCCTI), and strengthening of international cooperation.

15. In February 2002, the administration released a detailed policy document *U.S. Climate Change Strategy: A New Approach*, referred to herein as the Climate Change Strategy, that outlines a broad range of steps to address climate change. An integral part of this strategy was the setting of a national goal to improve the GHG emission intensity of the economy by 18 per cent between 2002 and 2012. This is

equivalent to 2 per cent annual improvement, or 1,833 Tg CO_2 equivalent cumulative reductions over the 10 years, compared to the current scenario with existing measures. Such improvement is expected to bring an additional 4 percentage point improvement in emission intensity over the projected 14 per cent improvement according to projections at that time. This goal is seen as a step to meeting the ultimate objective of the UNFCCC – the stabilization of GHG concentrations at a safe level. The Administration has noted that if, in 2012, progress is not sufficient and the science justifies further action, the United States will respond with additional measures.

II. GREENHOUSE GAS INVENTORY INFORMATION

A. Inventory preparation

16. The EPA assumed responsibility for coordinating the preparation of the United States national inventories, including the National Inventory Report (NIR) and the estimates of GHG emissions structured according to the common reporting format (CRF). On behalf of the Federal Government, the Department of State submits the NIR and CRF to the UNFCCC secretariat annually. The EPA works in close cooperation with agencies which provide emissions estimates, primary data (activity data and information needed to assess the emission factors) and methodological approaches. These include the Energy Information Administration (EIA) within the DOE, the Department of Defense and the USDA. The EPA also works with the United States Geological Survey, the Department of Transportation and the Department of Commerce, which mainly supply published data. The EPA prepares emissions estimates for the majority of the sources (except for bunkers and a few others). EPA estimates for a few sources, e.g., sulphur hexafluoride (SF_6) emissions from the electric power industry, are based on information provided directly by industry through voluntary programmes.

17. The EPA has established an Inventory Management Team, which has a pivotal role in inventory preparation. This team is entrusted with collecting data, implementing quality assurance/quality control (QA/QC) procedures, cross-cutting analysis, preparation of the CRF tables and overseeing the peer and public review. It is in the process of developing and implementing a detailed QA/QC plan, which aims to ensure the high quality of inventory estimates through quality checks of data gathering, input and documentation, as well as checks on the actual emission calculations. Also as part of the quality checks, the inventory is subject to an expert review and a separate public review (initiated by a Federal Register Notice) prior to submission, and the United States is one of the few countries to undertake such reviews.

18. Although the work on some issues related to the establishment of the national inventory system and implementation of the IPCC good practice guidance[1] is still ongoing, such as the implementation of QA/QC procedures and quantitative assessment of uncertainties, the review team formed the impression that the United States has in place most of the elements required to provide high-quality emission estimates on an annual basis, to constantly improve the quality of the estimates as new knowledge on the emission sources and gases becomes available, and to update the estimates of the historical time series with a view to obtaining consistent time series.

19. The CAR3 reports inventory data that are derived from the NIR 2001 and contains estimates for 1990–1999. The inventory comprehensively covers emissions of GHGs from practically all sources and sinks, as well as precursors required by the UNFCCC guidelines.[2] This encompasses emissions of the three main GHGs – carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) – and fluorinated gases, i.e. perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), and SF_6. It also includes emissions of indirect GHGs, such as nitrogen oxides (NO_X), carbon monoxide (CO), non-methane volatile organic compounds (NMVOCs) and sulphur dioxide (SO_2).

20. Some small sources of emissions are yet to be covered: for example, N_2O emissions from caprolactam production and CO_2 emissions from the drilling and production of petroleum and natural gas.

---

[1] *Intergovernmental Panel on Climate Change (IPCC) Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Emission Inventories.*

[2] "UNFCCC guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications."

Also, several sources of emissions from energy and removals by sink, mainly in Alaska and Hawaii, have not been estimated because of the lack of activity data. These sources and gases are transparently reported in the NIR 2001 and the CRF tables, and their possible inclusion in future inventories is being investigated. During the visit to Washington, the review team discussed the NIR 2002 and the preliminary data prepared for the NIR 2003. In terms of completeness, the NIR 2002 already included CH_4 emissions from industrial wastewater from the food processing industry and changes in carbon stock of urban trees.

21. The United States assesses the emissions by source and removals by sink using methodologies consistent with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC Guidelines). For some categories, such as estimates of forest carbon stock changes from land-use change and forestry (LUCF) and waste incineration, country-specific methods consistent with the IPCC Guidelines were used. In particular, for the LUCF sector very detailed estimates of forest carbon stock changes have been prepared using the FORCARB model. In most cases and for key sources, a more sophisticated method than the IPCC default method was used. Emission factors were country-specific in most cases. Qualitative estimates of uncertainties are provided for all sources. The review team was briefed on the preparation of quantitative estimates of uncertainties using a Monte Carlo procedure. Some of these estimates were available, although not yet published. The review team noted the effort to address uncertainties in a systematic manner and to improve the quality of the inventory.

22. As required by the UNFCCC guidelines, the GHG emission levels reported in CAR3 are identical to the data presented in the NIR 2001. The reported emission levels for 1990–1995 were somewhat different from the levels reported in the CAR2 (table 2). For 1990 and 1995, respectively, these differences amounted to 200 per cent and 194 per cent for N_2O, and to 131 per cent and 137 per cent for carbon sequestration. For CO_2 and CH_4, the differences were very small. Altogether this led to about 4 per cent change in the estimates of total emissions from 1990 and 1995.

Table 2. Comparison of 1990 and 1995 emissions reported in the CAR2, CAR3 and 2002 inventory (Tg CO_2 equivalent)

	CAR2		CAR3		2002 Inventory	
	1990	**1995**	**1990**	**1995**	**1990**	**1995**
CO_2	4 961	5214	4 913	5 220	4 999	5 306
CH_4	623	649	645	651	651	658
N_2O	132	147	397	432	387	420
Fluorinated gases	88	136	84	99	94	99
Carbon sequestration	458	429	1 060	1 019	1 098	1 110
Total emissions (without CO_2 from LUCF)	**5 804**	**6 145**	**6 038**	**6 401**	**6 131**	**6 482**

Note: Discrepancies in totals in this and the following tables are due to rounding errors.

23. The reasons for these differences in the data include ongoing methodological improvements, improvements initiated in response to the comments from the NIR 2000 review, changes in historical statistical data, and addition of some new emission sources and removals. For example, estimates of N_2O emissions from agricultural soils have been expanded to include direct and indirect emissions (from organic fertilizers, cropping practices and livestock manure management) and CO_2 fluxes from LUCF have been revised to include forest soils, forest understorey and non-forest trees. Changes have been transparently documented in the NIRs. Since the review of the NIR 2000, changes have been incremental. This means that differences between the CAR3 and NIR 2002 estimates are generally small, around 1–2 per cent. Still, for some gases and sources the difference was noticeable: around 3 per cent for N_2O for 1995 and 12 per cent for fluorinated gases for 1990. There were also small differences in estimates of carbon sequestration coming mainly from adding changes in carbon stock in urban trees. New data from the United States forest survey for 1997 were used to estimate 1997 forest and harvested wood carbon stocks. These were combined with the 1992 and 2000 estimates to derive carbon flux estimates for intervening years. The review team noted with appreciation that when methodological changes have been made, the entire time series has been recalculated to obtain consistent time series. The analysis of emission trends presented in this report is based on the NIR 2002, the most recent one available.

B. Emission profile and trends

24. The overall GHG emissions of the United States totalled 7,001,225 Gg CO_2 equivalent in 2000 according to the NIR 2002, an increase of 14 per cent compared to 1990 (table 3). The increase was mainly attributed to the robust economic growth during the 1990s, which resulted in a steady increase in CO_2 emissions from all energy-related sources (especially in transport and energy transformation industries). This was reflected in an overall growth of these emissions by 17 per cent, or an annual growth of 1.6 per cent. Another factor for the growth in emissions was relatively low energy prices. The mitigation effects from the 1993 CCAP and some increased utilization of nuclear capacity were too small to offset the effect of economic growth and low energy prices. Emissions of N_2O increased by 10 per cent for the same period. Emissions of fluorinated gases grew the most, by 30 per cent, but they continue to be a small fraction of the overall emissions. Only emissions of CH_4 fell, by 6 per cent for this period.

25. The emission profile of the United States is similar to that of most developed countries: CO_2 is by far the most important gas, accounting for 83 per cent of the total emissions in 2000, followed by CH_4 (9 per cent), N_2O (6 per cent) and fluorinated gases making up the remainder. Energy was by far the most important sector, accounting for 85 per cent of the total emissions, followed by agriculture (7 per cent), industrial processes (4 per cent), with waste and other sectors making up the remainder.

Table 3. Total GHG emissions and emissions by gas, 1990–2000

	CO_2 equivalent (Gg)										
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Net CO_2 emissions/removals	3 900 768	3 857 563	3 954 784	4 043 545	4 143 132	4 195 879	4 375 604	4 680 450	4 689 199	4 769 080	4 937 544
CO_2 emissions (without LUCF)	4 998 515	4 943 166	5 045 918	5 157 298	5 260 956	5 305 895	5 483 670	5 567 981	5 575 083	5 665 472	5 840 039
CH_4	651 285	651 038	656 746	648 919	653 327	657 604	643 728	633 336	627 114	620 503	614 509
N_2O	387 299	392 842	402 657	401 969	428 669	419 780	430 478	429 838	426 338	423 542	425 345
HFCs	36 023	31 706	36 481	37 184	40 170	49 043	61 920	68 199	85 267	81 945	87 814
PFCs	20 465	18 034	16 905	16 810	15 408	16 671	16 945	16 377	15 025	15 305	14 022
SF_6	37 138	38 390	36 064	39 978	37 179	32 816	33 016	32 332	27 363	22 723	19 496
Total (with net CO_2 from LUCF)	**5 032 977**	**4 989 573**	**5 103 637**	**5 188 404**	**5 317 885**	**5 371 792**	**5 561 692**	**5 860 532**	**5 870 307**	**5 933 097**	**6 098 730**
Total (without CO_2 from LUCF)	**6 130 724**	**6 075 176**	**6 194 771**	**6 302 156**	**6 435 708**	**6 481 809**	**6 669 758**	**6 748 063**	**6 756 190**	**6 829 489**	**7 001 225**

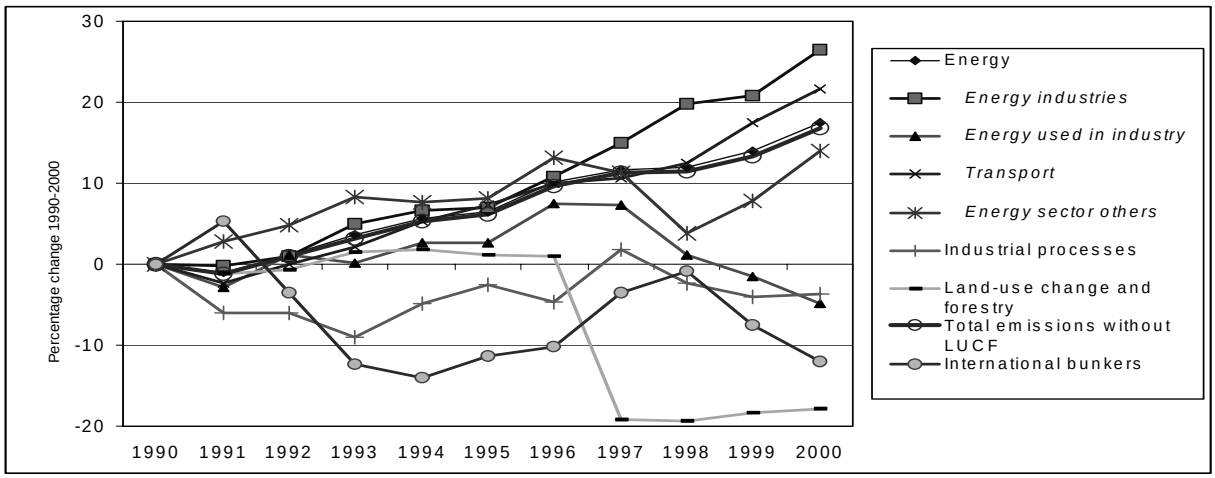
1. Carbon dioxide

26. In 2000, CO_2 emissions amounted to 5,840,039 Gg without emissions and removals from LUCF, a 17 per cent increase over 1990 levels (table 4 and figure 1). The energy industry and transport were by far the most important sectors, contributing 40 per cent and 31 per cent respectively to the total CO_2 emissions. Other important sectors were energy use in industry and energy use in other sectors (residential, commercial and institutional) with shares of 14 per cent and 12 per cent respectively. The increase in total CO_2 emissions was underpinned mainly by the growth of emissions from energy industries (27 per cent) and transport (22 per cent), which reflected overall growth in energy demand linked to economic growth. The growth in emissions from energy industries also reflected the continued reliance on fossil fuel for electricity production; more than half of the country's electricity was generated from coal, and about 94 per cent of the total coal consumption in 2000 was used for electricity production.

Table 4. Carbon dioxide emissions by source, 1990–2000

	Gg										
Source and sink categories	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Energy	4 830 350	4 785 112	4 887 921	5 004 147	5 100 961	5 141 838	5 323 312	5 396 825	5 410 844	5 504 115	5 678 099
Energy industries	*1 858 940*	*1 855 274*	*1 877 454*	*1 952 255*	*1 982 593*	*1 989 266*	*2 061 198*	*2 137 933*	*2 226 426*	*2 246 193*	*2 352 492*
Energy used in industry	*871 797*	*847 509*	*881 962*	*872 744*	*894 570*	*895 055*	*936 741*	*935 376*	*881 275*	*858 280*	*829 417*
Transport	*1 471 806*	*1 437 749*	*1 472 984*	*1 502 583*	*1 551 377*	*1 579 355*	*1 618 680*	*1 628 819*	*1 654 989*	*1 728 238*	*1 789 522*
Energy sector others	*591 551*	*608 455*	*620 115*	*640 724*	*636 700*	*640 175*	*669 778*	*658 992*	*613 938*	*637 942*	*674 525*
Fugitive emissions from fuels	*36 256*	*36 126*	*35 406*	*35 841*	*35 720*	*37 987*	*36 915*	*35 706*	*34 216*	*33 463*	*32 142*
Industrial processes	168 165	158 054	157 997	153 151	159 995	164 057	160 358	171 156	164 238	161 356	161 940
LUCF	–1 097 747	–1 085 604	–1 091 134	–1 113 753	–1 117 824	–1 110 016	–1 108 066	–887 531	–885 883	–896 392	–902 495
Total emissions (with net CO_2 from LUCF)	**3 900 768**	**3 857 563**	**3 954 784**	**4 043 545**	**4 143 132**	**4 195 879**	**4 375 604**	**4 680 450**	**4 689 199**	**4 769 080**	**4 937 544**
Total emissions (without net CO_2 from LUCF)	**4 998 515**	**4 943 166**	**5 045 918**	**5 157 298**	**5 260 956**	**5 305 895**	**5 483 670**	**5 567 981**	**5 575 083**	**5 665 472**	**5 840 039**
International bunkers	113 863	119 882	109 853	99 822	98 001	101 037	102 272	109 885	112 913	105 341	100 228

Figure 1. Carbon dioxide emissions by source: percentage change 1990–2000



Note: Energy sector others includes emissions from energy consumption in residential, commercial and institutional sectors.

27. The growth in emissions from transportation reflected steady, unabated growth in transportation activities, mainly vehicle miles travelled, and the impact of the decline in petroleum product prices. Also, it reflected some stagnation in the improvement in average fuel efficiency of the vehicle fleet that began in 1977 in response to the then new Corporate Average Fuel Economy (CAFE) standards: that was partly influenced by the increased share of new, less efficient light-duty trucks and sports utility vehicles (SUV). Emissions from the "Others" sector, including energy use in residential, commercial and institutional sectors, also grew, but at a slower rate of 14 per cent. The long-term growth of these emissions stemmed from population growth, regional migration trends and changes in building characteristics, while the short-term trend is also influenced by the weather.

28. Emissions from three sectors declined: fugitive emissions by 11 per cent, energy used in industry by 5 per cent and industrial processes by 4 per cent. The decline in emissions from energy use in industry reflected structural shifts in industry from manufacturing to services and a shift within manufacturing towards fast-growing industries such as computers, communications equipment and semiconductors and away from traditional manufacturing industries. It also reflected some fuel switching to natural gas, and efficiency improvement. The decline in emissions from industrial processes stemmed mainly from the decline in iron and steel production. This decline more than compensated for the increase in emissions from cement manufacture, limestone and dolomite use, and CO_2 consumption. Emissions from international bunker fuels declined by 12 per cent for the same period; the decline in emissions from marine bunkers more than offset the growth of emissions from aviation bunker fuels.

29. Activities in the LUCF sector resulted in a net sequestration of 903,000 Gg CO_2 in 2000, coming from forests, urban trees, agricultural soil and landfilled yard trimmings. The net sequestration declined by 18 per cent between 1990 and 2000, mainly due to a decline in the rate of sequestration by forests. According to the 2002 NIR, the major influences on the recent net carbon flux from forest land are management activities and the ongoing impacts of previous land-use changes.

2. Methane

30. In 2000, CH_4 emissions were 29,262 Gg (table 5, figure 2). Waste (mainly landfills), energy (predominantly fugitive emissions) and agriculture were the most important sectors, accounting for 38 per cent, 34 per cent and 26 per cent respectively of the total CH_4 emissions. Emissions from industrial processes were very small. Emissions of CH_4 declined by 6 per cent between 1990 and 2000. Two countervailing tendencies contributed to this trend: emissions from energy (fugitive emissions), enteric fermentation and waste declined by 16 per cent, 3 per cent and 2.3 per cent respectively, which more than offset the 28 per cent growth in emissions from manure management.

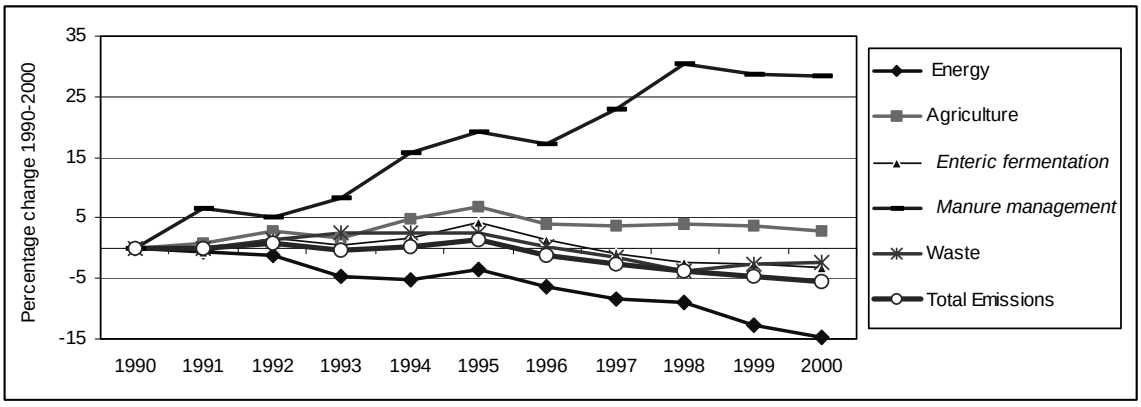
31. The decline of fugitive emissions resulted from a shift to less gassy coal for underground mining and increased utilization of coal-mine CH_4 for energy. Some improvements in management practices and

technology, and normal turnover of equipment, together more than offset the effect from the slightly increased use of natural gas during the 1990s. The slight decline in emissions from waste resulted from two opposing tendencies: an increase in the quantity of landfilled waste, and an increased number of landfills that are controlled by the Landfill Rule, which require the gas from landfills to be either flared or captured. In the agriculture sector the increase in emissions from manure management resulted from a shift by the swine and dairy industry towards larger facilities, with an increased use of liquid manure management systems. In contrast, the slight decrease in emissions from enteric fermentation was attributed to some decrease in the population of dairy cattle, while the beef cattle population increased slightly.

Table 5. Methane emissions by source, 1990–2000

Source and sink categories	Gg										
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Energy	11 789	11 718	11 663	11 256	11 185	11 379	11 052	10 807	10 715	10 298	10 050
Fuel combustion	*609*	*614*	*629*	*604*	*603*	*739*	*623*	*574*	*546*	*558*	*565*
Fugitive emissions	*11 179*	*11 104*	*11 034*	*10 652*	*10 582*	*10 640*	*10 430*	*10 233*	*10 169*	*9 740*	*9 485*
Industrial processes	57	58	61	67	71	73	76	78	79	80	79
Agriculture	7 851	7 905	8 072	7 987	8 236	8 392	8 166	8 136	8 172	8 149	8 076
Enteric fermentation	*6 089*	*6 058*	*6 198*	*6 118*	*6 196*	*6 342*	*6 171*	*6 037*	*5 948*	*5 929*	*5 898*
Manure management	*1 390*	*1 483*	*1 463*	*1 506*	*1 611*	*1 657*	*1 628*	*1 707*	*1 811*	*1 788*	*1 784*
Other	*372*	*364*	*411*	*363*	*429*	*394*	*367*	*392*	*413*	*431*	*395*
Waste	11 317	11 322	11 478	11 591	11 618	11 591	11 359	11 138	10 897	11 021	11 056
Total emissions	**31 014**	**31 002**	**31 274**	**30 901**	**31 111**	**31 434**	**30 654**	**30 159**	**29 863**	**29 548**	**29 262**

Figure 2. Methane emissions by source: percentage change 1990–2000



3. Nitrous oxide

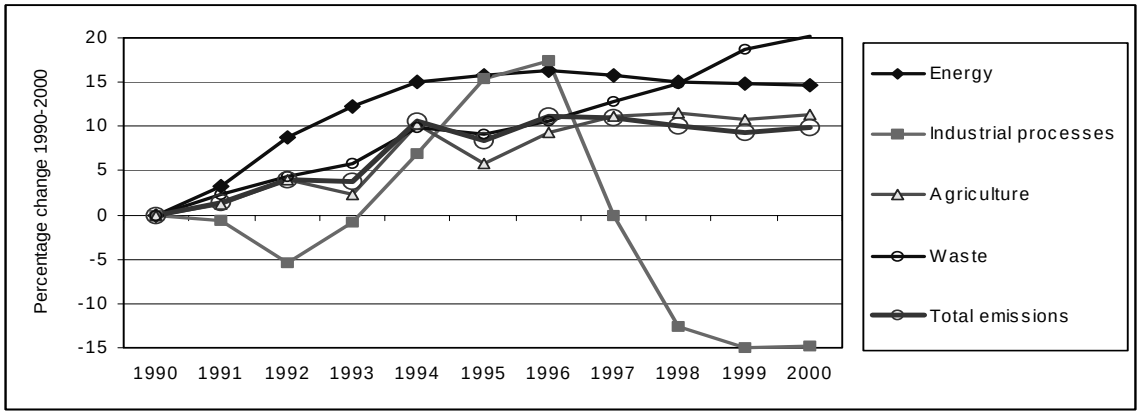
32. In 2000 the N_2O emissions totalled 1,372 Gg. Agriculture, mainly agricultural soils, was by far the most important source, contributing 74 per cent of the total N_2O emissions, followed by energy (17 per cent), industrial processes (7 per cent), with waste making up the remainder (table 6, figure 3).

33. The total N_2O emissions grew by 10 per cent from 1990 to 2000. The growth was underpinned by an 11 per cent growth in emissions from agricultural soil management. An increased use of fertilizers, manure production and crop production also contributed. Emissions from energy grew by 15 per cent over the same period, mainly as a result of the growth in emissions from transport and from stationary combustion. Emissions from industrial processes declined by 15 per cent, driven by the decrease in emissions from adipic acid production which was the result of installing control systems in 1996 and 1997 in the only one of three major facilities that did not already control its emissions. This more than compensated for the growth in emissions from nitric acid production.

Table 6. Nitrous oxide emissions by source, 1990–2000

Source and sink categories	Gg										
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Energy	206.56	213.40	224.57	231.98	237.59	239.22	240.16	239.21	237.68	237.12	236.92
Industrial processes	105.60	104.92	99.80	104.81	112.90	121.84	124.07	105.56	92.26	89.70	90.00
Agriculture	914.48	925.66	950.84	935.84	1 007.36	968.27	999.27	1 016.18	1 019.27	1 012.47	1 017.88
Waste	22.71	23.26	23.68	24.04	24.96	24.80	25.13	25.63	26.08	26.97	27.28
Total emissions	**1 249.35**	**1 267.23**	**1 298.89**	**1 296.67**	**1 382.80**	**1 354.13**	**1 388.64**	**1 386.57**	**1 375.29**	**1 366.26**	**1 372.08**

Figure 3. Nitrous oxide emissions by source: percentage change 1990–2000



4. Fluorinated gases

34. The total emissions of fluorinated gases stood at 121,300 Gg CO_2 equivalent in 2000. Emissions of HFCs accounted for most of this (72 per cent), followed by SF_6 (16 per cent) and PFCs (12 per cent). The total emissions increased by 30 per cent between 1990 and 2000, mainly as a result of the 144 per cent growth in HFCs used to replace the ozone-depleting substances controlled by the Montreal Protocol. In the same period emissions of SF_6 declined by 48 per cent and emissions of PFCs by 31 per cent. The large decrease in SF_6 emissions is believed to be a response to a marked increase in the price of this substance. The decline in PFC emissions came mainly from the reduction in domestic aluminium production and from the actions taken by aluminium smelting companies to reduce anode effects.

III. POLICIES AND MEASURES

35. The CAR3 was released in May 2002, shortly after the launch of the Climate Change Strategy in February 2002. This explains why it contains only an overview of the initiative, not its concrete details. The CAR3 focuses chiefly on the progress of the implementation of the measures reported in the CAR1 and CAR2, which were largely based on the 1993 CCAP, including projections of the future emissions levels that encompass effects of these measures.

36. The review team noted that the CAR3 complied with compulsory elements of the UNFCCC guidelines and provided a good and transparent overview of the key policies and measures, by sector and by gas, with their objectives, GHGs affected, policy instruments and status of implementation. Overall estimates of effects of policies were provided by sector for the year 2000. Sometimes the textual description went beyond minimum requirements and provided the estimated effect of individual policies and measures, for both 2000 and 2010. The review team noted that more could be done to enhance the transparency of reporting, including by providing information on non-compulsory elements of the UNFCCC guidelines. This could include information on estimated effects by sector for years other than 2000, e.g. 2005 and 2010, estimated effects of individual policies and measures or collections thereof, information on cost, non-GHG mitigation benefits and how a policy or measure might interact with other policies and measures. This could also include formatting the information in a more transparent way, as presented in table 1 of the UNFCCC guidelines. The team encouraged the United States to provide in future CARs information adhering to both compulsory and, when possible, non-compulsory elements of the UNFCCC guidelines. This would make it easier to follow the evolution of policies and measures, and their effects: (for example, as it was done in tables 1-2 of CAR2). This could also be linked to the reporting of projections; table 1 presented in the UNFCCC guidelines provides a useful tool for this.[3]

37. As noted in paragraph 15, the 2002 Climate Change Strategy laid down the foundation of the current climate policy of the United States. The key elements of this strategy encompass: (1) consistency

[3] The review team was informed that the Annual Energy Outlook (AEO) 2001 prepared by the EIA does not map the effects of the measures on a one-to-one basis. Still, some comparable assessment of the linkages between macro-scale effects considered in projections and micro-scale bottom-up analysis of individual policies and measures and collections could be provided.

with the objective of the UNFCCC for long-term stabilization of GHG concentrations, (2) sufficient flexibility to allow for adjustments in response to new scientific findings; (3) support for continued economic growth and prosperity; (4) reliance on market-based incentives, (5) inclusion of technological advances; and (6) promotion of global participation. On 12 February 2003, the President launched the Climate VISION (Climate, Voluntary Innovative Sector Initiative: Opportunities Now), a voluntary public–private partnership with industrial sectors, as one of the most important steps towards the implementation of the strategy.

38. Climate VISION and other initiatives launched under the Climate Change Strategy aim to achieve both a short-term goal and long-term stabilization objective. The short-term goal is linked to the national goal of improving emission intensity by 18 per cent between 2002 to 2012. This is 4 percentage points more than in the scenario with current efforts, implying that the additional policies and measures are to be designed to fill this gap. During the 1990s, emission intensity improved by 15 per cent for CO_2 and by 17 per cent for all GHGs**.** The Annual Energy Outlook (AEO) 2003 suggests that little fuel-switching from high-carbon to low-carbon fuel is to be expected during the next 20 years, implying that intensity improvement at least for CO_2 would come mainly from energy efficiency. At the time of the review team's visit, no sector-wide decomposition of the overall intensity goal was available.

39. Assessing whether this short-term goal is attainable is not straightforward. Environmental NGOs that the review team met during the visit maintained that the goal could be met with little additional effort. The review team found that, according to the analysis of the AEO 2003, around two thirds of the past overall intensity improvement has come from the structural shift in the economy and one third from improved energy efficiency. If the additional measures do not promote further structural shift, the efficiency improvement rate will have to almost double in order to achieve the goal. In addition, as the AEO 2003 suggests, even the high technology scenario cannot deliver the additional 4 per cent needed to reach the 18 per cent goal; new initiatives might be needed to boost efficiency improvements. Given these differences in assessment, the review team noted that the United States does not plan a formal interim review of progress towards meeting the 18 per cent intensity improvement goal before 2012. The review team noted that such a review could provide an implicit incentive for private companies to comply with their voluntary commitments, bearing in mind the potential regulatory framework to be set after the review in case the measures in place underperform.

40. To achieve the short-term goal, the Climate Change Strategy places a strong emphasis on voluntary approaches, although the possibility of using market-based approaches is also mentioned. So far, however, GHG emissions have not been considered to be covered by the cap-and-trade system established by the Clear Skies Initiative. This initiative, launched in February 2002, establishes new, stringent limits for air pollutants (nitrogen oxides, sulphur dioxide and mercury). The review team felt that the concern on setting the "overall cap" on GHG emissions and its impact on the economy might have prevailed over the benefits of market-driven approaches. On the other hand, the revised guidelines on the voluntary reporting system specified in section 1605(b) of the Energy Policy Act, referred to herewith as Voluntary Reporting Programme, were released in November 2003 after the review team visit, taking into account emerging domestic and international approaches. The issue of the transferable credit system associated with such a system remained open.

41. To achieve the government's long-term objective of stabilizing the GHG concentration, the Climate Change Strategy emphasizes technological development, reflecting the belief of the Administration in the role of technology in effectively addressing climate change. It also emphasizes the accumulation of scientific knowledge. However, if this objective were to be linked to the intensity approach, like the 18 per cent intensity reduction goal, absolute emission reductions would result only if the intensity goal is more rigorous; for example, if emission intensity improvement outpaces economic growth. Otherwise, as the AEO 2003 suggests, future absolute reductions in emissions are not expected in any of the scenarios despite that carbon intensity of economy declines significantly in all of them. Moreover, the AEO 2003 scenarios with higher GDP growth rate are characterized by higher absolute levels of emissions, although the rate of emission intensity improvement is also higher than in scenarios with lower GDP growth.

42. The review team noted that the Administration was still shaping its long-term vision on technological development, focusing on a hydrogen economy (with electricity as the secondary energy carrier) with low GHG emissions. The team also noted that this vision places a stronger emphasis on development of new supply-side technologies than previously, though efforts on energy efficiency and demand side technologies continue.

43. In line with the vision on technological development, the Administration launched a number of initiatives in climate change research and development: in particular, the 2003 FreedomCar and Hydrogen Fuel Initiative. This comprises several research programmes focusing on fuel cell technologies and systems and on hydrogen storage and hydrogen production from fossil fuels, renewables and nuclear power. Total resource appropriations of about USD 1.7 billion in five years have been requested for this initiative, but only USD 0.72 billion of this represents new funding. The allocation for 2003 was around USD 0.3 billion, and an increase of 25 per cent was requested for 2004.

44. The Carbon Sequestration Initiative centred on carbon capture and sequestration in all forms of carbon storage, including storage in terrestrial ecosystems, geological formations and oceans. Carbon capture and storage technology is considered essential for any plan to produce hydrogen from fossil fuels, while avoiding GHG emissions. The two technologies combined have the potential to address both long-term energy security concerns and emission mitigation issues. The appropriations requested for this research programme are much smaller than for the Hydrogen Fuel Initiative, but definitely increasing. In addition, the FutureGen Initiative, for coal-fired, zero-emissions electricity generation, was announced in 2003 as a USD 1 billion, 10-year demonstration project. Nuclear technology is also within the scope of the Climate Change Strategy through the Generation IV Nuclear Systems and International Thermonuclear Experimental Reactor initiatives.

45. The initiatives on hydrogen fuel, carbon sequestration and nuclear energy have a substantial international cooperation component. In this context, the Carbon Sequestration Leadership Forum, launched in June 2003, after the review team visit, is designed to improve carbon capture and storage technologies through coordinated research and development with international partners and private industry, and to make these technologies broadly available internationally. Also, in November 2003, the International Partnership for the Hydrogen Economy, with 16 international partners, was inaugurated. This reflects the prominence given to international cooperation as a key aspect of the technological approach to address climate change. The team noted that the determination to pursue long-term research objectives has been welcomed by both industry and environmental NGOs.

46. The requested annual resource appropriation for fiscal year 2003 of the Climate Change Strategy was around USD 4.5 billion (a 17 per cent increase over the previous budget) targeting mainly scientific research (USD 1.7 billion), and technological research (USD 1.6 billion). Most of this resource pool consists of existing research programmes, but some constitutes new research. A large share of the technological research is managed by the DOE and centres on energy supply (mostly renewables), energy efficiency and conservation technologies, clean coal and natural gas technologies, CO_2 capture and sequestration, hydrogen, nuclear fission and fusion, and basic research.

47. The CAR3 outlined several prominent initiatives taken at the state level (for example, in California, New York, New Jersey, Maine, Wisconsin, Oregon, Massachusetts, New Hampshire and Texas), at local government level and by NGOs. Initiatives at state level include setting of GHG reduction goals, state GHG inventories (37 states), public benefit charges to support energy efficiency and renewable energy as a component of the electricity restructuring policy (19 states), cap-and-trade systems, GHG registry systems, renewable portfolio standards (RPS) (14 states), automobile GHG emission standards in California and demand-side management. Some noteworthy examples are: in California, introducing the 2002 carbon standard for light duty vehicles and the RPS with an ambitious goal to increase the share of renewables by 1 per cent annually; in Massachusetts, preparing a cap-and-trade system for power plants; in Georgia, launching an initiative to address transport emissions through public awareness and behaviour changes. Also, New Jersey and Oregon were the first states to set GHG reduction goals, and emissions reporting is mandatory in Wisconsin.

48. During discussions with the review team, the state representatives acknowledged the role the EPA has played in supporting various activities at state level, including in developing state-level emissions inventories and GHG action plans. However, they also acknowledged the need for a more proactive approach and better coordination at federal level, for example on the RPS and on emission registries and inventories. They noted, in particular, that the 18 per cent intensity target does not go much beyond the business-as-usual approach and several states have adopted much more stringent emission reduction targets. While acknowledging the importance of the Federal Administration's strong support for technology research, they noted that other measures, such as efficiency standards, could also receive attention, as they could bring sizeable emission reduction gains in the short term. The initiatives taken by the states indicate some mounting pressure in the United States to do more to reduce emissions.

49. Before the launch of the new climate change policy, the Administration prepared a new National Energy Policy (NEP). The National Energy Development Group, led by the Vice-President Cheney, published the draft NEP report in May 2001. The report identified the major energy challenges and ways to address them. It emphasized the importance of energy security for the United States and the need to strengthen the domestic energy supply infrastructure, while also considering demand-side approaches for efficient use of energy. Many of the NEP recommendations have been implemented administratively. Those that require legislative action in the form of an Energy Bill have remained under consideration in Congress from 2002 to 2004. Some of the NEP measures and approaches are likely to contribute to GHG mitigation, including promotion of nuclear energy, renewables, landfill gas recovery, energy efficiency and transport congestion mitigation; others, aimed at promotion of fossil-fuel-based energy, are likely to increase emissions. The overall effect will depend on the way the NEP is reflected in the Energy Bill. The review team noted that the net effects of the NEP on GHG emissions was not specified in the CAR3 and remained unclear in 2003.

50. In terms of sectoral measures, the CAR3 reported that in 2000 the largest emission reduction gains were achieved in industrial processes (mainly fluorinated gases) and LUCF (carbon sequestration). Measures in the residential and commercial sectors made the largest contribution to the mitigation of energy-related CO_2 (table 7). Measures targeting CO_2 emissions in energy supply, industry and transportation sectors had little effect, in spite of the large contribution of these sectors to total GHG emissions. Measures targeting CH_4 had a relatively large effect in relation to the share of CH_4 in total GHG emissions.

Table 7. Overview of the sectoral measures and their effects in the National Climate Strategy

Sector and policy	Targeted GHG	Estimates of emission reductions achieved (Tg CO_2 equivalent per year in 2000)	Expected emission reductions (Tg CO_2 equivalent per year in 2010)
Energy supply sector	CO_2	15	≥30
	CH_4 (partially industry)	22	33
Industry sector	CO_2	28	≥16
	HFCs, PFCs, SF_6 (partially energy supply)	77	230
Residential/commercial sector	CO_2	63	>157
Transportation sector	CO_2	8	>111
Agriculture/forestry sector	CO_2	>132	NA
	CH_4, N_2O	NE	NA
Waste	CH_4	39	>75
Total		**384**	≥652

Note: The figures are mainly those from CAR3 supported by *US Climate Change Strategy – A New approach* (14 February 2002).
NA in this and in the following tables stands for not applicable.

A. Cross-cutting measures

51. The Voluntary Reporting Program under Section 1605(b) of the Energy Policy Act of 1992 started in 1994. It covers project-based and entity-level emission reductions**.** The latest report (2003) covered 228 entities and 1705 emission reduction and carbon sequestration projects in 2001. About half of the entities are in energy supply and the another half from the rest of the industry sector. Of the projects reported, 90 are conducted in other countries, designed under the pilot phase of the Activities Implemented Jointly. In total, the annual reduction of emissions due to these projects is 301 Tg CO_2 equivalent

estimated with respect to the reference case (actual historic data), or 251 Mt CO_2 equivalent with respect to the modified reference case (project-specific baseline). Also, 85 entities reported formal commitments to reduce future emissions, to take action to reduce emissions in the future, or to provide financial support for activities related to GHG reductions.

52. The Voluntary Reporting Program will provide one means of measuring progress to achieving the administration's objectives, and may be used in the policy review in 2012. Bearing in mind the need for a more credible and transparent reporting system, the DOE, in cooperation with the USDA, the Department of Commerce (DOC) and the EPA, took the initiative to improve and expand the present voluntary reporting programme. Also, this initiative envisions the need to ensure that the participants in the programme are not penalized under a future climate policy, although the specific actions required to ensure this are not clear.

53. To achieve the Climate Change Strategy short-term goal, two umbrella voluntary partnerships have been established between companies and the Federal Government: the Climate Leaders, based on agreements with individual companies, and the Climate VISION,[4] based on a new type of agreement with industry groups. Under Climate VISION, which covers economic sectors accounting for between 40 and 45 per cent of emissions, all but one of the sectoral organizations have quantitative targets, while others have more general goals. This programme aims at accelerating the transition to cost-effective technologies and practices that improve efficiency and reduce emissions. Under Climate Leaders, the company–government partnerships aim to encourage companies to set a clear GHG reduction targets to be achieved in 5–10 years, and to develop long-term climate strategies. As of January, 2004, 20 of the 54 companies that joined the Climate Leaders, have announced corporate-wide GHG reduction targets. Also under this umbrella, the EPA has several voluntary climate change programmes already initiated in the 1990s, such as Energy Star, Green Power Partnership, CHP (combined heat and power) Partnership, Waste Wise, Landfill Methane Outreach, Natural Gas Star, Coalbed Methane Outreach, Commuter Choice Leadership Initiative, and High GWP Environmental Stewardship programmes.

54. One of the most prominent, EPA's Energy Star programme, was initiated in 1992 as a voluntary labelling programme. It is a comprehensive family of government-backed voluntary programmes helping businesses and individuals to enhance their use of more energy-efficient equipment and practices. Since mid-1990s EPA has collaborated with DOE, which now has responsibility for certain product categories. Nowadays, Energy Star recognizes energy-efficient models in 38 product categories from lighting to computers to water coolers. For the business sectors, several partnership programmes are ongoing, in addition to offering a proven energy management strategy through making a commitment to improve energy efficiency as the first step. The EPA also provides an energy performance rating system which businesses have already used for more than 10,000 buildings across the country, and recognizes top-performing buildings with the Energy Star. The review team noted that this programme has been very successful both in terms of cost-effectiveness, with noticeable savings on energy bills, and high performance in diffusing efficient technologies. The underlying reasons for this success were good design and operation, with careful outreach, follow-up and evaluation. Maximizing co-benefits is another contributory reason for its success.

55. Energy Star and other programmes led by the EPA, such as CH_4 programmes and High GWP Environmental Stewardship programmes**,** are expected to save 1,900 Mt CO_2 equivalent emissions cumulatively between 2001 and 2012 due to actions already taken by partners in these programmes (table 8).

56. The Climate Change Strategy is also backed by a set of proposals on tax incentives and credits for clean energies such as CHP (10 per cent new tax credit for investment between 2002 and 2006), residential solar energy system (new 15 per cent tax credit), wind and biomass electricity (1.7 cent/kWh

[4] Climate VISION includes commitments by industry groups such as the Alliance of Automobile Manufacturers, Aluminum Association, American Chemistry Council, American Forest and Paper Association, American Iron and Steel Institute, American Petroleum Institute, American Public Power Association, Association of American Railroads, Business Round Table, Edison Electric Institute, Electric Power Supply Association, Magnesium Coalition and International Magnesium Association, National Mining Association, National Rural Electric Cooperative Association, Nuclear Energy Institute, Portland Cement Association, and Semiconductor Industry Association.

for wind and closed-loop biomass, 1.0 cent/kWh for existing facility and 0.5 cent/kWh for coal co-firing biomass), new CH_4 landfill projects (1.0 cent/kWh for regulated and 1.5 cent/kWh for unregulated projects), new hybrid or fuel cell vehicles (up to USD 4,000 for hybrid vehicles and up to USD 8,000 for fuel cell vehicles), funding for geothermal and renewable energy on public lands. In total, USD 4.4 billion tax incentives are available for fiscal years 2004–2008 inclusive.

Table 8. Expected benefits and GHG reductions from EPA-led voluntary programmes

		Cumulative values (2001–2012)	
		Net savings (2001 NPV)	**GHG reductions (Mt CO_2 equivalent)**
Energy Star	Labelled products	USD 39.1 billion	381
	Building/industrial	USD 26.1 billion	502
Methane programmes		USD 3.0 billion	590
High GWP Environmental Stewardship programmes		–	429
Total		**USD 68.2 billion**	**1 902**

57. In the context of its overall climate policy, the United States does not have cross-sectoral economic instruments such as a carbon and/or energy tax to encourage energy and emission saving and/or fuel switching, nor does it have a domestic emissions trading system.

B. Energy supply

58. The energy supply sector is the source of around 40 per cent of CO_2 emissions in the United States and remains the fastest-growing sector, although the carbon intensity (CO_2/kWh) was almost stable during the 1990s. More than half of the electricity was coal-based. This defines the focus of the energy supply sector measures on fuel switching from coal to natural gas, renewables and utilization of nuclear power. The Climate Challenge programme formed the foundation for these measures, whereby the participating utilities are encouraged to undertake a range of activities, linked to the Voluntary Reporting Program.

59. Bringing renewables into commercial use is promoted by technology research and development, including through programmes such as Distributed Energy Resources, High-Temperature Superconductivity, the Hydrogen Fuel Initiative, Superconductivity, the Clean Energy Initiative (Green Power Partnership and CHP Partnership), nuclear energy programmes, the hydropower programme, and the carbon sequestration programme (table 9). Economic incentives and tax credits are set for CHP, residential solar, wind and biomass, landfill CH_4, hybrid and fuel cell vehicles, geothermal energy, and renewables on public lands. Several states have already adopted the RPS, as noted in paragraph 46.

60. The mitigation impact for CO_2 in energy supply is estimated at 14.7 Mt for 2000 (table 9). No breakdown by measure is given in CAR3. Considering the size of this sector, this impact is rather small (at least in the short term). Still, the new Clean Energy Initiative alone is estimated to contribute 30 Mt CO_2 for 2010 (for example, the CHP Partnership will attempt to double CHP capacity by 2010). The 2003 Administration's budget proposal sought USD 4.6 billion over the next five years (USD 7.1 billion over the next ten years) for the new tax credit for investment referred to in paragraphs 55 and 56.

Table 9. Key policies and measures in the energy supply sector

Policy or measure	**Policy instruments used**	**Estimates of emission reductions achieved (Tg CO_2 equivalent in 2000)**	**Expected emission reductions (Tg CO_2 equivalent in 2010)**
Climate VISION, Climate Leaders	Umbrella partnership	NA	NA
Climate Challenge	Voluntary agreements	NA	NA
Clean Energy Initiative (Green Power Partnership (renewables) and CHP Partnership	Voluntary Partnership	NA	30
CH_4 emissions: Natural Gas Star	Voluntary partnership	15	22
CH_4 emissions: Coalbed Methane Outreach	R&D; information	7	11
Promotion of nuclear	R&D; information	NA	NA
Promotion of hydropower	R&D; information	NA	NA
Promotion of hydrogen energy	R&D; information	NA	NA
Promotion of carbon sequestration	R&D; information	NA	NA
Total (SF_6 reductions included in industry sector programmes)		**CO_2: 14.7 CH_4: 22**	**CO_2: ≥ 60 CH_4: ≥ 33**

C. Energy use in industry and industrial processes

61. Several voluntary initiatives and programmes apply to industry sectors, including the energy supply sector, in addition to the Climate VISION and Climate Leaders programmes discussed above. The Climate Wise programme (reported in CAR1 and CAR2) covering non-utility industries has become one of the Energy Star family for industry reported in the CAR3. It targets energy-related CO_2, while several other partnership programmes target other GHGs (table 10). These voluntary partnership programmes with industry remain the main thrust of the United States' climate change approach in the short term, and have recently expanded as Climate VISION develops.

Table 10. Partnership programmes for the industry sector, including energy supply

Targeted GHG	Energy supply	Other companies
	Climate Resolve (by Business Round Table)	
CO_2	Climate challenge	Energy Star for Industry (formerly Climate Wise)
	Clean Energy Initiative (Green Power, CHP)	Cement, iron/steel, automobile
CO_2 and CH_4	Petroleum	Chemical
CH_4	Natural Gas Star	
High GWPs	Environmental Stewardship (utilities, semiconductor, magnesium)	
		HFC-23 Partnership
		Partnership with Aluminum Producers
$C0_2$ and CH_4	Energy Policy Act 1605 (b) Voluntary GHG Reporting System	
Climate Vision (sector-wise) and Climate Leaders (corporate-wise)		

1. Energy use

62. The industry sector is the slowest-growing sector for energy-related CO_2 emissions. Energy Star for Industry (formerly Climate Wise), the Natural Gas Star programme for the natural gas industry (providing advice about best management practices) and the Coalbed Methane Outreach programme are the major voluntary initiatives targeting CO_2 and CH_4 and are estimated to deliver the bulk of energy-related emissions from this sector (table 11). The new Clean Energy Initiative also refers to industry.

63. Other information and research measures include: Industries for the Future (industry-driven vision and technology road map), Best Practice Program (information on best practices), Industrial Assessment Centers (information and education centres), Enabling Technologies (information and research), and NICE (financial assistance for technology research), mainly for CO_2. The cumulative effect of programmes noted in the current and previous paragraphs is estimated at 27.9 Mt CO_2 equivalent for year 2000. The United States has no mandatory energy management system or law for rational use of energy in industry.

2. Industrial processes

64. Emissions of fluorinated gases (HFCs, PFCs and SF_6) from industrial processes have grown rapidly, mainly as a result of increased use of HFCs to replace substances controlled by the Montreal Protocol. Sizeable reductions of fluorinated gases come from voluntary programmes, such as the HFC Partnership with HCFC-22 manufacturers, Partnership with Aluminum Producers for PFCs, and the Environmental Stewardship Initiative for applications of fluorinated gases in semiconductors, electric power systems, and magnesium production. Also, the Significant New Alternatives Program (SNAP), a regulatory programme under Section 612 of the Clean Air Act, reduces emissions of PFCs and HFCs by limiting use of these gases in specific applications where safe alternatives are available. In total, these programmes reduced emissions by 77 Mt CO_2 equivalent in 2000 (table 11).

65. In the absence of measures, the emissions of fluorinated gases in 2010 are expected to be over five times as large as the 1990 emissions of 94 Mt CO_2 equivalent. The voluntary programmes and the SNAP are estimated to reduce the emissions by 292 Mt CO_2 equivalent per year in 2010, which is considerable. In absolute terms, measures targeting fluorinated gases are expected to contribute significantly to the overall emission reduction notwithstanding that the share of these gases in total emissions is small.

Table 11. Key policies and measures in the industry sector

Policy or measure	Policy instruments used	Estimates of emission reductions achieved (Tg CO_2 equivalent in 2000)	Expected emission reductions (Tg CO_2 equivalent in 2010)
Climate VISION, Climate Leaders	Umbrella partnership	NA	NA
ENERGY STAR for Industry (Climate Wise)	Voluntary partnership	11	16
R&D [Industries of the Future, Best Practice Program, Industrial Assessment Centers, Enabling Technologies, NICE]	R&D; information	NA	NA
	Financial assistance (NICE)	NA	NA
Fluorinated gases (HCFC-22, Aluminum, Electric Utilities, Semi-conductor, Magnesium) Fluorinated gases (SNAP)	Voluntary partnership	27	130
	Regulatory information	50	**162**
Total (CH_4 accounted for in energy supply)		**CO_2: 27.9 HFCs/PFCs/SF_6: 77**	**CO_2: ≥ 16 HFCs/PFCs/SF_6: ≥ 292**

D. Residential and commercial sectors

66. Energy-related CO_2 emissions in the residential and commercial sectors are increasing rapidly. While certain appliance standards are applied in these sectors, a voluntary partnership approach is the instrument of choice. These partnerships focus mainly on offering technical assistance and the labelling of energy efficient products, new homes and office buildings. The core measure is the Energy Star family, including for labelled products, for the residential market and for the commercial market.

67. To date, more than one billion Energy Star-labelled products have been purchased in the United States. This labelling and rating system was extended to energy-efficient new homes in 1995 (>200,000 new homes built) and buildings in 1999 (>19,000 buildings used rating system) with noticeable mitigation impact (table 12). Such labelling practice is now recognized as a world standard. Energy Star for the Residential Market extended its coverage from new homes (CAR2) to existing homes (CAR3). It works through energy efficiency partnerships with national training and certification organizations. The Energy Star for the Commercial Market started with the introduction of Green Lights in 1991 and has focused on promoting highly energy efficient buildings. A benchmarking system for building energy performance was introduced in 1999 and has been expanded to cover a wide range of building types with a rating system covering more than 50 per cent of commercial buildings floorspace in the United States. The Energy Star family is being extended to include more products and an energy performance rating system for wider coverage of building types.

Table 12. Key policies and measures in the residential and commercial sectors

Policy or measure	Policy instruments used	Estimates of emission reductions achieved (Tg CO_2 equivalent/yr in 2000)	Expected emission reductions (Tg CO_2 equivalent/yr in 2010)
ENERGY STAR®-labelled products	Labelling/rating (voluntary)	33	75
ENERGY STAR® for the Residential Market (residential building system)	Voluntary partnering, training/certification	NA	20
ENERGY STAR® for the Commercial Market (commercial building system)	Voluntary partnering, benchmarking	23	62
Other residential and commercial sector programmes	Appliance standards, building codes, outreach programmes, R&D, funding/tax credits (solar home system)	NA	NA
	Federal/state/local information programmes	6.2	NA
Total		**63.0**	≥157

68. Other measures that supplement the Energy Star programme include: Rebuild America (a community energy programme), Building America (energy partnerships for affordable housing), state buildings codes (regulatory), partnerships for commercial buildings (research), some research and development programmes for building components (windows, lighting, etc.), residential appliance standards (regulatory), some state and community assistance programmes (funding and information), the Heat Island Reduction Initiative, and economic incentives/tax credits (mostly by the DOE). Information-related measures such as the Federal Energy Management Program for federal buildings and the State and Local Climate Change Outreach Program contributed 6.2 Mt CO_2 reduction in 2000.

69. The approach to energy saving in the United States, for the residential and commercial sectors in particular, is to promote energy saving through rational judgement by providing proper information through instruments such as labelling, rating systems and benchmarking. The government thus utilizes market forces to identify and achieve hidden low-cost options by providing appropriate information. The evaluation and follow-up of the ongoing measures are critical to ensure meaningful results.

E. Transport

70. Transport is the second fastest growing sector for GHG emissions. Measures in this sector focus mainly on research, development and information programmes (table 13). FreedomCAR is a new public-private research partnership with automobile manufacturers, targeting long-term and high-risk research, to promote the development of hydrogen for cars and trucks, with the goal of building a commercially viable system with supply infrastructure. This interacts with the Hydrogen Fuel Initiative. Other programmes, such as Vehicle Systems Research and Development, focus on shorter-term energy efficiency and alternative fuels for heavy vehicles. The Clean Cities programme promotes private–public partnerships to deploy alternative fuel vehicles and the supporting infrastructure, including community networks. The Biofuels Program promotes the development of bioethanol and biodiesel fuel technologies. The Clean Automotive Technology Program is a similar type of voluntary research programme.

Table 13. Key policies and measures in the transport sector

Policy or measure	Policy instruments used	Estimates of emission reductions achieved (Tg CO_2 equivalent in 2000)	Expected emission reductions (Tg CO_2 equivalent in 2010)
FreedomCAR and other R&D programmes	R&D programs	NA	NA
CAFE standards for light trucks	Fuel economy standards	–	20
Commuter Options Program	Voluntary agreements, tax incentives, outreach	3.5	14
Air quality measure (Smart Growth and Brownfields policies)	Technical assistance, outreach	2.7	11
Ground freight measures (Smart Way Transport)	Voluntary agreements	–	66
Tyre pressure monitoring systems	Mandatory standard	–	NA
Total[a]		**8.4**	**≥111**

71. In 2004 the Administration finalized a tightening of the CAFE standards for light trucks (for model years 2005–2007), to increase them from 20.7 to 22.2 miles per gallon (9.44 km per litre) by 2007. This new standard is projected to result in 31 Mt CO_2 saved over the lifetime of the trucks. The review team noted that for passenger cars, the standards have hardly altered for two decades (27.5 miles per gallon), as modifying such standards would require an act of Congress. For fuel cell and hybrid vehicles, USD 3 billion in tax credits over 11 years was allocated in the 2003 budget proposal.

72. Other measures to reduce current emissions comprise the existing voluntary programmes, such as the Commuter Options programmes (reducing emissions from single-passenger cars by providing incentives); the Commuter Choice Leadership Initiative (assisting participating Commuter Options employers by offering technical assistance, training, etc. for information exchange), Smart Growth and Brownfields policies (reducing motorized trips as an air-quality issue), Smart Way Transport (voluntary partnership programme for advanced management and technologies for trucks and rail), and programmes supported by the DOT such as the start-up of transit systems, Congestion Mitigation and Air Quality Improvement (for air pollution reductions), Transportation Enhancements (for bicycles, etc.), and the Transportation and Community System Preservation Pilot Program (for liveable communities). Also, a tyre pressure monitoring system was to be launched in November 2003 by the DOT as a part of a new federal Motor Vehicle Safety Standard for all new cars and light trucks, aiming at increased efficiency.

73. As a part of Climate VISION, the Association of American Railroads has committed to reducing the transportation-related GHG intensity of their Class 1 railroads by 18 per cent in the next decade. In 2001 alone, this improvement saved 30 Mt CO_2. In the future, railways will aggressively pursue innovative ways to reduce fuel consumption and GHG emissions. However, as of 2004, Climate VISION does not include a partnership to directly reduce CO_2 emissions from cars.

74. The review team noted that taking all measures into account, the most substantial emission reductions are expected from freight transport, 66 Tg CO_2 in 2010, while the technological development of fuel cell vehicles is expected to contribute to emission mitigation in the longer term. It also noted that mitigation effort in the transport sector seems disproportionately small given its share of total emissions. It further noted that a robust contribution from cost-effective measures to mitigate transport emissions has yet to be made.

F. Agriculture

75. Emissions of CH_4 and N_2O from agriculture increased slowly during the 1990s. The Farm Security and Rural Development Act of 2002 (2002 Farm Bill), is the latest comprehensive policy package of agriculture with impacts on emissions. Programmes introduced by this bill (with an annual budget of USD 3.9 billion) include the Conservation Reserve Program (CRP), the Environmental Quality Incentives Program (EQIP) for cropping and grazing systems, the Wetland Reserve Program (WRP), and changing management practices and conservation compliance plans for protecting environmentally sensitive areas from agricultural production. These conservation programmes deliver larger emission reductions than programmes in any other sector. Carbon sequestration from soil will be targeted by the development of accounting rules and guidelines for crediting under the Voluntary Reporting Program.

76. Without accounting for land-use change and forestry (LUCFMeasures specifically targeting emission mitigation include AgSTAR and the Ruminant Livestock Efficiency Programme (RLEP) for CH_4 emissions, and nutrient management tools aiming to improve fertilizer efficiency to reduce N_2O emissions. Other measures aimed to promote bioenergy include bio-based projects and bioenergy research programmes, the USDA Commodity Credit Corporation's Bioenergy Program (economic incentives) and the CRP Biomass Project (economic incentives) (table 14). A separate section of the 2002 Farm Bill also targets bioenergy. In addition, terrestrial sequestration research, conducted by the DOE's Offices of Science and Fossil Energy and the U.S. Forest Service of the USDA, focuses on integrating measures for improving the full life-cycle carbon uptake of terrestrial ecosystems, including farmland and forests, with fossil fuel production and use. The CAR3 does not report effects of CH_4 and N_2O reductions, which are expected to be comparable in scale to the carbon sequestration achieved by conserving land. The review team noted that there is also some potential for reducing energy-related CO_2 from large-scale agricultural activities.

Table 14. Key policies and measures in the agriculture sector

Policy or measure		Policy instruments used	Estimates of emission reductions achieved in 2000 (Tg CO_2 equivalent/yr)	Expected emission reductions in 2010 (Tg CO_2 equivalent/yr)
Reduction of CH_4 (AgSTAR, RLEP)		Outreach	NA	NA
Reduction of N_2O (nutrient management)		Technical assistance	NA	NA
Generation of bioenergy		Economic incentives	NA	NA
Conservation programmes (land protection)	CRP	Land protection	56	70
	EQIP	Economic incentives	NA	44
	WRP	Land protection	7	15
Total			**63**	**≥129**

G. Forestry and land use

77. The USDA provides technical and financial assistance to non-industrial, private forest owners (who provide 60 per cent of the nation's timber supply) to sequester carbon in trees and forest soils through the Forest Stewardship Program. The effect of the programme is estimated at 3 Tg CO_2 equivalent in 2000. A Forest Land Enhancement Program was implemented as a part of the 2002 Farm Bill. A National Fire Plan has been prepared in order to reduce risks from wildland fires.

78. As part of Climate VISION, the American Forest and Paper Association is committed to reduce its industry's GHG intensity by 12 per cent by 2012 relative to 2000. Specific actions include the enrolment of 114 million acres (41.6 million ha) in the Sustainable Forestry Initiative Program. It is also committed to recycling, with fibre recovery rates of at least 50 per cent, helping to avoid CH_4 emissions in landfills and enhancing carbon storage.

H. Waste management

79. Emissions of CH_4 from waste management fell substantially in the 1990s. The Climate and Waste Program was introduced to encourage recycling with a number of targeted efforts, including WasteWise, a voluntary agreement programme with manufacturers, the *Pay-As-You-Throw* Initiative and a community-based information programme for the residential sector (table 15).

80. The Climate and Waste Programme has a link with the Voluntary Reporting Program. The Stringent Landfill Rule and the Landfill Methane Outreach Program target landfill CH_4 emissions, the largest contributor of CH_4 emissions in the United States and deliver substantial emission reductions.

Table 15. Key policies and measures in the waste sector

Policy or measure	Policy instruments used	Estimates of emission reductions achieved (Tg CO_2 equivalent in 2000)	Expected emission reductions (Tg CO_2 equivalent in 2010)
WasteWise	Voluntary agreement with manufacturers	8	20
Pay-As-You-Throw Initiative	Community-based information		
Stringent Landfill Rule	regulatory	15	33
Landfill Methane Outreach Program	Voluntary agreements	11	22
Total		**39.2**	**77**

IV. PROJECTIONS AND THE TOTAL EFFECT OF POLICIES AND MEASURES

A. Preparation of projections

81. Projections of the future levels of GHG emissions reported in the CAR3 were prepared by the DOE, and its EIA branch, the EPA and the USDA. The DOE and EIA prepared projections of energy-related CO_2 emissions, included in the AEO 2002. The USDA prepared projections on emissions and removals from LUCF and projections on the main economic drivers in agriculture. The EPA was responsible for projections of GHG emissions other than CO_2, including CH_4, N_2O and fluorinated gases covering all sectors except LUCF.

82. The CAR3 contains a set of projections for one scenario, which is reported on a gas-by-gas basis for each of the main GHG gases (CO_2, CH_4, N_2O) and for each group of fluorinated gases (HFCs, PFCs and SF_6). For each gas, projections are reported by sector in tabular format. The CAR3 also contains projections of net carbon sequestration and of emissions from international bunker fuels,[5] which were not included in the national totals, as required by the UNFCCC guidelines. Projections are also provided in an aggregated format for each gas, as well as for a national total using global warming potential (GWP), but not for each sector. Projections of the indirect GHGs were not reported.

83. Projections cover the period 2000–2020, and 1999 was the base year for projections. Actual emission data from the emissions inventory for the period 1990–2000 or the latest year available when projections were prepared (1999) were not reported together with projections data, as suggested by the UNFCCC guidelines. Notwithstanding some difficulties in the direct comparison of projections and inventory data, the review team noted that these data are broadly consistent.

84. Projected emission levels were reported for one scenario only. It encompasses, in its energy-related part, a portion of the effect from the policies and measures reported in the CAR3, but does not include the effects from the climate change initiatives announced by the President in 2002. In projections of the non-energy related emissions, the full effects from policies and measures was considered. The review team considers that the scenario reported could be classified as a "with measures" scenario. The UNFCCC guidelines suggest that Parties may report on "with additional measures" and "without measures" scenarios in addition to the "with measures" scenario. Such scenarios were not reported. Also, the effect of policies and measures by sector and the total effect was estimated for

[5] The CAR3 reports on the so-called "adjustments" of emission projections, which contain emissions from international bunkers and the United States territories.

2000 only, not for 2005, 2015 or 2020. The CAR3 contains an array of information on results from sensitivity analysis of projected future emission trends for some key drivers discussed in paragraph 99.

85. The review team noted the improvement in the reporting of information on projections in the CAR3 compared to the CAR2. It also noted that the United States adhered to the reporting guidelines for the compulsory elements. To enhance further transparency, it encouraged the United States to adhere more closely to these guidelines for the non-compulsory elements also. This is particularly relevant to the estimates of the total effects of policies and measures and scenarios other than "with measures".

B. Scenarios, models and assumptions underlying future emission trends

86. As noted in paragraph 83, the energy-related part of the scenario reported in the CAR3 encompasses some of the effects from policies and measures reported in the CAR3. Since these measures comprise mainly voluntary agreements, some downwards adjustments to the reported effects of these measures were considered in the scenarios. These adjustments imply some differences in the diffusion rates and effects of individual measures and programmes compared to the effects reported in the policies and measures section of the CAR3. They also make it possible to account for possible interactions and feedback effects. In addition, they make it possible to take into account the insufficient funding of some of the measures from the 1993 CCAP and its follow-ups, and for some technological aims not being achieved; for example, the aims of the Partnership for New Generation of Vehicles programme.

87. The scenario also includes the effects of all laws and regulations that were in place as of July 2001. Major energy- and environment-related legislation covered includes: the National Appliance Energy Conservation Act of 1987, the Clean Air Act Amendment of 1990, the Energy Policy Act of 1992, the Federal Highway Bill of 1998, new standards for energy consuming equipment announced in 2001, and several other measures on fuel standards. The effects from several state programmes, such as California's Low Emission Vehicle Program, and mandates are also included. The net effects of the 2001 NEP on GHG emissions were not included as they remained unclear in 2003. The review team noted that depending on the ways in which the NEP is implemented, it could have different impacts on future energy and emission trends.

88. Projections of CO_2 emissions for the energy sector, including the impacts of climate change policies within this sector, were prepared by the EIA using the National Energy Modelling System (NEMS). NEMS is an integrated model of the economic and energy systems that was designed to project future levels of the energy demand and supply in the United States, and related pollutants and GHG emissions.

89. NEMS is a hybrid model integrating bottom-up and top-down approaches. It describes the energy system with a good level of regional and sectoral disaggregation. It comprises several modules representing each of the fuel supply markets (oil and gas, natural gas transmission and distribution, coal, and renewable fuels), conversion sectors (electricity and petroleum refineries), and end-use consumption sectors (residential, commercial, transportation and industry sectors). There are also interactive macroeconomic and international modules (world energy and domestic energy interactions). The model also includes a module that simulates a general market equilibrium among all the modules (the integrating module). NEMS balances the energy supply and demand for each fuel and consuming sector, taking into account the economic competition between energy sources. Primary input data (exogenous variables) for the model include the GDP growth rate, population growth rate and world oil prices.

90. Market liberalization trends in the energy sector are broadly reflected in the NEMS model. In particular, the cost of service pricing in regulated markets is replaced by marginal cost pricing in liberalized markets. Still, the model cannot represent some of the characteristics of liberalized markets, such as the volatility in certain prices and their impact on the energy system.

91. The rich representation of technology in NEMS allows analysis of the impact of mitigation policies thanks to the model's explicit representation of vintaged (time-dependent) capital (energy equipment and structures such as power plants), and tracking of its turnover rates. There is sufficient

detail in the transportation sector of NEMS to project the use of alternative or reformulated fuels. It is used for policy simulation, taking into account all synergies and feedbacks. However, the effects of individual voluntary measures and programmes are usually assessed outside the model.

92. The DOE projects energy-related CO_2 emissions for bunker fuels and emissions from the United States territories with quantitative tools other than the NEMS. The EPA prepares projections of energy-related non-CO_2 gases on the basis of EIA projections of underlying activity levels and the relevant emission factors. It also prepares projections of emissions from all non-energy-related sources, except for LUCF, mainly by using spreadsheet models, and again using projections of activity data and the relevant emission factors.

93. The USDA prepares projections of emissions and removals from LUCF and projections of the economic drivers for agriculture based on long-run trends, plans and policies in place. Projections of carbon sequestration by forests are prepared using the Timber Assessment Market Model, which projects timber supply, and availability and supply of other forest products. Emission or storage rates are then applied to those projections using the FORCARB model. The methodology used for projections has been adjusted to reflect relevant changes in inventory methodology, including accounting for carbon storage below ground, in wood products and in harvested wood. This has led to major changes in the historical and future carbon sequestration levels.

94. The approach for preparation of projections for energy-related CO_2 emissions in the CAR3 differed from the CAR2 and CAR1, in that projections from the AEO were used mainly for baseline projections. These projections were then used to calibrate another model, IDEAS, which is a system-dynamic model used as a policy analysis framework. Scenarios other than the baseline were then prepared using the IDEAS model. This approach reflected, in part, the emphasis placed on the estimates of the effects of policies and measures in the previous CARs. Like the CAR3 projections, the AEO baseline projections for the CAR2 were prepared using the NEMS model.

95. The CAR3 provides a detailed description of the underlying assumptions used for projections. These are summarized in table 16, together with the relevant values from the CAR2. A comparison of the assumptions in the CAR2 and CAR3 suggests a noticeable upwards revision of the GDP annual growth rates from 2 per cent and 1.4 per cent in the CAR2 to 3 per cent in the CAR3, which in part reflected the expectations that the stable economic growth rate achieved during the 1990s will extend into the future.

96. The projected energy intensity improvements are much higher in the CAR3 than in the CAR2. This stems, in part from the noticeably higher GDP growth rate used in the CAR3. This more than compensates for the much higher growth of energy and, especially, of electricity demand, for which some saturation affect was assumed in the CAR2. Assumptions for the growth in vehicle miles travelled are around 25 per cent higher in the CAR3 than in the CAR2. A moderate growth in world oil prices is expected in both CARs, while wellhead natural gas prices are expected to be consistently around 25 per cent higher in the CAR3 than in the CAR2. The review team noted that the assumptions used are internally consistent and broadly consistent with historical trends.

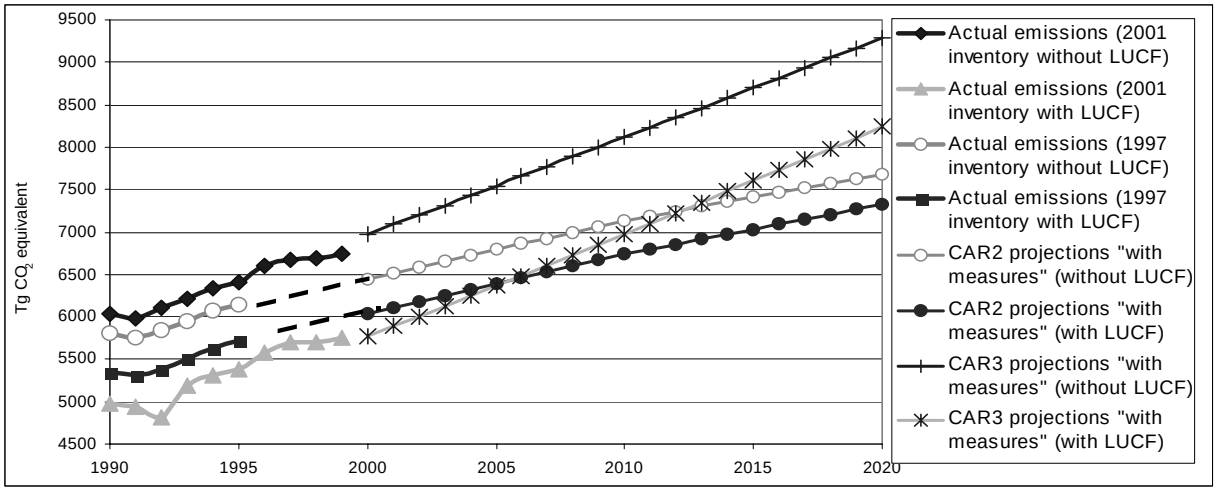
Table 16. Comparison of growth rates and values of some key parameters and assumptions for these parameters in the CAR2 and CAR3 scenarios

	2000		2000–2010		2010–2020	
	CAR2 values	**CAR3 values**	**CAR2 growth**	**CAR3 growth**	**CAR2 growth**	**CAR3 growth**
GDP (billion of 1996 USD) and growth rate (% annually)	8 152	9 224	2.0	3.0	1.4	3.0
Population (millions)	276	276	0.8	0.8	0.8	0.8
Energy intensity (British thermal unit (Btu)) per 1996 USD GDP) and its improvement rate (per cent annually)	11 903	10 770	1.18	1.35	1.0	1.7
Light-duty vehicle miles travelled (million)	2 373	2 340	2.0	2.4	1.5	2.0
	2000		**2010**		**2020**	
	CAR2 values	**CAR2 values**	**CAR2 values**	**CAR2 values**	**CAR2 values**	**CAR2 values**
World oil price (USD 2 000 per barrel)	19.86	27.72	22.16	23.36	24.18	24.68
Wellhead natural gas prices (USD 2 000 per cubic foot)	2.02	3.6	2.16	2.85	2.61	3.26

C. Results of projections

97. According to the data on projections reported in the CAR3, the total emissions of the United States with net CO_2 removals from LUCF are expected to rise by 21 per cent in 2010 and by 43 per cent in 2020 compared to 2000, which is in addition to the emission growth of 21 per cent already achieved between 1990 and 2000 (figure 5). Total emissions without net CO_2 removals from LUCF are expected to grow at a slower rate and to be 16 per cent higher in 2010 and 33 per cent higher in 2020 compared to the 2000 level, in addition to the 14 per cent growth already achieved between 1990 and 2000. The higher growth rate of the net emissions is explained by the expected reductions in the carbon sequestration by LUCF. In absolute terms, the total net emissions of the United States in 2010 are expected to be 1994 Gg CO_2 equivalent higher than in 1990, and in 2020 they are expected to be 3259 Gg higher than that level.

Figure 4. Projections of the total GHG emissions in the CAR2 and CAR3



98. The growth in total emissions is underpinned chiefly by the expected growth of energy-related CO_2 emissions, which are expected to increase by 34 per cent between 2000 and 2020. Within the same time frame, most of the other GHGs are expected to grow as well: non-energy-related CO_2 emissions by 21 per cent, N_2O by 16 per cent and fluorinated gases by 232 per cent defined by the growth of HFCs (although this contributes little to the total emissions and their overall growth). Only CH_4 emissions are expected to drop, by 2 per cent. The United States maintains that this expected emission growth is lower than the growth under a hypothetical baseline scenario because of the expected impact from new, cleaner and more efficient energy technologies, structural changes in the economy and the effects of implemented and adopted policies and measures discussed in section III of this report.

99. According to the reported scenario, the emission intensity of the United States economy will decrease by 13 per cent between 2000 and 2010 and by 15 per cent between 2010 and 2020. These results agree with the estimates underpinning the United States' new domestic goal of improving emission intensity over the decade between 2002 and 2012 by 18 per cent, and suggest that new policies and measures are deemed necessary to deliver the additional intensity improvement of around 5 per cent. The effects from the new initiatives may deliver at least part of this improvement; see paragraph 104 below.

100. A comparison between the projections in the CAR2 and the CAR3 suggests that the emission levels projected in the CAR3 are much higher (table 17). The outcome of discussions between the review team and the energy modellers suggests that this difference stems mainly from revised assumptions on higher economic growth, lower energy prices and a slower, more realistic rate of technological change. The review team noted that the assumption on economic growth may not remain valid, given the observed economic slowdown since 2000. The difference between projections in CAR2 and CAR3 also seems to stem from the difference in modelling approaches in CAR2 and CAR3, including very conservative assumptions on the effect of voluntary measures in CAR3.

101. The CAR3 provides detailed information on the sensitivity of the projection results to changes in assumptions on key drivers and variables, including technological development, economic growth, energy prices, regulatory and statutory changes and weather variation. It suggests that technological change and economic growth may have a greater impact on the future emission levels than the other drivers and variables. If an accelerated rate of technological change is assumed, reflecting possible impact from the NCCTI, energy use in 2020 is 5.6 per cent, or 507 Tg CO_2 equivalent, lower than in the reference case. In the high-growth case, with a GDP growth rate 0.4 per cent higher than the reference case, energy use in 2020 is 5.6 per cent or 462 TgCO_2 equivalent higher than the reference case. The review team noted that these impacts on emissions are twice as large as the total effect of policies and measures reported in the CAR3 for 2000 (242 Tg CO_2 equivalent) and much higher than the estimated impact of these policies in 2010. Therefore, they could potentially offset this effect.

Table 17. Historical and projected (CAR2 and CAR3) emissions in CO_2 equivalent (Tg)

	Historical emissions					Projected emissions							
	CAR 2		CAR 3			CAR 2				CAR 3			
Greenhouse gas	**1990**	**1995**	**1990**	**1995**	**1999**	**2000**	**2005**	**2010**	**2020**	**2000**	**2005**	**2010**	**2020**
Net CO_2	4 503	4 785	4 503	4 785	4 568	5 218	5 463	5 720	6 149	4 594	5 115	5 669	6 712
Energy	4 865	5 100	4 836	5 121	5 453	5 515	5 746	5 991	6 369	5 726	6 210	6 727	7 655
Adjustment and other sources	95	114	77	99	105	114	121	128	128	73	80	86	110
Carbon sequestration	–458	–429	–1 060	–1 019	–990	–411	–403	–400	–348	–1 205	–1 175	–1 144	–1 053
Methane	623	649	645	651	620	550	557	557	565	623	633	630	611
N_2O	132	147	397	432	433	114	117	125	125	433	447	464	504
HFCs, PFCs and SF_6	88	136	84	99	136	154	253	334	488	124	170	208	410
Total	**5 345**	**5 716**	**4 978**	**5 382**	**5 756**	**6 035**	**6 391**	**6 736**	**7 326**	**5 774**	**6 365**	**6 971**	**8 237**

D. Estimated effect of policies and measures

102. The CAR3 does not contain a "without measures" scenario produced using the NEMS model, which could be compared to the "with measures" scenario to assess the total effect of policies and measures. However, it contains estimates of the impact of policies and measures by sector, and also for some individual policies and measures. These estimates were prepared by the EPA using a bottom-up approach combining sectoral survey data, engineering parameters and expert opinion on potential market responses. Such estimates should not be considered as additive, i.e. the overall effect is not a sum of effects of individual measures as these individual estimates are not derived in a systematic context, or an economy-wide integrated framework, as in NEMS. For example, when following this approach it is difficult to account for rebound effects.[6]

103. According to the EPA estimates, the effect of policies and measures reported in the CAR3 totalled 240 Tg CO_2 equivalent in 2000, not including effects from agricultural and forestry sectors. When these effects are included, the total effect in 2000 was estimated at 384 Tg CO_2 equivalent (Table 7). This effect is expected to increase to around 700 Tg CO_2 equivalent in 2010. For comparison, CAR2 estimated the effect of policies and measures to be 280 Tg CO_2 equivalent in 2000 and 620 Tg CO_2 equivalent in 2010.

104. More recent estimates of the policies and measures reported in CAR3 provided to the review team during the visit to Washington suggest a slightly upwards revision to 700 Tg CO_2 equivalent for 2010. Most of this increase is expected to come from the Energy STAR programme, SNAP and the Environmental Stewardship Initiative.

105. The impact of new initiatives, such as Climate VISION, the Hydrogen Fuel Initiative and the FutureGen initiative has not yet been quantified either by the Federal Administration or by the industries involved. The impacts from Climate VISION are likely to be seen within the next 10 years, but some of

[6] The CAR3 notes that: "The reported impacts of the individual measures in Chapter 4 of this report are based on specific assumptions for the impact and adoption of each measure. However, those impacts recognize fewer interaction and competitive effects within and among the economic sectors in which the individual measures are applied. A precise mapping of the emissions reductions from individual policies and measures against the aggregate estimates of the NEMS used in the AEO modelling exercise is not possible."

the pledges made under this programme are a continuation of previous agreements and their effects could, in part, be included in the CAR3 estimates of effects. It will be difficult to assess the effects of this initiative, as the commitments are pledged through heterogeneous indicators, such as percentage efficiency of emission intensity improvements, percentage increase in carbon-free power capacity, percentage reduction in CO_2 emission per unit of physical output, percentage reductions in overall emissions from different base year levels and, finally, increase in plant capacity factor. It is also unclear to what extent each of these commitments exceeds the development that would take place naturally as a result of normal capital stock turnover and normal rates of technological change. At the time of the review team's visit it remained unclear to what extent Climate VISION will push the decline in emission intensity beyond the levels already projected by the EIA for the next 20 years and noted in paragraph 98.

106. The effects of other new initiatives, such as the Hydrogen Fuel Initiative and the FutureGen Initiative, if successful, may become visible only in the long term (beyond 2012). Any attempt to assess their potential impact at this stage would have to deal with huge uncertainties.

E. Projections by sector

107. In the CAR3, energy-related CO_2 emissions are projected to grow by 34 per cent between 2000 and 2020, which is equivalent to an annual growth of 1.5 per cent. This growth is underpinned, according to the AEO 2002, by an almost equal growth in the TPES, around 32 per cent, which is equivalent to an annual growth of 1.4 per cent. The growth in GDP within the same time frame was expected to reach 79 per cent, which is more than twice the growth in CO_2 and FEC and equivalent to an annual growth rate of 3 per cent. Energy intensity is expected to decrease at an annual rate of 1.6 per cent and energy-related emission intensity at an annual rate of 1.5 per cent. These rates are in line with recent historical trends. However, unless boosted by further measures, the expected level of emission intensity reduction may fall short of the domestic goal of 18 per cent reduction by 2012.

108. The projected levels of CO_2 emissions in the CAR3, being based on AEO 2002, are higher than the AEO projections from previous years and also higher than the figures in the CAR2. In addition to the reasons discussed in paragraph 99, these projection levels are higher because of the higher projected energy demand in the commercial and transportation sectors, and new coal-fired electricity capacity. The effect of this new capacity is partly offset by higher projections for nuclear generation. Nonetheless, the growth in CO_2 emissions is expected to be higher than the growth in TPES as a result of the increased use of fossil fuel, some decline in the share of nuclear generation and slow penetration of renewable energy.

109. The CAR3 provides some analysis of the emissions trend in the energy end-use sectors.[7] In the residential sector, CO_2 emissions are projected to grow by 24.5 per cent between 2000 and 2020 (slightly more than the increase in energy demand), driven by increasing dwelling sizes and greater use of electricity for air conditioning, appliances and consumer electronics. In the commercial sector, CO_2 emissions are expected to grow by 42 per cent for the same period, driven by the increase in commercial floor space. Increasing efficiency in space heating/cooling and electrical equipment partly offset the increase in use of office equipment and new technologies, but electricity consumption remains responsible for an increasing share of the sector's energy consumption.

110. In the same period CO_2 emissions in industry, including agriculture, mining and construction, are expected to grow by only 22 per cent, resulting from an increase in energy use of around 23 per cent. This relatively slow growth of energy demand and emissions stems from expected structural shifts in industry, moving away from energy-intensive industries, while maintaining growth in output of around 53 per cent.

111. In the transport sector, emissions of CO_2 are expected to experience the greatest growth in the period 2000–2020, by 46 per cent, following a 44 per cent increase in energy demand over the period. This increase is due almost entirely to increasing use of petroleum products, although natural gas and electricity use also grow noticeably, by more than 50 per cent. The main drivers for energy consumption

[7] However, the analysis on the sectoral emissions trends provided in pages 74 and 75 of the CAR3 appear somewhat unclear as sectoral emission trends are compared to the rate of increase of total GDP rather than to an appropriate measure of sectoral activity.

in this sector remain population growth, increase in incomes, and projected stable oil prices. The latter, together with the maintenance of the CAFE standards at the same level, contributed to the slowdown in the increase in vehicle efficiency that took place in the 1980s after the CAFE standards were phased in.

112. For non-CO_2 gases, the expected 16 per cent growth in N_2O emissions stems mainly from the expected growth of emissions from transport and from production of adipic acid and nitric acid. Emissions of fluorinated gases are expected to more than triple over the projection period, mainly as a result of the growth in HFCs used to replace ozone-depleting substances, while the other fluorinated gases are expected to drop. Emissions of CH_4 are expected to show a declining trend, resulting from a decrease in emissions from coal mines (closure of very gassy mines and some shift from underground to open-cast mining) and from landfills (continued recovery of landfill CH_4).

113. The LUCF sector is expected to remain a net sink, but the carbon sequestration rate is expected to drop by 13 per cent between 2000 and 2020. Emissions from international bunker fuels (both military and civilian) show a rather stable upward trend.

V. VULNERABILITY ASSESSMENT, CLIMATE CHANGE IMPACTS AND ADAPTATION MEASURES

114. Several Federal Government departments and agencies have been involved in climate change impact assessment, with an overall goal of obtaining better insights and initiating development of response and adaptation strategies. These include the USDA, the DoC and the National Oceanic and Atmospheric Administration (NOAA), the Department of Interior, Health and Human Services, the Department of Transportation, the EPA and various agencies at local level.

115. The chapter on impacts and adaptation in the CAR3 is primarily based on the outcomes of the United States National Assessment of the Potential Consequences of Climate Variability and Change (USNA). While it is not an official United States document, it does represent an integrated assessment, with involvement of both stakeholders and scientists, and provides a range of possible future conditions that can be used to explore the potential impacts of climate change for the United States. These include potential impacts at national and regional levels, as well as on five key sectors, including agriculture, forests, human health, water resources, and coastal areas and marine resources. The possible future conditions encompass mainly possible gradual climate changes, with little discussion of extreme events. The review team considers that in reporting on impacts and adaptation, the United States respected the UNFCCC guidelines. It also considers that notwithstanding uncertainties associated with future warming and regional and local projections of climate change, this chapter of the CAR3 represents a valuable source of information for decision-making and for understanding of the sensitivity of various systems underlined in the CAR3.

116. The assessments of vulnerability were performed at national and regional level, based mainly upon the utilization of two coupled ocean–atmosphere climate models, known also as global circulation models (GCM): the United Kingdom's Hadley Centre model (HadCM2) and the Canadian Centre for Climate Modelling and Analysis model (CGCM1). Downscaling of the results from these two models was used, together with the Vegetation Ecosystem Modelling and Analysis Project (VEMAP) package. The review team noted that regional climate models could be used in addition to the GCM to more rigorously simulate regional patterns of changes and projections. In addition to the national assessment, a number of states have set up programmes for assessing potential impacts of climate change.

117. The USNA considered mainly model simulations that used only one emission scenario which was close to the IPCC IS92a "business as usual" scenario, associated with middle-range projections of global average warming and sea level rise rather than the full set of IPCC scenarios. The review team felt that using a single scenario may not be sufficient because, *inter alia*, it did not include the effects from policies aiming to reduce air pollution and acid precipitation, and associated changes in aerosol levels (unlike the more recent IPCC scenarios). The review team also felt that utilization of sets of scenarios, such as the new IPCC SRES scenarios, is likely to reduce any single scenario-related bias and facilitate the policy-relevant implied effects.

118. For projections to the year 2100, the HadCM2 and CGCM1 models are in agreement that: (1) minimum temperatures would rise more rapidly than maximum ones, and gave different magnitude for such rises by region; (2) sea level would rise by around half a metre; (3) sea ice in winter would be reduced; (4) an increase in the global precipitation and in intensity and frequency of heavy and extreme precipitation is expected. Some differences were observed in the models' results for changes in the precipitation patterns across the regions of the United States; changes in atmospheric circulation patterns; and changes in projected soil moisture and drought tendencies. The review team noted that, although the types of consequences from climate change are plausible, they seem to be largely model dependent.

119. According to the CAR3, the USNA and its background documents climate change impacts are most likely in three sectors: agriculture, water resources and human health. In agriculture, the productivity of many major crops and grasses is projected to respond positively to increased CO_2 levels. It is also projected that, although projected temperature increases would directly reduce livestock productivity, improvements in pasture and grazing and reductions in feed prices due to lower crop prices would counter these losses.

120. The already observed increases in runoff volumes and changing seasonal availability of water supply resulting from increased precipitation and temperature changes, which might be partly due to natural climate variability, are projected to continue, and to become more dramatic. Also, the reduced snow cover is likely to alter the timing and amount of water supplies. The review team felt that because there is some disagreement at regional level on precipitation and temperature impacts between the two models, and also because of the likely increase in water demand to satisfy the expected economic growth, the impacts of climate change on water resources could be further studied by utilizing regional climate models, which could allow more detailed simulation of the regional climate impacts. It noted, however, that the confidence of these models is still low. It also noted that the basic science research, as suggested in the CCSP Strategic Plan, could improve knowledge of the water cycle.

121. The projected climate change may have some impacts on human health, both beneficial and adverse, including an increase in temperature-related illness and deaths. The other possible health impacts are from air pollution-related disease, water- and food-borne disease, and insect-, tick- and rodent-borne diseases. Changes in these health impacts could result from changes in air pollution levels, and increased temperature, and frequency, timing and duration of rainfall and runoff events.

122. The United States has broadly defined some actions to reduce its vulnerability and prepare for adaptation to the projected impacts of climate change. The review team noted that the emphasis in the CAR3 is placed on reliance on the nation's wealth and technological progress to cope with adaptation issues, rather than the adoption of specific adaptation policies at this stage.

VI. FINANCIAL RESOURCES AND TRANSFER OF TECHNOLOGY

123. Financial resources and technologies are transferred from the United States to developing countries and countries with economies in transition through governmental channels, as well as through assistance from NGOs and the private sector. At governmental level, the main part of the support for technology transfer goes through the Agency for International Development (AID). Other agencies involved, including the DOE, the USDA, the NOAA, the National Aeronautics and Space Administration (NASA) and the EPA, contribute mainly through transfer of knowledge and expertise. The review team noted that reporting of information on financial resources and technology transfer in the CAR3 adequately reflected the key areas and extent of these activities. It also noted that the CAR3 conformed to the UNFCCC guidelines and all required tables were completed with relevant information.

124. The CAR3 provides aggregated figures from 1997 to 2000 for the financial contribution of the United States to several multilateral financial institutions for the support of sustainable economic development, poverty alleviation and protection of the global environment. The review team noted some decrease in support to the Global Environment Facility (GEF) in 2000 for climate-related activities and was informed that the current Administration was committed to the required levels of support for the GEF. In particular, as part of the third replenishment of the GEF (2002–2005), the United States

has pledged USD 500 million, which represents a 16 per cent increase over its contribution to the previous replenishment.

125. Through bilateral and regional financial flows, the United States provided direct and indirect financial support as well as commercial sales related to the implementation of the UNFCCC in more than 140 countries. Areas of support ranged from mitigation, mostly energy and forestry, to adaptation, mostly capacity-building for water treatment and wastewater treatment facilities, and disaster preparedness. From 1997 to 2000, direct funding for these programmes totalled USD 4.1 billion; commercial sales, representing the largest share of private sector activities captured in the report, accounted for USD 3.6 billion; and indirect financing (which includes risk guarantees, loan guarantees, and investment insurance) accounted for USD 954 million. Examples of mitigation activities include efforts in the transportation sector to reduce greenhouse gas emissions, lead and particulates from motor vehicles in Egypt, India, the Philippines, and Mexico. Examples of adaptation activities include the Coastal Resources Management Program, which provided technical assistance in coastal zone management and research to Mexico, Ecuador, Jamaica, the Dominican Republic, El Salvador, Kenya, Tanzania, Egypt, Thailand, Indonesia, and the Philippines. The United States also has bilateral partnerships relating to climate change with 13 countries, including many developing countries that are large emitters such as China and India.

126. Private sector activities remain one of the most important vehicles for technology transfer of "soft" and "hard" environmentally and climate-friendly technologies. In 2000 alone, commercial sales of these technologies amounted to USD 18 billion. These included technologies for both mitigation and adaptation, such as waste water treatment, water supply, renewable energy and energy efficiency, and equipment for management and saving of heat and energy. However, the environmental NGOs that the review team met during the visit noted that, within the United States Ex-Im Bank, which supports private sector effort by promoting the foreign investments of the United States, mitigation projects comprise a small fraction of its investment portfolio.

127. Several Federal Government initiatives on climate change stand out. These include: (1) the initiative on Joint Implementation (1994–2000), involving 52 projects in 26 countries; (2) the Country Studies Program (1993–2000), helping 56 countries to build human and institutional capacity to assess vulnerability to climate change and mitigation options; and (3) the USAID Climate Change Initiative (1998–2002) with a funding of USD 1 billion over five years, which supported activities to address climate change in around 40 countries.

VII. RESEARCH AND SYSTEMATIC OBSERVATION

128. The United States Global Change Research Program (GCRP) has coordinated most of the research activities on observation, understanding and documentation of global change. In recognition of the need to address the key remaining scientific uncertainties associated with climate change, to enhance the global observation system with a view to reducing these uncertainties and to facilitate decision and policy making, the President established the CCRI in June 2001. As of the end of 2002, the GCRP and the CCRI have been working in collaboration under the direction of the CCSP, referred to in paragraph 113, and a joint strategic plan was completed in 2004. The CAR3 reports on several research activities outside the GCRP, comprising basic and applied research within the Climate Change Technology Initiative.

129. Spending for the GCRP totalled USD 1.7 billion annually, shared almost equally between scientific research and NASA space-based observations and data systems. Climate variability and change research are the major research topics, which together receive around 30 per cent of the total GCRP funding. The United States is actively involved in international cooperation on climate change research, to which it contributes around half of world expenditure. Priority areas for this research are: carbon cycle research; aerosol-climate research; feedbacks, water vapour and thermohaline circulation; integrated observation systems; carbon capture and storage; and hydrogen technology and infrastructure.

130. The United States has one of the most impressive national Global Climate Observing Systems (GCOS) for climate monitoring in five distinct yet integrated areas. The system acquires detailed local

and large-scale national data, including observation of environmental variables, representing a major contribution to the Integrated Global Observing Strategy.

131. The review team was informed that NOAA has formulated a framework for international GCOS support. It focuses on needed improvements to meteorological surface-based networks, and on the GCOS terrestrial and oceanic surface-based and satellite-based observation networks. NOAA has identified nine activities that it proposed to launch in 2003 in association with the GCOS secretariat, with a total spending of USD 4 million annually. Additional funding for rescue and digitization of long-period observational data in Africa and Asia is also provided. The provision of these datasets comprises a major contribution to the science of climate change, and is likely to enhance the IPCC process. The review team noted a NOAA initiative for the development of radio and Internet-based climate information dissemination tools for rural farmers in developing countries.

VIII. EDUCATION, TRAINING AND PUBLIC AWARENESS

132. The CAR3 provided more detailed information on domestic programmes than the previous national communications, and an impressive list of activities in the area of education, training and public awareness. This stems, in part, from the extended breath and scope of education and outreach activities and from the increased number of federal and state agencies involved in such activities, including the EPA, DOE, NASA, DOT, NOAA, the National Park Services and the Smithsonian Institution. Also, both environmental and business NGOs have been playing an increasingly important role in such activities, in many cases in partnership with the Federal Government, with the main objective of building the foundation for broad action to reduce risks from climate change.

133. The EPA compiled the information on these activities for the CAR3 and also helped, together with the Department of State, to ensure a flow of information on scientific aspects of climate change and links with sustainable development to developing countries, for example through the Integrated Environmental Strategies Program targeting eight countries. The review team noted that the CAR3 did not report on some major international activities focusing on this subject that had been included in the CAR1 and CAR2. It also noted that, in terms of budget allocation, the extent of the effort to promote education, training and public awareness on climate change remained unclear.

134. Research activities, in particular the USNA, have provided an opportunity to reach out to interested parties and stakeholders and stimulate dialogue on potential climate change impacts. This included both outreach at regional level (20 workshops), and outreach at national level in five key areas: agriculture, forests, human health, water resources, and coastal areas and marine resources. The recent public awareness efforts on mitigation and adaptation initiated by the agencies listed in paragraph 131 moved beyond the research community, and focused on public constituencies. In particular, the EPA has greatly enhanced the ability of decision-makers to address their environmental and economic goals through its State and Local Climate Change Program. At international level, the review team acknowledged the Global Learning and Observations to Benefit the Environment (GLOBE) programme as a unique science and education initiative for climate change and the other Rio Conventions. A variety of tools have been used for information dissemination, including web sites and video materials; for example, the CD-ROM on climate change impacts on national parks.

135. The review team was informed that awareness of climate change is gradually increasing. It noted several ongoing activities to monitor the effectiveness of the awareness campaigns. It also noted the usefulness of assessing any resulting changes in public behaviour: for example, on issues related to the links between climate change and the contribution of passenger cars to emissions from transport.

136. Responsibility for education rests mainly with the state and local governments. At the high-school level, climate change issues are broadly covered within Earth Science programmes. At the national level, the EPA contributed to educational activities by preparing educational kits for schools. Many higher education institutions promote research in global change, including elements of climate change and sustainable development, within atmospheric science programmes. Graduate fellowships and doctoral and postdoctoral assistance are the main incentives for such research.

IX. CONCLUSIONS

137. The CAR3 was prepared while the new Administration was in the initial stages of developing its climate policy. The review team recognized it as being a snapshot of that period in time and concluded that, in this context, it provides a comprehensive and consistent overview of the national climate policy. Key climate change policies and measures, GHG inventories, projections and other issues addressed in the CAR3 are presented there in a concise and objective way. The review team concluded that the presentation of the information broadly conforms with the UNFCCC guidelines, and did not identify major information gaps. During the visit to Washington, D.C. the review team was also provided with comprehensive and supplementary information on the most recent climate change policy initiatives, such as Climate VISION. This is reflected in the current report, which augmented the information from the CAR3.

138. The review team acknowledged with appreciation the improved reporting on inventories and in particular the inclusion of some small sources of emissions, reducing the uncertainties in estimates, consistency in the emissions time series and consistency between the inventory data and information reported in other sections of the CAR3, such as projections. It also acknowledged the transparency in the inventory reporting in terms of well-documented assumptions, explanations, reasons for recalculations, sources that are still missing, methodologies and emission factors. It further acknowledged that preparations for a national system of emission inventories is well under way in the United States. On policies and measures and projections, the review team noted that in the interests of enhanced transparency it would be useful to adhere to reporting guidelines even on those parts that are not compulsory. Specific suggestions for improvement are provided in the relevant section of the report.

139. In accordance with the aim of Article 4.2(b) of the UNFCCC, to return individually or jointly the emissions of greenhouse gases in 2000 to their 1990 level, which was also considered as a domestic target by the United States, the review team noted that in 2000 the total emissions (excluding emissions and removals from LUCF) were 14 per cent higher than the emissions in 1990. This was higher than projected in the CAR1 and CAR2. The growth was most pronounced in emissions of CO_2 and fluorinated gases, which grew by 17 and 30 per cent respectively; emissions of the other gases grew much more slowly or even declined, mainly as a result of targeted policy initiatives. Underlying reasons for these results were the high economic growth in the 1990s, insufficient funding for the initial 1993 CCAP, new policies and measures developed as a follow-up to this plan having small impact on total emissions, and climate policy in the 1990s being centred largely on voluntary measures. As well, the 1993 CCAP and the follow-up policy initiatives emphasize the mitigation of non-CO_2 emissions, rather than CO_2 emissions which accounts for the major part of GHG emissions. The United States has been successful in launching policies that have delivered notable reductions of non-CO_2 emissions. The success of these policies contributed also to slowing down the overall growth of emissions of fluorinated gases underpinned by the growth of use of HFCs as substitute for ozone depleting substances.

140. The new Administration chose not to proceed with the ratification of the Kyoto Protocol. However, it reaffirmed its commitments to the UNFCCC with the understanding that climate change poses a real threat and announced its new Climate Change Strategy in February 2002. This strategy laid down the foundation for the United States' current climate policy, aimed at contributing to the long-term stabilization of GHG concentration through flexible approaches that allow for adjustments in response to new scientific findings and do not inhibit continued economic growth. Broadly, the scope and content of the Climate Change Strategy reflect the thinking of the Administration that new technology could halt climate change, and continues to place emphasis on voluntary approaches in the short term.

141. The national goal to improve the emission intensity by 18 per cent during 2002–2012 was set as part of the Climate Change Strategy. This goal is set in terms of intensity improvement, not absolute emission limitation, because it is believed that this is less likely to constrain economic growth. The goal may be revised and related policies strengthened after the review scheduled for 2012 takes place; no interim review is envisaged. This goal is recognized as a step towards meeting the UNFCCC objective of stabilizing GHG concentrations at a non-dangerous level, possibly by reducing the level of national

emissions in absolute terms in the future through intensity improvement that outpaces economic growth. The review team noted different views on the possibility of attaining the national goal with current measures in place, and that further measures might be necessary to do this. It also noted that an interim review before 2012 could help to ensure that the target is met. It further noted the potential impact of the NEP on emission levels and on the possibility of attaining the national goal.

142. The overall stance of the United States on climate policy instruments, as outlined in the CAR3, continued to emphasize voluntary measures for short-term emission limitations, as in the CCAP and the previous CARs. To this end, the Voluntary Reporting Program, under Section 1605(b) of the Energy Policy Act is being strengthened. Two new comprehensive voluntary initiatives were launched, Climate VISION and Climate Leaders. These are supported by many existing voluntary programmes such as Energy Star. Most of these voluntary programmes aim at fostering emission mitigation, for example through promoting energy-efficient and cost-effective equipment. The overall budget for these programmes and for tax incentives to spur the use of clean, renewable and energy-efficient technologies totalled USD 4 billion for 2003 and marked an increase of USD 700 million. Although the use of market-based mechanisms, for instance a transferable credit system or a cap-and-trade system, is not excluded, the Administration does not set concrete incentives at federal level to utilize such mechanisms. Several prominent initiatives have been launched at the state level to set much more stringent emission reduction objectives, and to achieve these objectives through approaches that go far beyond the voluntary approach taken at the federal level. These initiatives are indicative of the intensified engagement by the states in addressing climate change.

143. Another characteristic feature of the overall stance is its emphasis on long-term technological development and accumulation of scientific knowledge. In spite of the lack of concrete estimates for emission reductions to be delivered by new technologies, this stance underpins the approach of the Administration in shaping climate policy responses. The team noted the Administration's long-term vision of a hydrogen economy (with electricity as the secondary energy carrier) with low GHG emissions and carbon capture and storage, and the leading role of the United States in the international effort in this context. The team also noted that the overall approach focuses largely on developing new supply-side technologies, but also includes efforts to promote efficient technologies on the demand-side. Concern for energy security is an important driving force behind this approach. The overall budget of USD 4 billion for 2003 for long-term technology research and development, together with climate change science, is indicative of the priority attached to these matters.

144. The integrated vulnerability assessment, involving both stakeholders and scientists, represents a valuable source of information for decision-making on climate change. Programmes for assessing the potential impacts of climate change implemented at the state level could contribute to the development of regional models and could facilitate policy responses. Climate change impacts were found to be most likely in three key sectors – agriculture, water resources and human health – with possible impacts that were both beneficial and adverse. Because of the capacity of the United States to face possible impacts of climate variability and change, the reduction of vulnerability is based mainly on reactive adaptation strategies.

145. The United States is providing support to developing countries to address climate change and several of its initiatives stand out. It is actively involved in international cooperation on climate change research and contributed around half of world expenditures in this field. It has one of the most impressive national GCOS systems for climate monitoring. Activities in the area of education, training and public awareness undertaken by federal and state agencies, in many cases in partnership with both environmental and business NGOs, were broadly aimed at building the foundation for action to reduce risks from climate change. These activities, together with a variety of tools developed for information dissemination, could be effective in promoting behaviour that is more environmentally and climate change friendly, and in raising awareness of the need for further action.

- - - - -