



**UNITED
NATIONS**



**Framework Convention
on Climate Change**

Distr.
GENERAL

FCCC/IDR.4/USA
17 February 2009

ENGLISH ONLY

**Report of the in-depth review of
the fourth national communication of the United States of America**

According to decision 4/CP.8, Parties included in Annex I to the Convention are requested to submit to the secretariat, in accordance with Article 12, paragraphs 1 and 2, of the Convention, a fourth national communication by 1 January 2006. This report reflects the results of the in-depth review of the fourth national communication of the United States of America conducted in accordance with relevant provisions of the Convention.

CONTENTS

	<i>Paragraphs</i>	<i>Page</i>
I. INTRODUCTION AND SUMMARY	1–7	3
A. Introduction	1–3	3
B. Summary.....	4–7	3
II. NATIONAL CIRCUMSTANCES RELEVANT TO GREENHOUSE GAS EMISSIONS AND REMOVALS.....	8–18	4
III. POLICIES AND MEASURES	19–69	7
A. Policy framework and cross-sectoral measures.....	25–40	9
B. Policies and measures in the energy sector	41–61	13
C. Policies and measures in other sectors	62–69	17
IV. PROJECTIONS AND THE TOTAL EFFECT OF POLICIES AND MEASURES	70–105	19
A. Projections overview and reporting issues	70–79	19
B. Scenarios, models and assumptions underlying future trends	80–85	20
C. Results of projections	86–94	22
D. Projections by gas.....	95–105	25
V. VULNERABILITY ASSESSMENT, CLIMATE CHANGE IMPACTS AND ADAPTATION MEASURES.....	106–112	27
VI. FINANCIAL RESOURCES AND TRANSFER OF TECHNOLOGIES	113–125	29
A. Financial resources	113–120	29
B. Transfer of technology	121–125	30
VII. RESEARCH AND SYSTEMATIC OBSERVATION.....	126–130	31
VIII. EDUCATION, TRAINING AND PUBLIC AWARENESS.....	131–136	32
IX. CONCLUSIONS	137–148	34
<u>Annexes</u>		
I. Documents and information used during the review		37
II. Acronyms and abbreviations		38

I. Introduction and summary

A. Introduction

1. The United States of America has been a Party to the Convention since 1992. It signed the Kyoto Protocol on 12 November 1998, which provided for a reduction of greenhouse gas (GHG) emissions by 7 per cent from 1990 levels by the period 2008–2012. However, the United States of America has not ratified the Kyoto Protocol. In 2002, the United States of America set a national goal to reduce the economy's GHG emission intensity by 18 per cent between the years 2002 and 2012.

2. This report covers the in-country in-depth review (IDR) of the fourth national communication (NC4) of the United States of America under the UNFCCC, entitled "U.S. Climate Action Report – 2006" (hereinafter referred to as CAR4), coordinated by the UNFCCC secretariat, in accordance with decision 7/CP.11. The in-country review took place from 11 to 15 February 2008 in Washington, DC, the United States of America, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: Mr. Philip Acquah (Ghana), Mr. Neil Ferry (Australia), Mr. Michael Gytarsky (Russian Federation), Ms. Erasmia Kitou (European Community). Mr. Acquah and Ms. Kitou were the lead reviewers. The review was coordinated by Ms. Astrid Olsson and Ms. Katia Simeonova (UNFCCC secretariat).

3. During the IDR, the expert review team (ERT) examined each part of the CAR4. A draft version of this report was communicated to the Government of the United States of America, which provided comments that were considered and incorporated, as appropriate, in this final version of the report.

B. Summary

4. The ERT noted that the United States of America's CAR4 complies broadly with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications" (hereinafter referred to as the UNFCCC reporting guidelines). The ERT acknowledged that the CAR4 provides a good overview of the national climate policy of the United States of America.

1. Completeness

5. The ERT noted that the CAR4 covers all sections required by the UNFCCC reporting guidelines, except for some of the mandatory and non-mandatory elements. This includes some of the elements required in the sections on policies and measures (PaMs), projections, and the total effect from PaMs. The United States of America does not always provide an explanation in the CAR4 as to why these mandatory elements are not reported, although the ERT was informed during the in-country review that information was generally not provided in cases where there was low confidence in the available data and estimates, and/or the data and estimates could lead to double counting of emissions.

2. Timeliness

6. The CAR4 was submitted on 27 July 2007, while decision 4/CP.8 requested Parties to submit their CAR4 by 1 January 2006.

3. Transparency

7. The ERT acknowledged that the United States of America's CAR4 is fairly comprehensive and concise. It is structured following the outline contained in the annex to the UNFCCC reporting guidelines. The ERT noted that the transparency of the CAR4 could be significantly improved, especially in the chapters on projections and PaMs. To that end, the ERT formulated a number of recommendations in the course of the review that may help the United States of America to further increase the transparency of its reporting. This includes the recommendation to provide in chapter on

projections sectoral information and information for each gas for the time periods stipulated in the UNFCCC reporting guidelines.

II. National circumstances relevant to greenhouse gas emissions and removals

8. In its CAR4, the United States of America has provided a description of its national circumstances and how these national circumstances affect GHG emissions and removals in the country. During the review, the ERT was provided with additional information, which is reflected in this report, including information provided during meetings with representatives of the executive and legislative branches of the Federal Government, non-governmental organizations (NGOs) and the business community, as well as information provided during a teleconference with state-level authorities, and information contained in the responses to questions submitted to the United States of America during the review.

9. The ERT noted that according to the CAR4, the factors influencing national GHG emission levels, their changes over time, and climate change policy included: economic and population growth; climatic and geographical conditions; transportation and urban structure; industrial and technology development; agriculture, land-use change and forestry; waste management; and government structure. In particular, emission levels are influenced by energy reserves, as well as energy production and consumption patterns, and by the fact that the United States of America remains the world's largest producer and consumer of energy. The diverse geography and climate zones means that the United States of America is susceptible to climate change and variability, as well as unfavourable weather events. The description of national circumstances included all mandatory elements as outlined in the UNFCCC reporting guidelines, however information on the factors affecting GHG emissions and removals, disaggregated indicators, and the relationship between national circumstances and GHG emissions and removals profile are not always clear. Reporting should be enhanced, in particular in the energy, industrial processes and land use, land-use change and forestry (LULUCF) sectors.

10. The population growth of almost 1 per cent per year between the years 2000 and 2005, mainly in the warm regions of the country, resulted in increases in the construction of private houses and in the car fleet in the United States of America. These increases led to significant growth in energy demand in the residential and transport sectors. The economy of the United States of America grew by 13.4 per cent from 2000 to 2005 and the gross domestic product (GDP) stood at around USD 11 trillion in 2005. This growth was mainly driven by growth in the high technology, and the commercial and service sectors, which increased their share of GDP substantially. However, there was a decline in the share of the manufacturing sector. The ERT noted that although the real GDP increased continuously from 1990 to 2005, GHG emissions per capita remained broadly stable and GHG emissions per GDP decreased. The underlying reasons for these trends are not sufficiently elaborated in the CAR4. The ERT encourages the United States of America to enhance the description of specific drivers, which explain the relationship between emissions growth and observed economic trends (para. 8 of the UNFCCC reporting guidelines).

11. In 2005, the total primary energy supply (TPES) in the United States of America reached 2340.3 Mtoe, which is 21.4 per cent higher than in 1990 and 1.5 per cent higher than in 2000. Energy consumption in the industrial sector decreased slightly in 2005, whereas the industry and transport sectors remained by far the largest consumers of energy. Coal remains the dominant energy source, as it provides almost half of the electricity generated. Due to domestic coal mining and relatively low coal prices, coal use has competitive advantages over oil and natural gas, since most oil is imported and oil and natural gas are strongly affected by changes in world market prices. Due to a continued increase in demand for transportation, oil remained the main energy source in 2005, accounting for 41 per cent of the total energy demand, followed by natural gas (24 per cent), coal (23 per cent), nuclear energy (8 per cent), and renewable energy (6 per cent). Land conservation, improved tillage practices in agriculture, and enhanced management and regeneration in forestry, led to the continuous increase in net carbon (C) removals in the LULUCF sector. Table 1 illustrates the national circumstances of the country by providing indicators relevant to GHG emissions and removals.

Table 1. Indicators relevant to greenhouse gas emissions and removals for the United States of America

	1990	1995	2000	2005	Change 1990–2000 (%)	Change 2000–2005 (%)	Change 1990–2005 (%)
Population (million)	250.18	266.59	282.43	296.68	12.9	5.0	18.6
GDP (2000 USD billion using PPP)	7 055.00	7 972.80	9 764.80	10 995.80	38.4	12.6	55.9
TPES (Mtoe)	1 927.44	2 090.00	2 306.63	2 340.28	19.7	1.5	21.4
GDP per capita (2000 USD thousand using PPP)	28.20						
		29.91	34.57	37.06	22.6	7.2	31.4
TPES per capita (toe)	7.70	7.84	8.17	7.89	6.1	-3.4	2.5
GHG emissions without LULUCF (Tg CO ₂ eq)	6 229.04	6 560.94	7 125.88	7 241.48	14.4	1.6	16.3
GHG emissions with LULUCF (Tg CO ₂ eq)	5 529.24	5 742.20	6 390.51	6 431.93	15.6	0.7	16.3
CO ₂ emissions per capita (Mg)	20.23	20.20	21.03	20.44	4.0	-2.8	1.0
CO ₂ emissions per GDP unit (kg per 2000 USD using PPP)	0.72	0.68	0.61	0.55	-15.3	-9.8	-23.61
GHG emissions per capita (Mg CO ₂ eq)	24.90	24.61	25.23	24.41	1.3	-3.6	-2.0
GHG emissions per GDP unit (kg CO ₂ eq per 2000USD using PPP)	0.88	0.82	0.73	0.66	-17.1	-9.6	-25.0

Data sources: (1) GHG emissions data: the United States of America's 2007 greenhouse gas inventory submission;

(2) Population, GDP and TPES data: the International Energy Agency.

Abbreviations: GDP = gross domestic product, GHG = greenhouse gas, LULUCF = land use, land-use change and forestry, PPP = purchasing power parity, TPES = total primary energy supply.

Note: The ratios per capita and per GDP unit are calculated relative to GHG emissions without LULUCF; the ratios are calculated using the exact (not rounded) values and may therefore differ from a ratio calculated with the rounded numbers provided in the table.

12. In the CAR4, the United States of America has provided a summary of information on GHG emission trends by economic sector and by gas for the period 1990–2004. The information provided is complete and consistent with the 2006 national GHG inventory submission. Summary tables, including trend tables for emissions in carbon dioxide equivalent (CO₂ eq) (given in the common reporting format (CRF)), are also provided in an annex to CAR4. However, the ERT noted that the United States of America provided information by sectors that differ from the sectors provided in the “Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories”. The ERT encourages the United States of America to follow the UNFCCC reporting guidelines in its next national communication.

13. During the review, the ERT used additional information contained in the latest inventory submission (2007) of the United States of America, which covers the period from 1990 to 2005, along with the major outcomes of its in-country review held prior to the review of the CAR4. Table 2 provides an overview of GHG inventory-related information. Accordingly, in 2005, the total GHG emissions (excluding emissions and removals from LULUCF) amounted to 7,241,482.12 Gg CO₂ eq and have increased by 16.3 per cent since 1990. The energy sector accounted for 85.6 per cent of the total GHG emissions in 2005 followed by agriculture (7.4 per cent), industrial processes (4.6 per cent), waste (2.3 per cent), and solvent and other product use (0.1 per cent). The LULUCF sector was a net sink equivalent to 11.2 per cent of total national emissions.

14. From 1990 to 2005, the energy sector displayed the highest increase in GHG emissions (19.2 per cent), driven by the energy industries and transport sectors. Industrial processes emissions increased by 11.2 per cent owing to the growth in cement production and intensive use of ozone depleting substances (ODS), however there was a decline in emissions from iron and steel, aluminium, and ammonia (NH₃) production, urea application, chlorodifluoromethane (HCFC-22) production and sulphur hexafluoride (SF₆) use in electrical equipment. Emissions from agriculture increased by 1.1 per cent mainly due to intensive manure management on larger dairy and swine facilities that use liquid systems. The net removals in the LULUCF sector increased by 15.7 per cent as a result of an increase in C stocks due to enhanced land use and forest management. The emissions from the waste sector decreased by 13.9 per cent owing to the increased recovery of landfill gas for energy and flaring as a consequence of Federal and local (that is, state-level) regulations, economic incentive schemes and

methane (CH₄) recovery under the Environment Protection Agency (EPA) Landfill Methane Outreach Program (LMOP).

Table 2. Greenhouse gas emissions by sector in the United States of America, 1990–2005

	GHG emissions (Tg CO ₂ equivalent)					Change (%)		Shares ^a by sector (%)	
	1990	1995	2000	2004	2005	1990–2005	2000–2005	1990	2005
1. Energy	5 202.19	5 525.80	6 069.22	6 181.72	6 201.95	19.2	2.2	83.5	85.6
A1. Energy industries	1 818.34	1 947.87	2 293.46	2 325.90	2 391.57	31.5	4.3	29.2	33.0
A2. Manufacturing industries and construction	863.57	889.76	881.99	882.58	846.58	-2.0	-4.0	13.9	11.7
A3. Transport	1 463.00	1 615.41	1 811.78	1 876.51	1 905.60	30.3	5.2	23.5	26.3
A4. – A5. Other	776.75	805.05	834.98	863.79	832.48	7.2	-0.3	12.5	11.5
B. Fugitive emissions	280.53	267.71	247.01	232.94	225.73	-19.5	-8.6	4.5	3.1
2. Industrial processes	300.08	314.82	338.67	330.64	333.55	11.2	-1.5	4.8	4.6
3. Solvent and other product use	4.30	4.48	4.77	4.28	4.28	-0.4	-10.1	0.1	0.1
4. Agriculture	530.30	526.78	547.36	507.37	536.27	1.1	-2.0	8.5	7.4
5. LULUCF	-699.80	-818.74	-735.37	-810.84	-809.55	15.7	10.1	-	-
6. Waste	192.17	189.05	165.87	165.70	165.43	-13.9	-0.3	3.1	2.3
GHG total with LULUCF	5 529.24	5 742.20	6 390.51	6 378.87	6 431.93	16.3	0.7	-	-
GHG total without LULUCF	6 229.04	6 560.94	7 125.88	7 189.71	7 241.48	16.3	1.6	-	-

Data sources: the United States of America's 2007 greenhouse gas inventory submissions

Abbreviations: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

Note: The changes in emissions and the shares by sector are calculated using the exact (not rounded) values and may therefore differ from values calculated with the rounded numbers provided in the table.

^a The shares of sectors are calculated relative to GHG emissions without LULUCF; for the LULUCF sector, the negative values indicate the share of GHG emissions which was offset by GHG removals through LULUCF.

15. The most important GHG in the United States of America was carbon dioxide (CO₂), contributing to 84.1 per cent of total national GHG emissions expressed in CO₂ equivalent (eq). In 2005, CO₂ emissions were 20.3 per cent above the 1990 level due to the substantial growth in emissions from energy industries and transport (see table 2). CH₄ and nitrous oxide (N₂O) provided 7.3 and 6.4 per cent respectively of the national total GHG emissions, that is, 12.3 and 3.1 per cent lower than in 1990. The decrease in CH₄ and N₂O emissions was mainly caused by the decline in fugitive emissions and emissions from waste. Collectively, fluorinated gases (F-gases), including hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF₆), contributed to 2.3 per cent of the overall GHG emissions in the United States of America. Since 1990, HFCs have displayed the highest increase (294.7 per cent), whereas PFC emissions have decreased by 70.6 per cent and SF₆ emissions have decreased by 49.1 per cent. The ERT noted that these trends were insufficiently explained in the CAR4. The additional information provided during the review indicated that these trends mainly resulted from the intensified use of substitutes for ODS and the decline in aluminium production in the industrial processes sector. The ERT encourages the United States of America to enhance the description of these drivers, which affect the emission trends for each gas.

16. The ERT noted, as they did in the second and third in-depth reviews, that the political and institutional system of the United States of America renders climate change policymaking complex and difficult. In particular, climate change policies and actions proposed by the President (who has executive power), have to be approved by the Congress (which has legislative power). The Congress includes the Senate and the House of Representatives, which have diverse and sometimes competing policy mandates. Hence, the legislative process can be lengthy and cumbersome. This explains why climate policies and actions at the federal level often remain voluntary rather than mandatory in nature. However, sometimes voluntary actions at the federal level can be implemented in conjunction with regulatory approaches and actions at the state level. Many state governments, such as Arizona, California, Colorado, Connecticut, Illinois, Maryland, and Massachusetts are supporting the implementation of climate change mitigation policies and actions through legislation at the state level.

17. As noted in the third in-depth review, the national climate policy of the United States of America continues to be developed through a cooperative inter-agency process that involves more than 20 federal

agencies under the guidance of the high-level Committee on Climate Change Science and Technology Integration (CCCSTI), which is under the Executive Office of the President. The CCCSTI develops strategic policy and technology recommendations and oversees the work of the Interagency Working Group on Climate Change Science and Technology. This Working Group oversees the activities of two programmes: the Climate Change Science Programme (CCSP) led by the Department of Commerce (DOC) and the Climate Change Technology Programme (CCTP) led by the Department of Energy (DOE). In addition, the DOC, DOE and other key federal entities such as the Department of State (DOS), the Department of Defence, the Department of Agriculture (USDA), EPA, the National Airspace Agency (NASA) and other entities, develop and implement their specific programmes that have climate change abatement as a co-benefit.

18. During the in-country review, the ERT was informed of the most recent presidential initiatives, such as the Energy Independence and Security Act 2007 (EISA 2007) launched in December 2007, which attempts to put climate change policy in the United States of America within the broader policy agenda. It is aimed at promoting technological innovation, energy security, and sustainable economic growth, and reducing air pollution. Several other national initiatives and acts have recently been put in place to support the implementation of the EISA 2007. These include: the Executive Order for strengthening environmental, energy and transportation management in the Federal Government; the Farmland Conservation Bill; the targeted support of advanced energy appliances; and the development of hydrogen, bio-diesel, ethanol fuels, and hybrid vehicles in the 2008 budget allocations. Overall, the long-term climate mitigation strategy of the United States of America appears to be increasingly geared towards low-carbon and renewable technologies, and C capture and storage technology, which are supported by market incentives and regulatory initiatives at states level. The ERT encourages the United States of America to describe all relevant initiatives and legal acts in its next CAR.

III. Policies and measures

19. The ERT noted that the CAR4 is generally in line with the mandatory requirements of the UNFCCC reporting guidelines and provides a good overview of the key PaMs, along with the objectives of these PaMs, the GHGs affected, policy instruments and the status of implementation of PaMs. The CAR4 contains, with a few exceptions, a similar set of PaMs to those in the CAR3. Table 3 provides a summary of the reported information on the PaMs of the United States of America. Some of the recommendations from the previous review were taken into consideration to improve reporting in the CAR4. For example, in the CAR4 any federal programmes that were primarily research-oriented, but without quantifiable impacts, have been moved to chapter on research and systematic observation of the CAR4. Also, estimates for historical and future mitigation impacts from individual policies for the years 2002, 2012, and 2020 were reported in the CAR4.

20. The information provided on state actions is still fairly limited and does not help to gain a clear understanding of the potential significance of state-level measures for the reduction of overall GHG emissions in the United States of America. The ERT believes that the United States of America should provide more information on key state actions, followed by a discussion of their emission reduction potential and their importance in complementing national-level efforts (para. 15 of the UNFCCC reporting guidelines).

21. The ERT noted that the impact estimates provided for the various PaMs are not aggregated at the sectoral level because of possible synergies and interactions that could result in double counting. The ERT recommends that these synergies be explored so as to enable a better understanding of the contribution of the various PaMs to the overall trends observed per sector. The ERT noted that the emission estimates from policies provided for 2020 do not demonstrate how the PaMs influence the longer term GHG trends (para. 25 of the UNFCCC reporting guidelines), especially since the figures provided do not account for policy interactions. The ERT recommends that in its next national communication, the United States of America elaborate on how these PaMs are expected to influence the development of GHG emissions in the future.

Table 3. Summary of information on policies and measures

Major policies and measures	Examples/comments
Framework policies and cross-sectoral measures	
Integrated Climate Programme	Revised Guidelines for Voluntary GHG Emissions Reporting; Clean Energy - Environment State Partnership Programme (2010: 73,000 Gg, 2020: 73,000 Gg) Climate Leaders - partners (individual companies) set corporate-wide GHG reduction goals; Climate VISION; US Mayors Climate Protection Agreement.
Energy/electricity/emissions taxation	
Emissions trading	Chicago Climate Exchange, Regional Greenhouse Gas Initiative, and Western Climate Initiative.
Support to research and development	Industrial Technologies Programme/Industrial Assessment centres: provides recommendations to manufacturers by identifying opportunities to improve productivity, reduce waste, and save energy (effect in 2010: 17,600 Gg, 2020: 51,300 Gg).
Energy sector	
Combined heat and power generation	Clean Energy Initiative/Combined Heat and Power Partnership (including gross primary production) – moves market barriers to increased penetration of cleaner, more efficient energy supply (effect in 2010: 29,300 Gg, 2020: 73,300 Gg).
Renewable energy sources	Energy Policy Act (2005) mandates an increase in the renewable content of gasoline; Clean Energy Initiative/Green Power Partnership (including combined heat and power) demonstrates environmental leadership by choosing electricity products generated from renewable energy sources (effect in 2010: 29,300 Gg, 2020: 73,300 Gg); Renewable energy commercialization: wind, solar, geothermal, and biomass (research) (effect in 2010: 5,200 Gg, 2020: 153,500 Gg); Renewable fuel standards and biofuels and biorefinery systems (research).
Energy efficiency improvements	Programmes to improve energy efficiency taking place in various sectors, for example the commercial and residential, industrial, transport, and energy supply sectors: Energy Star-labelled products (effect in 2010: 102,700 Gg, 2020: 148,500 Gg); Energy Star Commercial (effect in 2010: 64,200 Gg, 2020: 93,500 Gg); Energy Star Residential (effect in 2010: 7,300 Gg, 2020: 44,000 Gg); Energy Star Industry (effect in 2010: 21,300 Gg, 2020: 36,700 Gg); Distributed Energy (effect in 2010: 23,800 Gg, 2020: 57,200 Gg); Commercial Building Integration (Rebuild America) (effect in 2010: 500 Gg, 2020: 3,100 Gg); Residential Building Integration (effect in 2010: 3,800 Gg, 2020: 9,500 Gg); Residential Appliance Standards (effect in 2010: 5,100 Gg, 2020: 17,300 Gg); Emerging Building Technologies (effect in 2010: 4,400 Gg, 2020: 25,400 Gg).
Energy sector liberalization	Energy Policy Act (2005) to accelerate market penetration of advanced, clean-energy technologies.
Transport	
Integrated transport planning	Congestion Mitigation and Air Quality Improvement Program; Corporate Average Fuel Economy (effect in 2010: 41,800 Gg, 2020: 76,700 Gg)
Agreements/partnerships	Freedom Car and Fuel Partnership and Vehicle Technologies Program (effect in 2010: 11,500 Gg, 2020: 72,000 Gg) SmartWay in transport works through partnership to increase energy efficiency and energy security (effect in 2010: 33,000 Gg, 2020: 43,000 Gg).
Vehicle and fuel taxes	Energy Policy Act (2005) offers federal tax credits for purchasing hybrid-electric vehicles that are fuel efficient; a 10 cent per gallon tax credit is offered to small producers for up to 15 million gallons of agri-biodiesel produced.
Industrial processes	
Pollution prevention and control	High Global Warming Potential/Environmental Stewardship Initiative (effect in 2010: 35,600 Gg, 2020: 54,300 Gg); Methane Programmes/Coalbed Methane Outreach (effect in 2010: 10,600 Gg, 2020: 12,100 Gg); Methane Programmes/Natural Gas Star (effect in 2010: 30,800 Gg, 2020: 46,900 Gg); Significant New Alternatives Program – facilitates transition away from ozone depleting substances in the industrial and commercial sectors. (effect in 2010: 149,600 Gg, 2020: 222,900 Gg).
Agreements/partnerships	Mobile Air Conditioning Climate Protection Partnership (effect in 2010: 5,500 Gg, 2020: 24,500 Gg); High Global Warming Potential/HFC-23 Partnership (effect in 2010: 16,500 Gg, 2020: 15,400 Gg); Voluntary Aluminium Industry Partnership (effect in 2010: 10,300 Gg, 2020: 10,300 Gg).
Agriculture	AgStar and Environmental Quality Incentives Programme/Conservation Innovation Grants (effect in 2010: 26,100 Gg, 2020: 26,100 Gg); Conservation Reserve Program (effect in 2010: 3,100Gg, 2020: 7,800Gg); Conservation Security Program; Commodity Credit Corporation Bio-energy Program; rural development renewable energy programmes (effect in 2010: 1,200 Gg, 2020: 1,200 Gg).
Waste management	Landfill Methane Outreach Program (effect in 2010: 24,6 00 Gg, 2020: 30,800 Gg); Stringent Landfill Rule (effect in 2010: 9,500, 2020: 9,900 Gg); WasteWise encourages recycling, source reduction, and other progressive integrated waste management activities for reducing GHG emissions (effect in 2010: 20,900 Gg, 2020: 33,000Gg).
Land use, land-use change and forestry	Healthy Forest Initiative – (provides technical and financial assistance with a goal to enhance carbon sequestration and reduce forest fire risk); Forest Land Enhancement Program (cancelled in 2006) (effect in 2010: 2000 Gg, 2020: 2000 Gg).

22. Although information on the methods used for the monitoring, evaluation and estimation of the effects of PaMs was provided during the review, this information is not available in the CAR4. The ERT recommends that the United States of America provide this information in its next national communication (paras. 21 and 23 of the UNFCCC reporting guidelines). The ERT encourages the United States of America to provide quantified estimates for all PaMs presented and their cost efficiency.

23. The CAR4 provides estimates of the effects from PaMs by sector, but the effects on individual gases within each sector are not disaggregated (para. 17 of the UNFCCC reporting guidelines). The ERT recommends that the United States of America report in its next national communication information on PaMs and adhere more closely to the requirements of the UNFCCC reporting guidelines. The ERT encourages the United States of America to maintain consistency in its reporting on PaMs in the summary table and the main text of the national communication. It also encourages the United States of America to highlight any changes or further developments that have affected existing policies, and to include information on when a particular policy was implemented (paras. 18 and 22 of the UNFCCC reporting guidelines).

24. The ERT also noted that more could be done to enhance the transparency of reporting, including providing information on other non-mandatory elements of the UNFCCC reporting guidelines. This could include information on cost, non-GHG mitigation benefits, policies no longer in place, as well as presenting information in a more transparent way, in line with table 1 of the UNFCCC reporting guidelines.

A. Policy framework and cross-sectoral measures

25. Over the past few years, the overall climate policy framework in the United States of America has been largely underpinned by the President's goal to reduce GHG intensity by 18 per cent between 2002 and 2012. Although this goal was expected to improve the GHG emission intensity of the economy by 4 percentage points, (compared to the projected levels of 14 per cent improvement between 2002 and 2012 in the business as usual (BAU) scenario) it was not expected to influence the emission trends in any significant way. This is why the PaMs implemented by the United States of America continued to be for the most part voluntary in nature, with a few exceptions, such as the fuel economy standards in the transport sector or the efficiency standards in the commercial and residential sectors. However, these standards have remained unchanged for more than a decade, and have been lagging behind recent market developments. As noted in the previous review, the United States of America has been successful in the reduction of non-CO₂ emissions from the non-energy sectors, in particular reductions in CH₄ emissions due to highly-targeted and cost-effective approaches. The energy sector, however, in which emissions have been rising) continues to receive little attention.

26. A suit of policies, measures, and policy instruments is presented in the CAR4 as part of the effort by the United States of America to address climate change. As in the CAR3, voluntary approaches reported in the CAR4 account for around half of the federal policy portfolio. Technology development and measures that enable research, along with some regulatory measures (primarily in the transport and waste sectors) are also part of the overall policy framework. During the review, the United States of America explained that voluntary approaches are usually based on strong monitoring and evaluation systems that are put in place to ensure that participants deliver the agreed results. The Party also explained that voluntary approaches mainly target cost-effective opportunities identified through the assessment of market needs and the existing potential for large environmental benefits. The ERT felt that voluntary approaches may not necessarily utilize the full potential for GHG emission reductions in the United States of America. The statutory framework is evolving in the United States of America, with a shift in focus from broadly voluntary to regulatory and incentive-based actions and approaches, such as the EISA 2007 and several bills under consideration in Congress, including the Warner-Lieberman Bill. These new actions and approaches are expected to utilize the emission saving potential, particularly in the areas of renewable vehicle fuel, vehicle mileage standards, and appliance and lighting efficiency. In addition, in April 2008 (after the review visit), the President proposed a goal of: (1) slowing and then

peaking GHG emissions in the power sector over 10–15 years; and (2) slowing and peaking national GHG emissions by 2025, with declines thereafter.

27. The policy overview presented in the CAR4, suggests that market-driven approaches, or approaches that clearly address market barriers and concerns, are becoming more prominent, as markets have the necessary mechanisms to eventually select the most optimal way of emission mitigation. The ERT noted that as of 2008, the climate policy of the United States of America was reshaped to follow four streams: (1) regulations and mandates ('market push'), for example an update of corporate average fuel economy (CAFE) standards and the introduction of renewable fuel standards (RFS); (2) incentive-based approaches ('market pull'), for example tax incentives and loan guarantees of up to USD 38.5 billion; (3) continuation of partnerships with industry, for example ClimateVISION and Climate Leaders programmes; and (4) long-term technology development. The ERT also noted that the climate policies of the United States of America started increasingly to address CO₂ emissions, which have increased by approximately 14 per cent since 1990, according to 2008 greenhouse gas inventory submission.

28. Fossil fuels continue to dominate the market and there are few policy initiatives at the federal level for improving the energy efficiency of electricity generation or internalizing the external costs of CO₂ emissions, which is important for emission trends in the energy supply sector. During the review, the United States of America explained that responsibility for electricity regulation traditionally lies with individual states, many of which have implemented renewable energy standards and CO₂ limitations. A national renewable standard was considered but not passed by Congress as part of the EISA 2007. This can create uncertainty for the renewable energy industry, which requires clear market signals in order to proceed with investments in innovative technologies and programmes. Regarding energy demand, there have been few policies addressing the increasing energy demand in the country, the most notable exception being the Energy Star programme. The EISA 2007 has introduced some additional measures in various sectors, including appliances, buildings, and transport, and for federal government emissions.

29. Policymaking in the area of climate change in the United States of America, in addition to climate concerns and market considerations, were initially driven by air pollution concerns, especially in the transport and industrial sectors. However, more recently, energy security concerns have become increasingly prominent. An attempt to address energy security concerns, short- and long-term energy supply, and, to some extent, climate change concerns, was made in the Energy Policy Act 2005 (EPAAct 2005) and the EISA 2007.

30. The EPAAct 2005 has been the first comprehensive energy act to be passed since 1992. It is aimed at the diversification of energy supply sources by providing tax incentives and loan guarantees. In particular, the EPAAct 2005 provides production tax credit to support nuclear energy (up to USD 6 billion), which is in addition to the appropriation for 2008 for loan guarantees for new nuclear technologies for 2008 (USD 18.5 billion) and support for front-end nuclear fuel cycle activities (USD 2 billion). The Act also provides tax incentives and credits for clean coal (USD 1.65 billion), which is in addition to the appropriation for 2008 for clean coal projects for 2008 (USD 9 billion), and appropriation for 2007 (USD 4 billion), which is shared with renewable energy. The technology deployment tax incentives provided are equal to a total of USD 14.5 billion and the offsets are equal to USD 3 billion. The EPAAct 2005 aims to foster the further development of nuclear energy by providing standby support coverage to indemnify against certain regulatory and litigation delays for the first six new nuclear plants. Overall, the EPAAct 2005 reinforces the leading position of the United States of America on the development of technologies relating to C sequestration, second generation biofuels and fourth generation nuclear stations, in particular through the CCTP. The portfolio of technologies under the CCTP has received an impressive amount of USD 22.1 billion between 2001 and 2008 and another USD 4.4 billion has been requested for 2009. The EPAAct 2005 not only sets new directions for clean energy development, it also provides significant subsidies for the oil and gas industries, which may offset the benefits from the clean energy development.

31. The EISA 2007 was passed by the Congress in December 2007. It builds on the EAct 2005 and is expected to shape future climate change responses by the United States of America. During the review, the ERT was provided with information on the Act, as it was passed after the CAR4 was published. The EISA 2007 is aimed at reducing oil dependence and implements to a large extent the President's proposal to reduce gasoline usage in the United States of America by 20 per cent within the next 10 years (the '20-in-10' proposal). The Act stipulates that vehicle fuel economy standards are to be raised to 35 miles per gallon by 2020, which is an anticipated increase in efficiency of around 40 per cent. The Act also sets more ambitious RFS, by expanding the EAct 2005 and raising the production of renewables to a total of 36 billion gallons by 2020. The act includes efficiency provisions on appliances and introduces over 45 new standards, including energy efficiency standards for lighting that are set to improve lighting efficiency by more than 70 per cent by 2020, and the phasing out of low-efficiency light bulbs (such as incandescent light bulbs) by 2014. The act includes energy programmes concerning federal facilities and commercial, residential, and government buildings (known as the Federal Government Operations Mandate), which are expected to reduce the energy consumption in federal government facilities by 30 per cent and increase renewable fuel use by 20 per cent by 2015. All new federal buildings are expected to be carbon-neutral by 2030. The Act includes research and development programmes on carbon capture and sequestration (CCS) and electricity grid development programmes that aim to have CCS commercially available after 2030.

32. Under the EISA 2007, additional loan guarantees of up to USD 38.5 billion, are allowed, of which USD 18.5 billion supports the construction of new nuclear plants; USD 10 billion goes towards renewable and/or energy-efficient systems and manufacturing, and distributed energy generation, transmission, and distribution; USD 6 billion is used for coal-based power generation and industrial gasification activities; USD 2 billion is used for advanced coal gasification; and USD 2 billion for advanced nuclear facilities.

33. Preliminary estimates suggest that the EISA 2007 may help to reduce GHG emissions by about 6 billion tonnes by 2030. The most recent projections contained in the Annual Energy Outlook (AEO) 2008 suggest that the effect of the EISA 2007 would be equivalent to a reduction of emissions by about 520 Mt CO₂, or 7 per cent of emissions by 2030 compared to the current scenario (from 7,373 Mt CO₂ to 6,851 Mt CO₂). It appears that although the Act is a significant step forward, it may only have a limited effect on emissions in the United States of America which, even under the most optimistic scenario, would be close to 30 per cent above 1990 levels by 2030.

34. Several proposals for bills on domestic emissions trading were under consideration by the Congress during the in-country visit, including the Lieberman-Warner Bill. If the current revised draft of the Lieberman-Warner Bill (which has reached the most advanced stage of consideration compared to the others) were to be implemented, it could lead to the establishment of one of the largest domestic carbon trading schemes in the world, as it covers around 70 per cent of the economy of the United States of America, including the energy, transport, and industry sectors at the federal level. The targets set out in the bill are expected to be achieved through a combination of energy efficiency improvements, renewable energy, CCS, and domestic emission credits known as off-sets. If implemented, the bill could help to reduce emissions from the sectors included in the scheme by around 100 Mt CO₂ annually.

35. Individual states play an important role in energy regulation and standard setting, and play an increasingly important role in the development and implementation of climate change policies in the United States of America, as they often develop initiatives that go beyond federal action, which encourages the introduction of policies at the federal level. One example is the ambitious vehicle fuel standards in California. At the federal level, the important role of individual states in advancing climate change action is often recognized and approaches are developed to support those actions by providing states with the necessary tools. An example for such support is the Clean Energy Environment Strategy (CEESP), which is aimed at advancing clean energy policies at the state level. However, the overall level of coordination and cooperation between state and federal government on climate change is limited.

36. The most notable developments at the state level have been the elaboration of climate change plans by 29 states, the adoption of GHG targets by 18 states (see table 4), the introduction of ambitious RPS (25 plus four voluntary standards) by 29 states, participation by almost 40 states in setting up a climate registry, and the increasing promotion of cap-and-trade schemes over the last years.

Table 4. Overview of major policies, policy instruments, and targets at the state level

Entity	Target	Entity	Target
Arizona: state-wide	2000 levels by 2020	New Hampshire: state-wide	1990 levels by 2010
	50% below 2000 by 2040		10% below 1990 by 2020
California: state-wide	2000 levels by 2010	New Hampshire: Electric Utilities	75-85% below 2001 long-term
	1990 levels by 2020		1990 levels by 2006
California: Major industries state-wide	80% below 1990 by 2050	New Jersey: state-wide	1990 levels by 2020
	1990 levels by 2020		80% below 2006 levels by 2050
Connecticut: state-wide	1990 levels by 2010	New Mexico: state-wide	2000 levels by 2012
	10% below 1990 by 2020		10% below 2000 by 2020
Florida: state-wide	75-85% below 2001 levels in the long term	New York: state-wide	75% below 2000 by 2050
	2000 levels by 2017		5% below 1990 by 2010
Florida: Electric Utilities	1990 levels by 2025	Oregon: state-wide	10% below 1990 by 2020
	80% below 1990 levels by 2050		Stabilize by 2010
Hawaii: state-wide	1990 levels by 2020	Rhode Island: state-wide	10% below 1990 by 2020
Illinois: state-wide	1990 levels by 2020	Vermont: state-wide	1990 levels by 2010
	60% below 1990 levels by 2050		10% below 1990 by 2020
Maine: state-wide	1990 levels by 2010	Virginia: state-wide	75-85% below 2001 long-term
	10% below 1990 by 2020		30% by 2025 (return to 2005)
Massachusetts: state-wide	75-80% below 2003 long-term	Washington: state-wide	1990 levels by 2020
	1990 levels by 2010		25% below 1990 levels by 2035
Massachusetts: Electric Utilities	10% below 1990 by 2020	Western Climate Initiative	50% below 1990 levels by 2050
	75-85% below 1990 long-term		15% below 2005 levels by 2020
Minnesota: state-wide	10% below 1997-1999	Regional Greenhouse Gas Initiative: CO ₂ emissions from power plants	Cap emissions at current levels in 2009
	15% below 2005 levels by 2015	New England Governors and Eastern Canadian Premiers:	Reduce emissions 10% by 2019
30% below 2005 levels by 2025	1990 levels by 2010		
	80% below 2005 levels by 2050		

37. The RPS generally require a certain percentage of the power plant capacity or generation of a given utility to come from renewable sources by a given date. Although these standards are not always climate-driven, depending on the level of ambition, they could result in significant GHG emission savings. However, the EISA 2007, unlike the approach it followed for vehicle fuels, failed to set national standards for renewables under the premise that there is too much variation between the particular circumstances of states on the potential for uptake of renewables. The ERT noted that some states consider this to be a hindrance to the introduction of renewables at the state level because of the constraints introduced by the differential treatment of the various renewable sources, facility location concerns, and lack of capacity.¹

38. One of the most notable developments at the state level has been the decision by some states and regions to introduce cap-and-trade systems, the most marked of which being that developed under the Regional Greenhouse Gas Initiative (RGGI) (10 states), which aims to cap emissions at the 2009 level and then reduce emissions by 10 per cent by 2019. The initial phase of the RGGI involves the allocation

¹ The Energy Information Administration estimated that the RPS at the state level may bring an additional 62 billion KWh of renewable generation by 2030, based on current federal law and policy. This represents a 30 per cent increase on the reference case, or about 10 per cent of the total renewable requirement if a 15 per cent renewable standard were to be implemented at the federal level.

and trading of CO₂ allowances among sources in the power sector only. In a subsequent phase of the RGGI, states and stakeholders will work together to develop reliable protocols for off-sets (that is, creditable reductions outwith the power sector), which may be used to achieve compliance with the cap. The ongoing development of a cap-and-trade system within the Western Climate Initiative (WCI) (7 states) is also noteworthy. The WCI aims to achieve an ambitious emission reduction target of 15 per cent by 2020 compared to 2005 levels for its Member States. In addition, the Climate Registry aims to manage a common GHG emissions reporting system capable of supporting various GHG emission reporting and reduction policies for each Member State and is supported by a robust accounting and verification infrastructure.

39. Cross-cutting measures include voluntary measures that target businesses (such as the Climate VISION, Climate Leaders, and voluntary GHG reporting programmes), states (such as the CEESP programme), and the Federal Government. Climate VISION is one of the programmes developed to try to address the presidential goal of reducing GHG intensity. It is specifically aimed at helping industry develop and deploy cleaner, more efficient energy technologies, and encouraging energy conservation. Since the launch of the programme, the number of participating sectors has risen to 14 and the participants cover about 42 per cent of total GHG emissions. According to the 2008 Climate VISION progress report, overall emissions from the sectors covered have increased since the year 2002, however the growth has been slower than that prior to 2002 and slower when compared to a BAU baseline. The CAR4 does not contain any projected estimates on the impact of Climate VISION, as there are significant overlaps with other programmes such as the Climate Leaders programme, which could lead to potential double counting of the effects. The ERT was informed that the Administration believes that the programme is working well and is delivering the expected outcomes.

40. The Climate Leaders programme, which was announced in 2002 along with Climate VISION, now includes 150 companies that represent 8 per cent of the total GHG emissions and approximately 20 new companies are added per year. Climate Leaders provides companies with a package of tools to help them reach the targets they have set by joining the programme, including targets for the reduction of emissions and the emission intensity of output. Progress has been monitored on a yearly basis and the programme has been very successful, given that 11 companies have already met the goals set. The main limitation of the programme is the lack of administrative capacity to deal with the increasing number of participating companies. CEESP is similar to the Climate Leaders programme in that it provides states with the necessary tools to reach their goals, but unlike the Climate Leaders programme, it does not have a target-setting element.

B. Policies and measures in the energy sector

41. *Energy supply.* In 2005, energy use in this sector accounted for 33 per cent of the total GHG emissions of the United States of America. Fossil fuel continues to dominate energy production in the United States of America, constituting four fifths of the total energy production in 2005. According to the International Energy Agency, the United States of America is among the few developed countries in which the share of fossil fuel consumption in the total energy supply is expected to increase. Dependence on oil remains strong in the transportation sector, whereas coal supplies around half of the energy used to generate electricity and is becoming increasingly attractive as the price of oil and natural gas rise.

42. According to the AEO 2008, despite the incentives in the EISA 2007, coal remains the fuel of choice for electricity generation, and coal consumption is expected to grow and even accelerate after 2020, as coal use for the new coal-fired generating capacity grows rapidly. The coal share in electricity generation is expected to increase from 49 per cent in 2006 to 54 per cent in 2030. Although renewable-based electricity is expected to grow at an even faster rate (73 per cent between 2005 and 2030) than that of coal-based electricity (41 per cent between 2005 and 2030), the share of the former is expected to remain at the level of 12 per cent from the total energy used for electricity generation.

43. From 2004 to 2006, 70–80 per cent of the annual new capacity added in the United States of America was natural gas. Although this could be considered a positive development, as the annual new capacity added for coal remains limited, this has raised concerns because the increasing reliance on natural gas in the United States of America could lead to insufficient supplies and inadequate means for their transmission, higher consumer prices, and increased price volatility. Given increasing energy security concerns, the current growth in energy demand, fuel prices, and environmental considerations, the United States of America is now attempting to diversify further its energy portfolio by spending more on nuclear and renewable energy sources. The ERT noted that in 2006, 22 per cent of the annual new capacity added were from renewables, compared to 11 per cent in 2005 and 2 per cent in 2004. The uptake of renewable energy technology for electricity generation is expected to accelerate further as a result of the improved technologies that are now available, RPS of states, tax credits for production of electricity from renewables (to be put in place before the end of 2008), and higher fossil fuel prices. Currently, there is no new nuclear capacity, however nuclear power capacity is expected to grow from 100 GW in 2006 to 115 GW in 2030, marking a resurgence in the use of nuclear power. This is evident from the proposed 2009 budget allocation under the CCTP, which includes USD 803 million for nuclear energy, USD 622 million for clean coal, USD 613 million for renewables, and USD 498 million for energy efficiency.

44. The federal programmes in place to address emissions from the energy supply are primarily research-enabling, focusing on the development of more efficient technologies and the removal of market barriers. Energy is primarily regulated at the state level. At present, there are no federal policies that internalize the external costs of CO₂ emissions. The Combined Heat and Power (CHP) Partnership is one of the primary measures to ensure the improvement of efficiency in electricity generation. Currently, the United States of America has coal-fired power plants, which have a lower average efficiency compared to some other developed countries for various reasons, such as fuel diversity, the competitive landscape, the age of the capital stock, and the focus on reliability. Reducing emissions from the energy supply is one of the four main goals of the CCTP, which has a budget of USD 4.4 billion for 2009. Thus, the United States of America is focusing on providing the appropriate incentives to accelerate the uptake of the new technologies developed under this programme, such as the ultra-supercritical pulverized coal technology or the integrated gasification combined cycle, and appropriate incentives to accelerate capital stock turnover. In this regard, the EPA 2005 authorized USD 1.65 billion in tax credits for clean coal technologies (USD 800 million to support integrated gasification combined cycle (IGCC) projects for electricity generation; USD 500 million to support advanced coal electricity generation projects other than IGCC projects; and USD 350 million to gasification projects for purposes other than electricity generation). About USD 900 million of this sum has been awarded to support the construction of eight clean coal and advanced gasification projects, and the remaining USD 750 million is due to be awarded soon.

45. The most promising of the programmes presented in the CAR4 in the long term, is the Renewable Energy Commercialization Programme administered by the DOE. The main share of the impact envisaged from this programme comes from large-scale adoption of wind energy, with biomass starting to play an increasingly important role. Overall, the percentage of annual new capacity added with regard to renewables has been increasing (by 22 per cent in 2006), and primarily with regard to added wind capacity. In 2007, installed wind capacity in the United States of America was 15,616 MW, which was an increase of 4,377 MW compared to 2006 projects, and accounted for 25 per cent of the new electric capacity. This is significant, given that in the year 2000 wind capacity was approximately 3,000 MW. The share of other renewables has remained relatively stable over the last seven years, with the most notable increase in added photovoltaic capacity. The commitments of states to the RPS is important, however they would not be able to deliver all of the anticipated benefits. The lack of a policy framework at the federal level makes the RPS less efficient (see paragraph 37 above).

46. Another programme administered by the DOE is the Distributed Energy Programme, which places more fuel-flexible systems near the consumer, helping to avoid transmission and distribution

power losses. Distributed energy systems can also help to reduce emissions by utilizing waste heat created during power generation to enable additional heating and cooling, and humidity control in buildings.

47. During the review, it was acknowledged that the effects of CCS are overestimated in the CAR4. The expected effect in 2012 is 3 Tg CO₂, instead of the reported 30 Tg CO₂, and the reported effect for 2020 was also overestimated. More accurate estimates are expected to be provided in the next national communication.

48. The CHP and the Green Power Partnerships are the two EPA programmes in the area of energy supply reported in the CAR4. The significant increase in efficiency of power generation with CHP results in lower fuel consumption and reduced emissions compared to the separate generation of heat and power, and makes CHP an economically attractive approach for reducing emissions. The DOE and the EPA have committed to double CHP capacity by 2010. This is an ambitious, yet realistic, goal, but the CHP partnership has been slow to take off due to regulatory barriers. For example current regulations do not recognize the overall energy efficiency of CHP or credit the emissions avoided from displaced conventional electricity generation. The Green Power Partnership has been more successful and the voluntary targets set annually continue to be exceeded. In 2007, it helped to increase the size of the voluntary green power market of the United States of America by almost 50 per cent.

49. **Residential and Commercial sectors.** In 2005, energy consumption in this sector accounted for 22 per cent of the total energy consumption of the United States of America. In the last five years, energy consumption in this sector has increased by 6.6 per cent, primarily due to migration to warmer climates, which results in an increased need for air conditioning; an increase in the size of homes; and increasing demand and use of consumer electronics. In the commercial sector, total energy use has also increased over the last five years (by 4.4 per cent) representing 18 per cent of total energy demand and 18 per cent of GHG emissions from fossil fuel consumption in 2005.

50. Despite the high share of the residential and commercial sectors in overall GHG emissions and the observed increasing emission trends, the Energy Star Programme is one of the few federal measures reported in these sectors which is expected to reduce emissions significantly. During the review, the United States of America explained that the regulation of the residential and commercial sectors traditionally falls within the domain of individual states. The Federal Government plays a role in the development of incentive programmes and efficiency standards. The residential appliances standards, which set minimum efficiency requirements for selected appliances and equipment and are administered by the DOE, remained largely unchanged until 2005, at which point a five-year schedule was released for setting new standards as a follow-up to the EPA Act 2005. The new standards are set at such levels that the saving potential from their introduction is equal to just over one tenth of the savings anticipated under the Energy Star labelling programme. The EISA 2007 contains new and expanded requirements, and the DOE has set a five-year schedule for setting new standards, which includes all pre-existing and new EISA standards.

51. Energy Star, which is recognized worldwide, is by far the most important programme in the residential and commercial sector and has various focus areas such as commercial and residential markets and various product groups. It is anticipated that Energy Star will bring the bulk (more than 80 per cent) of the expected emissions reductions in the longer term. Due to the fairly limited administrative capacity of the EPA, which is responsible for the programme, and based on market analysis that indicates that there is higher potential for savings over the next few years in the commercial sector, the programme is expected to place more emphasis on the residential and commercial sector and product labelling.

52. Up to 2007, the main developments in the Energy Star programme were the standardization of measurements for the commercial programme (more than 60,000 homes have been rated), the addition of new focus areas for the labelling programme (more than 2.5 billion labelled products purchased), and the

expansion of the existing homes market in the residential programme (more than 36,000 existing homes were retrofitted).

53. Regarding buildings, the DOE supports three programmes that are primarily research-enabling: (1) Commercial Building Integration; (2) Residential Building Integration (41,000 households built to date) (both of these programmes focus on more efficient building design and construction); and (3) Emerging Technologies for the Building Sector. The latter seeks to develop cost-effective technologies for residential and commercial buildings in order to reduce their energy use by between 60 and 70 per cent. Two other programmes supported by the DOE have a limited impact on emissions, including the State Energy Programme, which gives resources directly to states, and the Weatherization Assistance Programme, which provides resources to enable householders to reduce their energy bills. The Weatherization Assistance Programme was not funded under the current DOE budget request due to the long pay-back period and the resources used for other programmes. The DOE is working on model building codes that could be applied by state and local governments (under the federal system of government of the United States of America building codes are the responsibility of state and local authorities).

54. **Transport sector.** In 2005, emissions from the transport sector rose by around 30 per cent compared to 1990 levels, driven by an increase in activity levels, and a shift in modes of transportation, for example, increased use of modes of transportation with lower efficiency, such as sport utility vehicles, and frozen efficiency standards for vehicles. Energy demand in this sector accounts for almost 28 per cent of the total energy demand in the United States of America, mainly comprising of petroleum products. The number of passenger vehicles rose by around 27 per cent compared to 1990 levels and in 2005, passenger vehicles accounted for around 70 per cent of the energy consumed in this sector. In 2005, vehicle miles travelled in the United States of America increased by 40 per cent compared to 1990 levels. The share of mass transit and rail only accounted for about 1 per cent of the passenger kilometres travelled. The average fuel economy of passenger vehicles has remained almost unchanged at 14.3l/100 km in 1990 and 14.1l/100 km in 2005 due to the frozen CAFE vehicle standards.

55. Recognizing the significant impact of the transport sector on GHG emissions, the United States of America has increased the portfolio of measures addressing emissions from this sector in the last few years, in particular regulatory measures. This represents a clear shift away from the voluntary approaches that were favoured in the past. The most notable first effort has been the introduction of RFS under the EAct 2005, which foresees a share of 7.5 billion gallons of renewable fuels by 2012. The EISA 2007 expanded the provisions of the EAct 2005 and raised the production to 36 billion gallons by 2022, stipulating that by 2022 approximately 15 per cent of the total transportation fuel pool should come from renewable sources. This would increase the use of renewable fuels by 500 per cent. The RFS are allocated between ethanol made from corn starch, mainly until 2015, and advanced biofuels, which are defined as biofuels made from feedstocks other than corn starch, which take over in 2015 and should replace ethanol production by 2021.

56. The EISA 2007 brings another important development that proposes the renewal of fuel efficiency standards and aims for a fuel economy of 6.4 l/100 km by 2020, which is expected to increase efficiency by 40 per cent. This is important, as there have been very few measures put in place to encourage energy efficiency in the transport sector in more than two decades, and because these standards remained fairly steady at 27.5 mpg during that time. The new standard translates to 157g CO₂/km, compared with 163g/km (170g/km for gasoline and 155 g/km for diesel), which were the 2006 auto industry averages for new passenger cars observed in other countries.

57. Among the voluntary programmes in this sector that were reported in the CAR4 is the FreedomCAR, which is a research-enabling programme administered by the DOE. It has the second highest emission reduction potential by 2020 after the CAFE standards. FreedomCAR goes beyond the promotion of hydrogen use and aims to advance technologies such as plug-in hybrids and advanced batteries. Many technology targets in the 2010/2015 timeframe are in the areas of electric propulsion and

storage, and the improvement of the efficiency of internal combustion engines. Thus, independent of the future of hydrogen technologies, the research and development supported by this programme is expected to help the industry achieve the vehicle efficiency mandates of the EPCA 2007.

58. Aviation is responsible for just under than 10 per cent of the overall energy consumption in the transport sector. However, it is expected that travel demand will continue to grow rapidly and associated emissions are projected to increase by 60 per cent by 2025 compared to 2001 levels. One initiative reported in the CAR4 is the aircraft fuel efficiency programme by the Department of Transportation (DOT), which aims to reduce aviation emissions by improving engine technology and operational procedures. The ERT was informed of proposed new legislation that is expected to provide funding for the development of aircraft technology, air traffic procedures, and alternative fuels in order to reduce the environmental impact of aviation. No programmes for the maritime sector are included in the CAR4, however the ERT was informed that the United States of America is currently evaluating policies that could improve the efficiency of vessel movements, port operations, and the transfer of goods between transport modes.

59. Other programmes are the Congestion, Mitigation and Air Quality Improvement Programme (administered by the DOT), which provides investments (USD 8.6 billion dollars) for projects that reduce air pollutants from transportation-related sources over a period of five years (2005–2009). The Smartway Transport partnership (administered by the EPA) focuses on freight transport and aims to make fuel efficiency improvements in the freight industry sectors.

60. **Industrial sector.** Since 1973, the industrial sector has accounted for a gradually decreasing portion of the total energy consumed in the United States of America, falling from 43 per cent to about one third in 2005. This was a result of the decline in industrial output and the reduced share of the energy intensive industry, caused by the economic recession in the past few years. Accordingly, fossil fuel-related CO₂ emissions from this sector have also fallen by about 33 per cent since 1990 and account for about 28 per cent of the total emissions.

61. The four main programmes that address energy use in the industrial sector include three research-enabling programmes administered by the DOE: the Best Practices Programme; the Industrial Assessment Centres (IAC); and the Industrial Technologies Programme (ITP); as well as the Energy Star programme for industry administered by the EPA. All of these programmes are expected to bring comparable emission reductions in the short- and long-term. The scope of the IAC and the ITP has changed slightly over the years, as they have evolved from promoting a sectoral research and development approach to focusing more on energy assessments. This change resulted from the development of the Save Energy Now initiative, which helps industries assess their potential for energy use reduction and enables them to operate more efficiently. Given the success of the Save Energy Now initiative, shown through an increased demand by the industry for further assessments, it is likely that the effects of the IAC and ITP programmes are underestimated in the CAR4. In 2006, 70 per cent of the plants assessed attempted to implement the potential energy cost savings that were identified six months after the assessment. Around 7 per cent of the identified potential energy cost savings have been implemented.

C. Policies and measures in other sectors

62. **Industrial processes.** Research and experience have demonstrated that large, economically attractive emission reductions of non-CO₂ gases can be achieved in the industrial processes sector. This has led the United States of America to undertake a significant effort in this area by employing targeted approaches that are enabled using market analysis. In addition, the boundaries of the targeted industries are very well-defined, which enables a more tailor-made approach. There are a number of voluntary programmes that target non-CO₂ emissions from the industrial sector, which are all administered by the EPA. The most significant by far in terms of estimated impacts is the Significant New Alternatives Programme (SNAP), which is the only regulatory measure in this group of policies.

SNAP was primarily put in place as a result of the requirements of the Montreal Protocol on Substances that Deplete the Ozone Layer and the Clean Air Act. The high emission reduction estimates are a result of the substantial and increasing demand for substitutes for ODS and the relatively high global warming potential of ODS and certain substitutes that would no longer be used because of SNAP. The ERT was informed that the estimates provided in the CAR4 are based upon actions already that have taken and do not include substitutes that are currently under review.

63. In terms of expected emissions reductions, another significant programme is the Natural Gas STAR Programme. It covers 57 per cent of industry and has brought about reductions equal to 231 Mt CO₂ eq since 1993. The Mobile Air Conditioning Partnership was launched in 2004 as part of the High GWP programmes that implement the strategy to control emissions from gases such as HFCs, PFCs and SF₆. This partnership has the potential to deliver significant benefits, depending on the type of refrigerant and type of air conditioning system in place, and is expected to help maintain emissions below 1990 levels beyond the year 2010 for the industries involved.

64. **Agriculture.** The CAR4 describes four programmes coordinated by the USDA and one implemented by the EPA in cooperation with the USDA. During the review, the ERT noted that three of these programmes, the Environmental Quality Incentives Programme (EQIP), the Conservation Reserve Programme (CRP) and AgStar were also included in CAR3, while the Conservation Security Programme (CSP) and the Renewable Energy Systems and Energy Efficiency Improvement Programme are new. In addition, the Commodity Credit Corporation Bioenergy Programme was completed in 2006. In terms of estimated 2005 emission reductions, the EQIP provided for the sequestration of 2.3 Mt CO₂, while the removals due to the CRP were estimated to be as high as 50 Mt CO₂, which is 2 Mt CO₂ higher than in 2001. The implementation of the Renewable Energy Systems and Energy Efficiency Programme enabled a reduction of GHG emissions by 1.0 Mt CO₂ eq between 2002 and 2006. The overall mitigation impact of PaMs is estimated to reached 35.1 Mt CO₂ eq by 2020, with a major contribution from EQIP.

65. Most of the PaMs in the agriculture sector have been designed to promote natural resource conservation and sustainable land management with GHG mitigation as a co-benefit. The programmes are implemented at the federal and regional level on a voluntary basis, but some (EQIP, CRP and CSP) also include financial incentives. Although the United States of America has a system for the monitoring and evaluation of PaMs in agriculture, it considers it to be too soon to provide robust efficiency estimates for these programmes, as they are relatively new.

66. **Forestry.** In 2005, the LULUCF sector was a net sink equivalent to 11.2 per cent of total national emissions. Between 1990 and 2005, the sectoral removals increased by 15.7 per cent, owing to the growth in C stocks due to enhanced land use and forest management. The CAR4 only includes two programmes in this sector: the Forest Land Enhancement Programme (FLEP), which was also presented in the CAR3, and the Healthy Forest Initiative (HFI), which is new. Both are coordinated by the USDA. The main goal of the HFI is to enhance fire protection through improved forest management practices, but the reduction of non-CO₂ emissions from forest fires would be an important co-benefit. The ERT was informed that the FLEP has been terminated for financial reasons, thus it is unlikely that the expected mitigation impact of 0.2 Tg CO₂ by 2020 would be achieved. The ERT noted that the HFI programme was not included in the summary table 4–2 of the CAR4.

67. **Waste management.** In 2004, the United States of America produced 247 million tonnes of municipal solid waste (MSW). The recycling rate between 1990 and 2004 has increased from 16 per cent to 32 per cent. Of the remaining MSW, 55 per cent is landfilled and 14 per cent is combusted. Landfill emissions have declined substantially from 1990 to 2001, as a result of the increase in recycling and in the recovery of CH₄ from landfills. However, since 2001, the increases in the total amount of waste deposited, which was driven by a population increase, have resulted in increases in CH₄ emissions (accounting for 25 per cent of the total CH₄ emissions).

68. Two voluntary programmes and one regulatory measure are in place to address emissions from the waste sector, all of which are administered by the EPA. The LMOP and WasteWise are the most promising of these in terms of estimated impacts. WasteWise has been in effect for 13 years, however the programme will no longer receive funding due to recent budgetary cuts. Between 1995 and 2006, the LMOP brought in total emission reductions equal to 90.5 Mt CO₂ eq, which is much higher than the goal that was set. The one regulatory measure in place is the Stringent Landfill Rule, which currently covers about 50 per cent of landfills. The Rule was developed under the Clean Air Act and has the primary objective of reducing hazardous air pollutants, however it has also led to significant CH₄ emission reductions.

69. The United States of America is a member of an effective international partnership, Methane to Markets, which aims to reduce CH₄ emissions and has the potential to deliver annual reductions in CH₄ emissions of up to 50Mt CO₂ eq by 2015.

IV. Projections and the total effect of policies and measures

A. Projections overview and reporting issues

70. In the CAR4, the United States of America provides GHG emission projections up to 2020, which include both a “with measures” and a “without measures” (or BAU) scenario for 2012 and 2020, with 2004 as the base year for projections. This represents a major improvement on the CAR3, where only one (“with measures”) scenario was reported. The “with measures” scenario assumes full implementation of the climate PaMs reported in the CAR4. The projections are presented relative to actual inventory data, but only for the years 2000, 2002 and 2004. They refer to 2002, which is the base year for the President’s commitment to reduce the GHG intensity of the economy of the United States by 18 per cent by 2012. The projections data appear to be consistent with the inventory data since 1990 provided in the CAR4, as recommended in the UNFCCC reporting guidelines (para. 37), but this is difficult to ascertain, as inventory data are only presented from the year 2000 onwards.

71. Projections data were reported for the years 2012 and 2020, but not for the five-year periods 2005, 2010 and 2015, as recommended in the UNFCCC reporting guidelines (para. 37). This reflects the emphasis given on the domestic GHG intensity target, which is due to be reached by 2012. A graph showing unadjusted inventory data and the “with measures” projections for the period 1990–2020 (as recommended in para. 38) was not included. The ERT was provided with aggregate projections data for these five-year periods during the review visit and these data are presented in this report.

72. Projections are presented on a gas-by-gas basis for the following GHGs: CO₂, CH₄, N₂O, and collectively for the group of F-gases (PFCs, HFCs, and SF₆). The main areas of concern for the ERT about meeting the requirements of the UNFCCC reporting guidelines on projections are: (1) the absence of projections by sector using the same sectoral categories as in the PaMs section (para. 34); (2) the absence of estimated and expected total effect of implemented and adopted PaMs (paras. 39 and 40); (3) the absence of separate projections for each one of the groups of F-gases and for the indirect gases (para. 35); and (4) the absence of separate projections for emissions relating to fuel sold to ships and aircrafts engaged in international transport, (bunker fuels)(para. 36). The CAR4 did not present relevant information on factors and activities for each sector, which would have provided readers with a better understanding of the emissions trends in the period 1990–2020 (para. 48).

73. The CAR4 provides total projections and projections by gas, but projections by sector are missing even though paragraph 34 of the UNFCCC reporting guidelines stipulates that projections should be presented on a sectoral basis, to the extent possible, using the same sectoral categories used in the PaMs section. Information was not provided on factors and activities for each sector, as required in paragraph 48 of these guidelines. The CAR4 explains that since some types of GHG emissions cannot be attributed to a particular economic sector, as the totals are reported only in aggregate. However, this

problem only appears to relate to the allocation of the impacts of some PaMs in the residential and the commercial sectors, and did not prevent the presentation of projections by sector in the CAR3.

74. Projections of bunker fuels were not reported separately in the CAR4. Unlike in the CAR3, projected emissions for these categories were only included in an ‘adjustments’ category, along with projected emissions from the US Territories. As a result, it was not possible for the ERT to separate projected emissions from these two categories.

75. Key underlying assumptions for the projections of the energy sector-related CO₂ emissions, such as GDP and population growth, are only shown for 2020 and such assumptions are not shown in relation to the projections for non-CO₂ emissions (as recommended in para. 47 of the UNFCCC reporting guidelines). In addition, assumptions relating to factors such as residential housing stock, and commercial floor space, which had been provided in the CAR3, were not provided in the CAR4. The CAR4 only provides a short summary of the main differences in the underlying assumptions between the NC3 and the NC4, and does not provide adequate explanations for these differences. Furthermore, sensitivity analysis is reported for key variables that underpin the CO₂ emissions, but there is no discussion relating to the non-CO₂ emissions (as recommended in para. 46 of the UNFCCC reporting guidelines).

76. The National Energy Modelling System (NEMS), which accounts for the interactions between the energy system and the economy, and the AEO 2006 reference case, which underpins the projections reported in the CAR4, are well documented and publicly available. However, adjustments made to the AEO 2006 reference case to produce the BAU scenario have not been explained in a transparent manner in the CAR4.

77. Projected non-CO₂ emissions were estimated by the EPA using inventory-based models and key drivers. For the energy-related projections, these drivers were based on the estimates of economic activity from the AEO 2006. Other sources used for the non-energy related projections were, for example, the EPA landfill model. Projections of CO₂ emissions by source and removals by sink for the LULUCF sector were prepared by the USDA using a C accounting model. Overall, the ERT noted that the description of the methods and the key drivers used for the projections of non-CO₂ gases is not transparent. In addition, the ERT noted that the CAR4 contains limited discussion of the factors that underpin the projected trends in these gases, such as the projected trends in CH₄ emissions from coal mines, livestock, and landfills, as well as the reasons for the significant differences observed in the projections of F-gases between the CAR3 and CAR4, especially in the BAU projection.

78. The ERT noted that there was a lack of transparency in how the effects of PaMs were incorporated into the projections of all gases, especially non-CO₂ gases, which made it difficult to assess the results. In addition, there limited explanation was provided in the CAR4 of the differences observed in the methods employed and the results obtained between the CAR3 and CAR4.

79. The ERT noted that the United States of America did not provide a number of elements required by or recommended in the UNFCCC reporting guidelines. The ERT recommends that the United States of America adhere closely to the requirements of these guidelines, in particular the mandatory requirements. This would enhance the consistency, transparency and comparability of projections.

B. Scenarios, models and assumptions underlying future trends

80. **Scenario definition.** The EPA, with the DOE, its EIA branch, and the USDA prepared projections of the future levels of GHG emissions, which were reported in the CAR4. The projections of the energy-related CO₂ emissions in the BAU scenario were based on those contained in the AEO 2006. These projections were adjusted to remove some residual non-energy related CO₂ emissions and to avoid any double counting with the projections of the non-energy CO₂ emissions, and then included in the CAR4. This resulted in a difference of 244 Tg CO₂ in 2002, 218 Tg CO₂ in 2012 and 188 Tg CO₂ in 2020, between the projections of the energy-related CO₂ emissions presented in the CAR4 and those in

the AEO 2006. The EPA prepared projections of the non-energy CO₂ emissions based on the extrapolation of historic inventory estimates

81. The ERT acknowledged that in the CAR4, the AEO 2006 reference scenario represents (with some adjustments) the BAU projection for energy-related CO₂ emissions. In contrast, the comparable AEO 2002 reference scenario represented the “with measures” projections in the CAR3. As noted in the CAR4, projected estimates of energy-related CO₂ emissions reported under the BAU scenario partially reflect the impact of PaMs outlined in chapter IV of the CAR4, and hence may not strictly represent a “without measures” scenario.

82. The “with measures” scenario was obtained by subtracting the proportion of the total effect of the PaMs reported in chapter IV of the CAR4 from the BAU projections, which was assessed in most cases on a stand-alone basis using partial equilibrium models. Expert judgement was used to account for the extent to which the measures are already included in the AEO projections (in the case of energy-related CO₂ projections) and to account for interactions between various measures, including overlaps, double counting, or synergistic effects.

83. Accordingly, the total effect of PaMs on CO₂ emissions was reduced by 25 per cent in 2012 and 50 per cent in 2020 before subtracting it from the BAU scenario. This reflected the increasing amount of emission reductions resulting from energy efficiency improvements that are already embedded in the AEO baseline scenario. For measures targeting non-CO₂ gases, the estimates presented in chapter IV were reduced by 25 per cent in 2012 and 2020. The ERT noted a lack of transparency in the projections for non-CO₂ gases, as well as a lack of clarity as to which scenario (the BAU or the “with measures”), was initially estimated, and which of the two scenarios was subsequently generated by reducing the total effects of the PaMs.

84. The ERT concluded that the expert judgement approach taken in the CAR4 to integrate the estimates of effects from PaMs in the projections was appropriate. Nevertheless, the assessment appears to have been carried out at the national level in a very aggregated way. The ERT recommends that the United States of America develop further the approach for projections, including by preparing projections at a sectoral level, and report thereon with a more detail in its next national communication. In addition, as the overall effect from PaMs increases in the future (as a result of new PaMs that have been introduced since the CAR4), integrating the assessments of the energy sector PaMs (reported in chapter IV), with the AEO projections using the NEMS model, as was done in the most recent AEO, could have significant advantages. This is important given the rich representation of technology within the NEMS model, including the vintaged (also known as time-dependent) capital, such as power plants, and the tracking of turnover rates. This could reduce the significant risks that can arise from inconsistent assumptions, or the double counting of efficiency or other improvements, for example, in the fuel mix.

85. **Key parameters and assumptions.** Table 5 provides a summary of the key assumptions provided for the projections presented in CAR4, along with a comparison with the assumptions presented in the CAR3. The CAR4 outlines that real GDP of USD 17,541 billion in 2020 is somewhat lower (around 3.3 per cent) than that reported in the CAR3 (USD 18,136 billion). However, the ERT noted that the data provided in the CAR3 suggest that the GDP growth assumptions in the CAR3 and CAR4 are in fact close to identical, for example with around 2.95 per cent annual growth between 2000 and 2020. Regarding the other key assumptions for 2020, the vehicle miles travelled are lower, and prices for oil, gas, coal and gasoline are higher in the CAR4 than in CAR3. However, electricity prices are lower in the CAR4 than in the CAR3, which could at least partly offset the impact from the changes made in the other assumptions.

Table 5. Comparison of key parameters and assumptions underpinning projections as reported in the CAR3 and CAR4

Parameter	CAR3			CAR4		
	2000	2010	2020	2000	2010	2020
GDP ^a (billion USD 2000)	9 828	13 118	17 607	9 817 ^b	NE	17 541
Population	276	300	325	NE	NE	337
Energy intensity (BTUs per USD 2000 GDP)	10 108	8 822	7 433	NE	NE	6 877
Light duty vehicle miles travelled (billions)	2 340	2 981	3 631	NE	NE	3 474
World oil price (USD 2000 /barrel)	29.54	24.89	26.30	NE	NE	41.24
Wellhead natural gas (USD 2000 /tonne)	3.84	3.04	3.47	NE	NE	4.49
Minemouth coal (USD 2000 /tonne)	17.53	15.03	13.63	NE	NE	18.52
Average price of electricity (2000 cents/kwh)	7.35	6.71	6.93	NE	NE	6.64
Average price of gasoline (USD 2000/gallon)	1.63	1.49	1.49	NE	NE	1.90

Abbreviations: BTUs = British Thermal Units, GDP = Gross domestic product, CAR3 = third Climate Action report, CAR 4 = fourth Climate Action Report, NE = Not estimated

Data sources: the United States of America's CAR3 and CAR4

^aTo allow for a comparison, the GDP estimate has been recalculated by the ERT from the estimate reported in the CAR3 in 1996 prices using the United States of America's chain-linked GDP deflator available at:

<http://www.bea.gov/national/xls/gdplev.xls>), as at March 2008 to present the estimates in CAR3 and CAR4 on the same basis in 2002 United States dollars.

^bThis estimate is not provided in the CAR4, but for comparison with the CAR3 is also sourced from <http://www.bea.gov/national/xls/gdplev.xls> as at March 2008.

C. Results of projections

86. A summary of the GHG emission projections reported in the CAR4 is provided in table 6 and is illustrated in figure 1. The summary suggests that in 2012 and 2020, in accordance with the "with measures" scenario, the total GHG emissions are projected to increase steadily to 126 and 136 per cent of 1990 levels, which is 7 and 12 percentage points lower than the projected growth in accordance with the "without measures" scenario, respectively.

Table 6. Summary of greenhouse gas emission projections for the United States of America

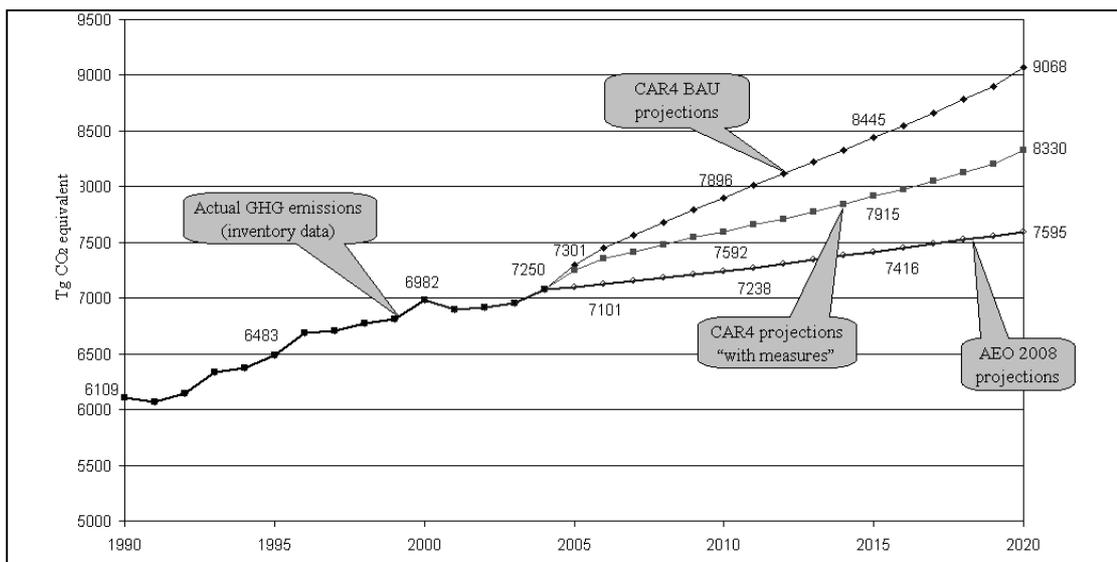
Inventory data and scenarios	GHG emissions (Tg CO ₂ equivalent per year)	Changes compared to base year level (%)
Inventory data 1990	6 109	100
Inventory data 2004	7 074	116
"Without measures" projections for 2010	7 896	129
"With measures" projections for 2010	7 592	124
"Without measures" projections for 2012	8 115	133
"With measures" projections for 2012	7 709	126
"Without measures" projections for 2020	9 068	148
"With measures" projections for 2020	8 330	136

Abbreviations: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

Data source: inventory data are from the United States of America's 2006 GHG inventory submission; the projections data are from CAR4; all inventory and projections data are without LULUCF.

87. The CAR4 provides information on projected trends in emissions intensity (emissions per unit of GDP), given the President's goal to improve the GHG emission intensity of the economy by 18 per cent between 2002 and 2012. When this goal was announced by President George W. Bush in 2002, this target implied a 4 per cent intensity improvement on the then projected levels of 14 per cent improvement. Under the "with measures" projections, the emissions intensity is projected to improve by 18.6 per cent between 2002 and 2012, and hence, the United States of America is projected to meet its domestic emission intensity target for 2012. In absolute terms, this means a 26 per cent increase in emissions in 2012 compared to 1990 levels.

Figure 1. Greenhouse gas emission projections



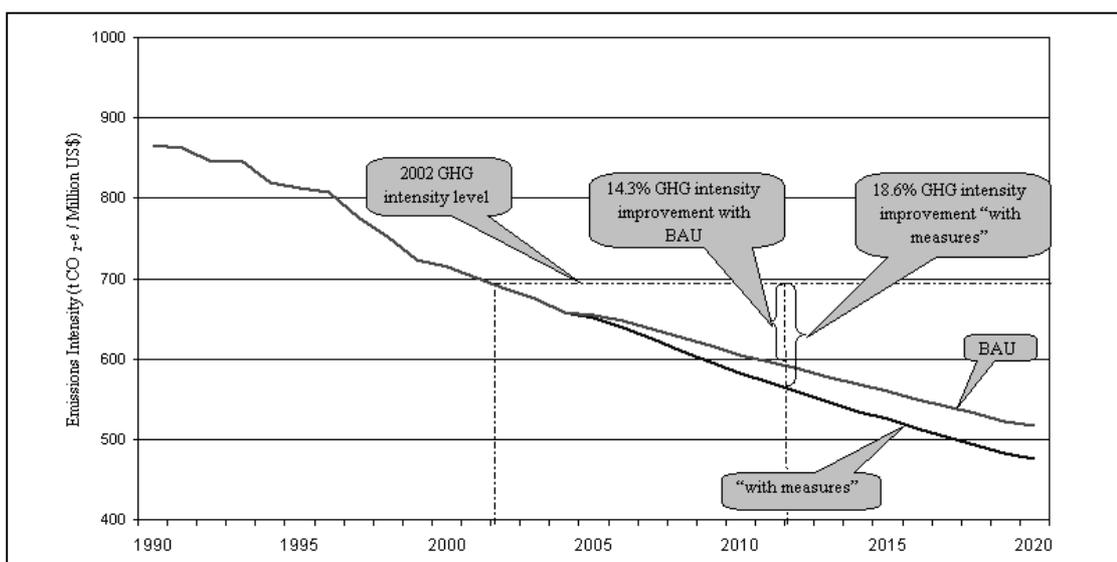
Data source: the CAR4 of the United States of America; the projections are for greenhouse gas emissions without land use, land-use change and forestry.

Abbreviations: AEO = Annual Energy Outlook, BAU = business as usual, GHG = greenhouse gas, CAR4 = fourth Climate Action Report.

Note: The 2008 projections represent projections of the total emissions based on the projections of energy-related CO₂ emissions from AEO 2008 and all other projections taken from CAR4 unchanged.

88. Figure 2 shows the projected improvements in emission intensity of the economy in the CAR4 since 1990. It illustrates that the projected improvement in emissions intensity of 18.6 per cent between 2002 and 2012 in the CAR4 “with measures” scenario is broadly similar to the 18.1 per cent reduction achieved over the previous 10 years from 1992 to 2002. It also illustrates that significant improvements in emission intensity occurred between 1996 and 1999, which was largely attributed to the fall in the level of absolute emissions from industry as a result of a major shift in the economy towards the service sector.

Figure 2. Historical and projected greenhouse gas intensity



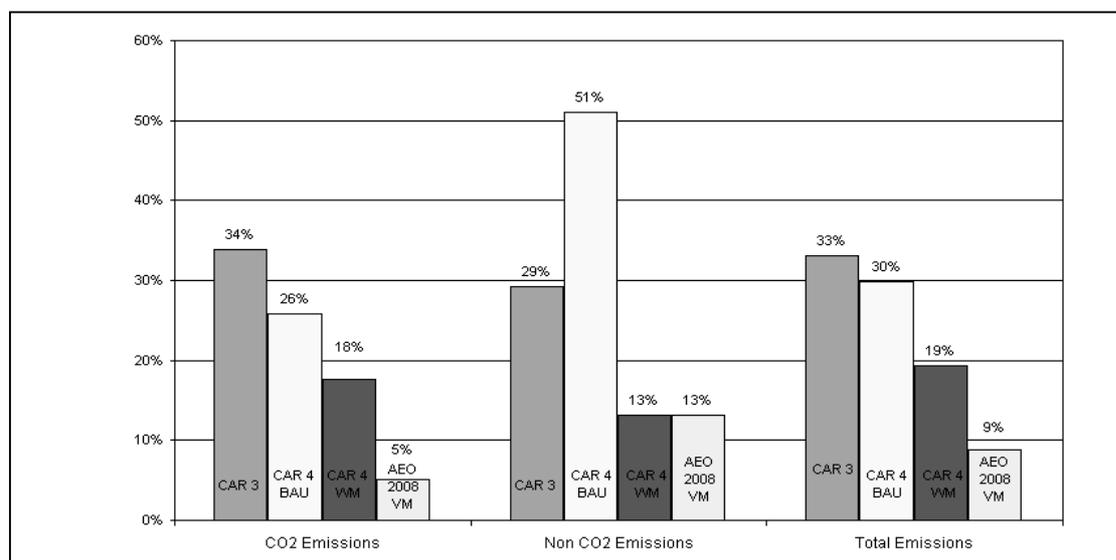
Data source: United States of America CAR4; the projections are for greenhouse gas emissions without land use, land-use change and forestry.

Abbreviations: BAU = business as usual, GHG = greenhouse gas, CAR4 = fourth Climate Action Report.

89. In addition, as shown on figure 1, BAU emissions are projected to grow at a faster rate between 2002 and 2012 than over the previous 10 years, which largely reflects the assumption that the earlier decline in emissions from industry was a ‘one-off’ event, and that the GDP should grow at about the same rate as in the earlier period, which would mean growing a total of 37 per cent over 10 years. As a result, the small effect of the PaMs in the “with measures” scenario essentially offsets this assumed faster level of BAU emissions growth by helping to achieve the 18 per cent emissions intensity target in 2012.

90. Figure 3 shows that the overall growth in total emissions over the period covered in CAR4 is lower than in the CAR3. There is only a slightly lower BAU growth than in the CAR3 scenario (30 per cent compared to 33 per cent in the CAR4). However, the big difference is in the “with measures” scenario, where emission growth is only 19 per cent over the period, hence, the impact of the measures is the key factor driving the change in the projections from the CAR3. The ERT notes that although there are very few new measures presented in the CAR4 compared to the number of new measures that were presented in the CAR3, this mainly appears to represent the effect of the change in methodology used. As outlined in chapter IV, the results differ significantly by major gas category.

Figure 3. Projected growth in emissions without land use, land-use change and forestry, 2000–2020: CAR3, CAR4 and most recent AEO 2008 projections



Abbreviations: AEO = Annual Energy Outlook, BAU = business as usual, CAR3 = third Climate Action Report, CAR4 = fourth Climate Action Report, WM=with measures

Data sources: United States CAR3, CAR4 and the updated CAR4 projection using energy sector emissions contained in the AEO 2008 revised early release.

Note: The 2008 “with measures” projections represent projections of the total greenhouse gas emissions based on the projections of energy-related CO₂ emissions from AEO 2008 and all other projections taken from the CAR4 unchanged.

91. More recent projections published in the AEO 2008 (revised early release as at March 2008) show significantly lower projected growth in energy-related CO₂ emissions compared to the CAR4 projections. In the AEO 2008, energy-related CO₂ emissions in 2020 are projected to be 6,384 Tg CO₂, or over 10 per cent less than the 2020 emissions of 7,119 Tg CO₂ projected in the AEO 2006. This represent a growth in emissions by only 7 per cent between 2005 and 2020, compared to the projected growth in the AEO 2006 of 19 per cent for the same period.²

92. The main changes in assumptions for 2020 in the AEO 2008 compared to the AEO 2006 are lower levels of GDP growth (around 9 per cent lower) and higher oil prices (around 8 per cent higher). The price of natural gas in the AEO 2008 is above the level assumed in the AEO 2006, while coal prices

² 2005 data was not provided in the AEO 2006; the estimate for 2005 in the AEO 2008 has been used for comparability.

are broadly similar in the AEO 2006 and the AEO 2008. The lower level of assumed GDP may reflect, in part, the projected impact of higher oil prices on the economy of the United States of America.

93. In addition, the AEO 2008 includes the projected effect of the EISA 2007 on emissions in the transportation sector, using the impact on fuel standards for renewables and the CAFE standards. The AEO 2008 projects CO₂ emissions from transportation to be over 14 per cent lower in 2020 than that projected in the AEO 2006. However, in addition to the effect of the EISA 2007, these lower projections for the transportation sector reflect the impact of the lower GDP and higher oil price assumptions. These lower transportation emissions account for nearly 50 per cent of the energy sector emissions that are lower in the AEO 2008 than in the AEO 2006. Energy-related CO₂ emissions are also significantly lower in the AEO 2008 than in the AEO 2006 projection in sectors other than transport. Projected emissions in the industrial and residential sectors for 2020 are 11 and 8 per cent lower respectively, which primarily reflects the changed assumptions on economic activity.

94. These new projections for energy-related CO₂ emissions have significant implications for the overall rate of projected growth in total emissions. Assuming that the projections for all the other components were unchanged, the revised energy-related CO₂ projections would imply total growth in emissions (excluding LULUCF) of 9 per cent between 2000 and 2020, compared to the 19 per cent growth shown in the CAR4.

D. Projections by gas

95. Table 7 provides data on projected emissions by gas reported in the CAR3 and the CAR4 for the period 2000–2020. They show projected emissions for the CAR4 “with measures” scenario and the only scenario reported in the CAR3, which was defined as the “with measures” scenario.

Table 7. Projected emissions by gas: CAR3 and CAR4

Greenhouse gases and sectors	GHG emissions in CAR 3			GHG emissions in CAR 4 “with measures”		
	(Tg CO ₂ equivalent per year)			(Tg CO ₂ equivalent per year)		
	2000	2010	2020	2000	2010	2020
Energy-related CO ₂	5 726	6 727	7 655	5 534	5 983	6 447
Non-energy related CO ₂	132	145	161	331	353	396
CH ₄	623	630	611	567	596	621
N ₂ O	433	464	504	416	378	397
GHGs with high GWP	124	208	410	135	295	417
Adjustments	-59	-59	-51	0	-15	52
LULUCF	-1 205	-1 144	-1 053	-760	-806	-709
Total (excluding CO₂ from LULUCF)	6 979	8 115	9 290	6 982	7 591	8 330
Total (including CO₂ from LULUCF)	5 774	6 971	8 237	6 223	6 785	7 621

Abbreviations: GHG = greenhouse gas, GWP = greenhouse warming potential, LULUCF = land use, land-use change and forestry, CAR3 = third Climate Action Report, CAR4 = third Climate Action Report,

Data sources: the CAR3 and CAR4.

Note: For 2010 the ERT used net removal data for LULUCF provided in for 2012, since 2010 data were not provided even though they were requested. The other 2010 data had to be extrapolated from the 2012 data, as this was not provided either

96. **Projections of CO₂ emissions.** In the CAR4, CO₂ emissions are projected to increase by 26 per cent between 2000 and 2020 in the BAU scenario, and by 18 per cent in the “with measures” scenario. The growth in both scenarios in the CAR4 is much lower than the 34 per cent growth in emissions projected in the CAR3 (see figure 3).

97. The growth of energy-related CO₂ emissions by 25 per cent between 2000 and 2020 in the BAU scenario, and by 16 per cent in the “with measures” scenario to a large extent defined the overall growth in CO₂ emissions. By comparison, energy-related CO₂ emissions were projected to grow by 34 per cent over the same period in the CAR3. This lower projected growth in the energy-related CO₂ emissions in the CAR4 compared to that in the CAR3 mainly relates to the assumption regarding oil prices and related gasoline and natural gas prices (as the GDP growth assumptions are, in fact, very similar in the CAR3

and the CAR4). In the CAR4, the oil price assumption for 2020 is USD 41 a barrel, compared to USD 25 a barrel in the CAR3.

98. Non-energy related CO₂ emissions in the CAR4 are projected to grow by 20 per cent between 2000 and 2020 in the BAU and “with measures” scenarios, which reflects an absence of PaMs that aim to reduce the emissions of these gases. Although the rate of growth in the CAR4 is broadly similar to the rate of growth in the CAR3, the CAR4 states that the estimates of non-energy CO₂ emissions presented are around two and a half times higher than those in the CAR3. This reflects the inclusion of significantly more non-energy sources of CO₂ emissions in the inventory of the United States of America.

99. **Projections of non-CO₂ emissions.** In the CAR4, non-CO₂ gases are projected to increase by 51 per cent between 2000 and 2020 in the BAU scenario, and by 13 per cent only in the “with measures” scenario. In contrast to CO₂ gases, the increase of 51 per cent in BAU emissions for non-CO₂ gases in the CAR4 is much higher than the increase of 29 per cent projected in the CAR3 (see figure 3). However, in the CAR4 this increase is more than offset by the effects of measures, which results in overall “with measures” emissions growth of 13 per cent.

100. CH₄ emissions are projected to increase by 18 per cent between 2000 and 2020 in the BAU scenario, and by 10 per cent in the “with measures” scenario. The levels of CH₄ emissions in the CAR4 are reported as being lower than those reported in the CAR3 in absolute terms⁷, due to an improved inventory accounting model in the landfill sector. However, projected emissions for 2020 in the CAR4 at 621 Tg CO₂ eq are higher than the projected emissions of 611 Tg CO₂ eq in the CAR3. The rate of growth in projected CH₄ emissions is significantly higher in the CAR4 than in the CAR3, where projected CH₄ emissions were expected to fall by 2 per cent over the same period.

101. In the CAR4, emissions of N₂O are projected to fall by 4 per cent in the BAU scenario and by 5 per cent in the “with measures” scenario between 2000 and 2020. This is equivalent to an increase on projected emissions in the CAR3 of 16 per cent over the same period. The decrease in emissions is explained by the expected decrease in transportation emissions, but this does not sufficiently explain the projections, given the small share of transportation emissions in the total N₂O emissions.

102. Emissions of gases with high GWP, including PFCs, HFCs, and SF₆, are projected to increase by 361 per cent between 2000 and 2020 in the BAU scenario, and by 209 per cent in the “with measures” scenario. Growth in projected high GWP gases represents the largest area of difference between projected rates of BAU emissions growth between the CAR3 and the CAR4. According to the CAR4, projected estimates of BAU emissions for high GWP gases are 622 Tg CO₂ eq by 2020 compared to only 410 Tg CO₂ eq in the CAR3. The projected rate of growth in BAU emissions between 2000 and 2020 is around 360 per cent in the CAR4, whereas it is only 230 per cent in the CAR3.

103. This higher growth in BAU emissions in the CAR4 is almost exactly offset by the effects from measures targeting the HWP gases (205 Tg CO₂ eq) (such measures were not included in the CAR3 projections) and, hence the overall projected emissions growth is very similar in the CAR4 and the CAR3. The ERT notes that these results are difficult to explain, given that the estimated effect from measures targeting the high GWP gases increased substantially, but overall the level of projected “with measures” emissions is similar to that in the CAR3. The ERT encourages the United States of America to explain these results, including the reasons for the large increase in the BAU projections of non-CO₂ gases.

104. **Carbon sequestration.** The projections of emissions and removals from the LULUCF sector show that this sector is expected to remain a net sink. However, it is unclear why C sequestration is projected to increase up until 2012 and then decrease by 2020. The ERT encourages the United States of America to explain the underlying assumptions and drivers that define the projected increase in the C sequestration rates in 2012 and the drop by 2020.

105. Although the LULUCF sector is expected to remain a net sink in both the CAR3 and the CAR4, the absolute value of the net sink decreased between the CAR3 and CAR4 by almost one third due to changes in the underlying inventory estimates. In addition, the EPA explained that the projected net sequestration of CO₂ in the CAR4 reflects a continuation of trends in land-use management and expected results from the conservation programmes that target the farm sector.

V. Vulnerability assessment, climate change impacts and adaptation measures

106. In the CAR4, the United States of America provides comprehensive information on ongoing and potential impacts of climate variability and change, as well as on the adaptability of key sectors and measures that might be taken to reduce vulnerability. It also provides information on some international programmes and activities, that the country is leading, including activities on international cooperation on adaptation with developing countries (see chapter VII). However, the ERT noted that by presenting the information on climate change impacts and adaptation, the United States of America did not strictly follow the outline for this chapter (paras. 5 and 49 of the UNFCCC reporting guidelines).

107. During the in-country review, the United States of America presented additional information on the outcome of various studies to be completed by the end of 2008 under the CCSP. With an annual budget of around USD 1.5 billion, the CCSP is designed to integrate the individual Earth and climate science missions of 13 participating federal agencies and their international partners. The CCSP was established in February 2002, building on the commitment of the United States of America to research global climate change with the goal to coordinate, research, integrate and synthesize information in order to achieve results that no single agency or small group of agencies could attain.

108. Table 8 summarizes the information on vulnerability and climate change by area (sectors and systems) presented in the NC4 and additional information provided during the in-country review.

109. While the chapter on impact and adaptation in the CAR3 was primarily based on the outcomes of the National Assessment of Potential Consequences of Climate Variability and Change of the United States of America, the relevant information presented in the CAR4 is geared towards addressing mostly high-priority research questions. This is achieved through 21 synthesis and assessment products (SAPs) developed by the CCSP, which were designed to communicate scientific information on ongoing and potential impacts, vulnerability and adaptation to a diverse group of decision makers and stakeholders. The main objective was to facilitate better scientific understanding of adaptation and encourage and facilitate the inclusion of climate change into decision-making and help avoid maladaptation. Improved scientific understanding was considered essential to building resilience into human and natural systems, and hence building resilience into adaptation to climate change. The ERT noted that this marked an evolution in the approach outlined in the CAR3, which placed the emphasis on reliance on the nation's wealth and technological progress to cope with adaptation issues, and not the adoption of specific adaptation policies.

110. The information presented in the CAR4 on adaptation strategies, including sector-specific options, comprised national, regional, and state actions, reflecting the complexity of the national circumstances in the United States of America, including its geographical and climatic diversity. The greatest public interest by far was in the impact of climate change in the North American and Arctic regions. The ERT was informed that in accordance with current plans, once the ongoing studies under the CCSP are completed at the end of 2008, and with the results of the 21 SAPs, these regions are expected to serve as a basis for an integrated national report on adaptation responses. The ERT encourages the United States of America to report on SAPs in its next national communication.

Table 8. Summary information on vulnerability and adaptation to climate change

Vulnerable area	Examples/comments/adaptation measures reported
Biodiversity and natural ecosystems	<p>Vulnerability: it is very likely that vegetation zones will shift, and animal species diversity, ranges and distribution will change based on the Arctic Climate Impact Assessment findings. Critical vulnerable ecosystems identified are wetlands, forests, grasslands, rivers, and lakes.</p> <p>Adaptation: gain insights into the potential impacts of climate change on biodiversity and the vulnerability of forestry, agriculture, and water resources. Characterize and reduce uncertainty associated with specific climate-related issues and provide decision makers with practical scientific information and tools via the Climate Change Science Programme and other mechanisms. Future research should provide knowledge on ecosystem impacts adaptation, and vulnerability will be addressed in three different the Climate Change Science Programme synthesis and assessment products.</p>
Coastal zones	<p>Vulnerability: along most of the coast of the United States of America, the sea level is rising by 2–3 millimetres per year.</p> <p>Adaptation: legislative recognition of potential impacts of climate change in the Federal Coastal Zone Management Act, mandatory preparation of adaptation plans by coastal states. Several states have adopted policies and measures to address impacts of sea-level rise. Many agencies and institutions are developing data that can provide insights into the implications of sea-level rise and adaptation response actions. There are also ongoing mapping efforts related to the implications of the rising sea level.</p>
Water resources	<p>Vulnerability: decline in spring snowfall, substantial declines in snow water equivalent, significant reduction in river runoff, severe and extreme drought, increased salinity of aquifers and estuaries.</p> <p>Adaptation: Climate Programme Office of the National Oceanic and Atmospheric Administration funds eight programmes on Regional Integrated Sciences and Assessments, as part of the Climate Change Science Programme to support decision-making. Regional Integrated Sciences and Assessments programmes include: the Climate Impacts Group, Western Water Assessment, and Climate Assessment for the Southwest. Other initiatives are the Integrated Drought Information System, and the New York City Task Force on Climate Change.</p>
Transportation	<p>Vulnerability: increases in coastal vulnerability, it is expected that changes in the intensity and frequency of coastal storms will affect transportation infrastructure and its operation in coastal states.</p> <p>Adaptation: research projects are providing guidance to transportation planners and decision makers on how to incorporate potential climate change impacts and adapt a response strategy into policy and planning decisions to ensure a reliable and robust future transportation network.</p>
Human health	<p>Vulnerability: emergence and re-emergence of infectious diseases. Mortality and morbidity associated with excessive heat events may be exacerbated.</p> <p>Adaptation: the Division of Vector-Borne Infectious Diseases of the Centres for Disease Control is currently working on studies to outline adaptation measures for vector-borne infectious diseases and the transmission dynamics of malaria and other diseases via el Niño and Hurricane Gilbert; Global Change Research Programme of the Environmental Protection Agency is developing integrated health assessment frameworks and decision support tools that consider the effects of multiple stress, the interactions of multiple stress, and human adaptive responses.</p>

111. The existing 21 SAPs encompass comprehensive analysis of sector-specific impacts on climate variability, change, and vulnerability, including: water and ecosystems, public health and welfare, coastal elevations and sensitivity to sea-level rise, transportation systems and infrastructure, and energy production and use. The analysis shows that as a continuation of the CAR3, the sectors that are potentially most vulnerable to climate change according to the CAR4 include agriculture, water resources, and human health. In view of recent events in New Orleans, some other sectors gained prominence, such as human health and infrastructure, with a focus on disaster preparedness rather than disaster mitigation. The evaluation of the outcomes of the SAPs demonstrated that the understanding of climate impacts on human well-being and vulnerabilities is much less developed than the understanding of the natural climate system. This underpins the increased interest in the development of national climate change information services and tools to enhance adaptive capacity in the United States of America.

112. During the in-country review, the United States of America presented information on the methodologies used for the scenario-based analysis of the vulnerability assessment, which is complementary to the assessments of the Intergovernmental Panel on Climate Change. It also presented information on the review process of both the CCSP studies and SAPs, which aims to ensure the accuracy of the information on sectoral impacts and key federal activities and programmes. The ERT noted the lack of information on methodologies and key scenarios in the CAR4 and recommends that such information be provided in the next national communication.

VI. Financial resources and transfer of technologies

A. Financial resources

113. In the CAR4, the United States of America provided details of measures taken to give effect to its commitments under Article 4, paragraphs 3, 4 and 5, of the Convention as required by the UNFCCC reporting guidelines. In particular, it provided information on financial resources related to the implementation of the Convention through bilateral, regional and other multilateral channels, including the Global Environmental Facility (GEF), and summarized this information using the tabular format in line with the UNFCCC reporting guidelines. Table 9 summarizes information on financial resources.

114. The ERT noted that the United States of America did not provide an indication of what ‘new and additional’ financial resources it has provided pursuant to Article 4, paragraph 3, and how it determined such resources as being ‘new and additional’ as required by the UNFCCC reporting guidelines (para. 51). The United States of America indicated in the review that it considers all funding in any year to be “new and additional”, as the nature of the budget process requires that programmes be justified. It provided limited information on the assistance it has made available to developing country Parties that are particularly vulnerable to the adverse effects of climate change to help them meet the costs of adaptation to those adverse effects. During the review, the United States of America provided additional information and explained that based on the data available, it was not possible to differentiate funds used for mitigation from adaptation. Rather than risk double counting or dividing the funds equally, the United States of America chose to list all funds under mitigation. The ERT recommends that such information be provided in the next national communication as required by the UNFCCC reporting guidelines.

Table 9. Summary of information on financial resources

Contributions to GEF (USD million)	146.90 (2003); 138.40 (2004); 106.64 (2005); and 79.2 (2006).		
Financial contribution to multilateral institutions other than GEF (USD million)	1307.453 (2003); 1402.834 (2004).		
Climate-related aid in bilateral and regional mitigation, adaptation and capacity-building programmes (USD million)	Africa	4,044.15 (2001);	4,601.68 (2004)
	Asia Pacific	54,467.56 (2001);	62,543.81 (2004)
	Europe	1,854.60 (2001);	2,557.42 (2004)
	Latin America/ and Caribbean	71,389.13 (2001);	66,554.53 (2004)
Other global programmes (USD million)	31.41 (2001);		107.86 (2004)
Adaptation programmes in LDCs	USAID: builds on country study programmes of the United States of America for 56 LDCs, which carried out vulnerability assessments to develop national adaptation plans with pilot countries to be incorporated into the guidance manual on adaptation activities for development projects FEWS-NET: a famine early warning systems network that provides early warning and vulnerability issues to address food security in 22 LDCs in Africa (USD 13.0 million). RANET: radio and internet communication of hydro-meteorological and climate-related information for development in Africa, South and South East Asia, and the Western Pacific.		
Climate-related support programmes and technology transfer partnerships	The effort of the Government of the United States of America to promote the transfer of climate-friendly technologies for clean fossil energy, nuclear energy, Methane to Markets, and hydrogen energy partnerships.		

Abbreviations: GEF=Global Environmental Facility, LDCs = Least developed Countries, USAID = United States Agency for International Development.

115. The United States of America provided information on the activities of a number of agencies in the United States of America that aim to provide financial resources and technical assistance, including the US Agency for International development (USAID), the EPA, the DOE, the DOS, the USDA, the National Oceanic and Atmospheric Administration (NOAA), NASA and the DOC. The Party also provided information on trade and development funding provided through USAID, the Overseas Private Investment Corporation, USAID Development Credit Authority and Global Development Alliance, the Export-Import Bank, the Development Credit Authority, and the U.S. Trade and Development Agency.

116. In terms of financial contribution flows, the ERT noted that the financial contribution to the GEF increased until 2003, reaching USD 147 million, and declined thereafter. Conversely, the contribution to the World Bank group increased from USD 783 million in 2001 to USD 909 million in 2004.

Contributions to the other multilateral institutions, funds and programmes do not show a clear trend. For some, contributions increased, for example the Asia Development Fund, whereas for others, contributions decreased, for example the Montreal Protocol Multilateral Fund. In other cases, contributions remained stable, for example the European Bank for Reconstruction and Development.

117. Overall, the attention paid to activities that address vulnerability and adaptation in developing countries is growing. The focus is on furthering the knowledge and capacity to assess vulnerability to climate change, mobilizing adaptation action, building resilience through development assistance, providing early warning and vulnerability adaptation, and providing assistance to governments and populations so that they can cope with hydrometeorological hazards and environmental fluctuations. However, the ERT noted that assistance to developing countries that are particularly vulnerable to the adverse effects of climate change remains modest. The United States of America explained that such assistance is integrated into the various programmes of its agencies, such as USAID, EPA, DOE, the United States Geological Survey, and NOAA, and that it aims to build resilience in the least developing countries through development assistance activities that are aimed at strengthening the capabilities of these countries to respond to the challenges posed by climate-related impacts and risks.

118. The ERT noted the USAID assistance programmes, which seek, among other things, to strengthen the capabilities of programme managers, host country institutions, project implementers, and sectoral experts to assess relative vulnerabilities, and to evaluate and implement adaptation options for agriculture, water and coastal zone management projects within USAID's development assistance portfolio. This includes cooperation on the Famine Early Warning System Network (FEWS NET), which combines data from satellite observations with local meteorological, crop, and livelihood information to provide decision makers with early warnings with regard to food security risks. Similar programmes are being developed to warn about risks of malaria, meningitis, and pests.

119. The ERT also noted the USAID and NOAA implementation of the RANET programme (Radio and Internet for the Communication of Hydro-Meteorological and Climate-related Information for Development), which provides environmental information that assists governments and populations in coping with hydro-meteorological hazards and environmental fluctuations. The programme operates in Africa, South and Southeast Asia, and the Western Pacific, and seeks to strengthen the early warning and response networks by increasing local technical capacity and strengthening networks, developing policy-relevant information, and forming consensus about food security problems and solutions.

120. In addition, the United States of America informed the ERT of its new funding mechanism, the Millennium Challenge Account for development assistance. This account, among others, provides support for vulnerability and adaptation programmes, and provides enhanced support to adaptation activities envisaged in the 2008/2009 financial year budget proposal (USD 60 million). The climate-sensitive sectors identified are agriculture and water resource management. It is hoped that this mechanism will also directly support ongoing adaptation efforts in the small island developing countries.

B. Transfer of technology

121. In the CAR4, the United States of America provided details of measures relating to the promotion, facilitation and financing of, or access to, environmentally- and climate-friendly technologies. The ERT noted that while the United States of America distinguished between activities undertaken by the public sector and those undertaken by the private sector, it reported very limited information on the latter, and the ERT further noted that some foreign direct investment (FDI) information was reported with information on public sector activities (see table 7-4 of CAR4). It did not report explicitly on its activities for financing access by developing countries to 'hard' or 'soft' environmentally-sound technologies as required by the UNFCCC reporting guidelines (para. 55). The ERT noted that capacity-

building, including enhancing endogenous capacities, for example by facilitating the creation of enabling environments and improving conditions for private sector investment, is an element of a number of technology transfer initiatives and programmes led by the United States of America. However, although a significant amount of information was provided, related information on specific endogenous technologies were not reported in the CAR4 (para. 56 of the UNFCCC reporting guidelines). The ERT recommends that the United States of America include such information in its next national communication.

122. The ERT also noted that the United States of America provided information on government agencies that provide trade and development financing to developing and transition countries to facilitate the transfer of technologies, including activities that promote climate objectives through official assistance, export credits, project financing, risk and loan guarantees, and investment insurance to companies in the United States of America, as well as credit enhancements for host country financial institutions. These activities are aimed at leveraging direct investment by decreasing risks associated with long-term projects that are capital-intensive or projects in non-traditional sectors.

123. The United States of America provided information on major country and regional programmes on climate-friendly technology transfer by agencies in the United States of America in developing and transition countries. These include the USAID Climate Change Programme, the Asia-Pacific Partnership on Clean Development and Climate, the International Partnership for the Hydrogen Economy, the Clean Energy Technology Export Initiative, the Carbon Sequestration Leadership Forum, and the Generation IV International Nuclear Energy Research Initiative.

124. The ERT acknowledged the potential of the EPA activities through the Methane-to-Markets Partnership to deliver annual reductions of CH₄ emissions of around 180 Mt CO₂ eq by 2015, which could stabilize or even help reduce the levels of global atmospheric CH₄ concentrations. The ERT also acknowledged the potential of nuclear power in Brazil and South Korea to reduce 375 million tonnes of CO₂ over the lifetime of the new plants. The ERT also acknowledged the significant financial resources provided for technology transfer activities, such as emissions reduction and clean coal technologies for China (USD 1.994 billion in 2004 and 2005), the support for 400 business alliances under the USAID global development alliance programme (USD 1.4 billion), which helped lever more funds (USD 4.6 billion) from partners for technology transfer to reduce GHG emissions growth, and support for the development of climate mitigation technologies in developing countries, such as biofuels in Brazil, wind power technology in India, and solar power development in China.

125. The ERT was informed during the in-country review of a noteworthy initiative by the United States of America to set up a fund to facilitate technology transfer with an initial portfolio of USD 3 billion that would catalyse its efforts to deploy and increase the growth and market share of environmentally-sound and climate-friendly technologies. The fund is expected to facilitate support for building institutional capacities and good governance structures in developing countries, particularly in the large developing economies that have an increasing global share in GHG emissions, such as Brazil, China, and India. The objective is to encourage and sustain an enabling environment for the functioning of capital markets, through which it aims to facilitate access to FDI for funding the transfer of climate-friendly technologies.

VII. Research and systematic observation

126. The United States of America is among the leaders in research on climate and other global environment changes, as it funds a significant proportion of the world's climate change research. In its CAR4, the United States of America has provided information on its actions relating to research and systematic observation, and addresses both domestic and international activities. Key components include the CCSP and the CCTP. The ERT acknowledged that the information provided by the United States of America is in line with the UNFCCC reporting guidelines. The ERT encourages the United

States of America to provide information on fundamental research currently under way that is relevant to climate change.

127. The CAR4 outlined actions taken under the CCSP to support capacity-building in developing countries. The CAR also outlined activities in the area of systematic observation, including on the Global Climate Observation System (GCOS), but did not provide a separate report on these activities (para. 59 of the UNFCCC reporting guidelines). The GCOS programme supports a number of climate observing systems and projects in developing countries. The ERT was informed of recent developments relating to the GCOS, including bilateral programmes in China and South Africa, as well as the support provided for the regional GCOS programme in the Pacific, for example to enhance quality and availability of data to facilitate understanding of climate phenomena such as el Niño. In addition to the GCOS, the United States of America reported on a wide range of activities relating to ocean, terrestrial, and polar observation, as well as on space-based observation and data management issues.

128. The CCTP was created to coordinate and prioritize the investment of the United States of America in climate-related technology research, development, demonstration and commercialization. The focus is on a suite of activities in the area of basic and applied science, which could advance technologies to avoid, reduce, or capture and store GHG emissions on a large scale. An impressive amount of investments in implementing the CCTP (see para. 30 above) are geared towards short- to long-term technology research and development options across four emissions-related strategic goals, including reducing emissions from energy end-use and infrastructure; and energy supply; capturing and sequestering CO₂; reducing emissions of non-CO₂ gases; and enhancing capabilities to measure and monitor GHGs.

129. The United States of America reported on the progress made in multilateral research, including on the International Partnership for the Hydrogen Economy, the Carbon Sequestration Leadership Forum and the Generation IV International Forum (which aims to demonstrate the scientific and technical feasibility of fusion power), and the Global Energy Partnership.

130. The ERT was informed of the recent integrated scenario and portfolio analysis being undertaken by the United States of America under the CCTP to quantify the benefits of advanced technologies under a range of different technology and carbon constraint scenarios. This analysis, which has been undertaken to optimize the CCTP, concluded that: (1) there is a need to accelerate research activities to achieve significant emission reductions; (2) a portfolio approach provides the highest likelihood of success and prevents the risks of relying upon a single type of technology; (3) a research and development emphasis on nuclear power and coal with CCS is expected to result in the highest global return (though over a long time-scale and at higher risk); (4) a policy emphasis on accelerating clean energy and efficient technologies is important to achieving short-term abatement from technology; and (5) investing in climate modelling is important for the solution of technology research and development problems.

VIII. Education, training and public awareness

131. The CAR4, the United States of America has provided contains a wealth of information on a variety of domestic programmes and an extensive list of activities, along with their objectives, in the area of education, training and public awareness, which are reported in line with the UNFCCC reporting guidelines (para. 65). These programmes are administered by approximately 10 different government agencies including the EPA, DOE, NASA, DOT, NOAA, the National Park Services and the Smithsonian Institution, and aim to inform the public of various aspects of climate change, ranging from communicating scientific facts to informing individuals of actions they can take to make a difference. Although it is not mandatory, the ERT noted that it would be helpful for the reader if the activities reported in the CAR4 were grouped according to their objective, as opposed to being presented by agency, with a view to presenting better the focus areas and the type of communication tool selected for

each area. The ERT noted that it would add to the value and clarity of the CAR4 if the activities reported included information on the target audience and the time frame of implementation.

132. A very important development in the area of education compared to the CAR3 is the increasing emphasis on formal education, for which NOAA has legislative authority. The goals of the Climate Literacy Programme launched by NOAA in 2008 are: (1) to help individuals understand the essential principles and fundamental concepts of the functioning of weather and climate, and how they relate to variations in the air, water, land, life and human activities in both time and space; (2) to help individuals communicate about the climate and climate change; and (3) to help individuals make scientifically informed and responsible decisions regarding the climate. The main elements of the Climate Literacy Programme are to align with the National Science Education Standards, expand the National Science Digital Library (NSDL), and help with the professional development of teachers.

133. With regard to awareness-raising activities, the ERT noted the efforts of the EPA, which in addition to the numerous outreach activities (business and industry outreach, and general public outreach through its climate change web page), also provides useful tools to help individuals and organizations identify measures that they can take to reduce GHG emissions, including the climate change wildlife toolkit or the student's energy manual. The EPA, along with the DOE, has also launched the Home Energy Saver initiative as part of the Energy Star programme. The DOE also supports numerous other education and outreach initiatives that focus on increasing energy efficiency and reducing GHG emissions, including the Energy Savers Programme, which is aimed at promoting smart energy use. The EPA has also joined the Department of Interior and the National Park Service to conduct the Climate-Friendly Parks Programme, which aims to reduce the GHG emissions in parks by putting forward action plans. NASA conducts education, training, and public awareness on climate change, using its observational, research, and modelling assets. USAID's Global Climate Change Programme incorporates climate change matters into development projects.

134. Up until recently, education and awareness activities depended, for the most part, on the initiatives of the various agencies to take action, without a formalized process for coordination of these activities or an overall mandate in place. The success of the programmes relied on the partnerships that the agencies were able to establish themselves and the networks they created to channel the necessary information. The ERT was pleased to hear during the review that there is currently an effort to develop a more coordinated approach among agencies through the CCSP.

135. The ERT noted the role of the CCSP in communicating with interested partners in the United States of America and throughout the world on a number of issues, including issues relating to climate variability and climate change science, and learning from interested partners. The Communications Interagency Working Group (CIWG), established in 2004, develops and carries out an implementation plan each year that focuses on disseminating the results of CCSP activities, and making CCSP science findings and products easily available to a diverse audience. In 2008, emphasis is given to the finalization of the Synthesis and Assessment Reports, which cover various climate issues. The Climate Change Science Programme Office, funded and supervised by the agencies and departments that are participating in CCSP, and members of the CIWG support the communications goals of the CCSP.

136. Despite the existing number of interesting and promising activities, the ERT noted that so far there has not been a national climate change campaign on a large scale to inform citizens. The ERT noted that there is not a framework that allows for the proper follow-up and evaluation of the outcomes of the aforementioned programmes, and concerns about the protection of individual data is an issue. The individual agencies try to circumvent this obstacle by requesting feedback and tracking use statistics from the online climate change tools. Having a framework in place at the federal level could enhance the implementation aspects of the various programmes in place.

IX. Conclusions

137. The ERT concluded that, the CAR4 generally provides a good overview of the national climate policy of the United States of America and that the information provided broadly conforms to the UNFCCC reporting guidelines. Key climate change PaMs, GHG inventories, and other issues addressed in the CAR4 are presented in a comprehensive manner. During the review, the ERT was provided with additional information that augmented its understanding of the evolving climate policy, measures, and approaches of the United States of America that are reflected in this report.

138. The ERT acknowledges the wealth of information reported in the CAR4 and noted that the CAR4 could benefit by the establishment of clear links between its various chapters. Currently, the CAR4 makes it difficult to understand how the national circumstances influence the development of emissions in the United States of America, and also how the implemented PaMs influence past and future trends. More specifically, in the chapter on PaMs, although individual policy estimates are presented their ultimate effect on the past or future emission trends should be made clearer. Assessing the evolution of future emissions is also made difficult, as the chapter on projections does not follow the UNFCCC reporting guidelines in several instances, and the link between the impact of PaMs at the sectoral level and emission projections is not always made clear. While the chapter on projections emphasizes data relevant to the GHG intensity goal of the United States of America, it did not strictly follow the UNFCCC reporting guidelines, which require that projections be reported by sector and by gas for set time periods. Specific suggestions for improvement are provided in the relevant section of the report.

139. On the overarching goal of the UNFCCC (Article 4.2(b)) for the Parties included in Annex I to the Convention to return individually or jointly the emissions of GHGs to their 1990 level, the ERT noted that in 2005 the total GHG emissions (excluding emissions and removals from LULUCF) amounted to 7,241,482.12 Gg CO₂ eq, which marks an increase of 16.3 per cent compared to 1990 levels. The energy sector accounted for 85.6 per cent of the total GHG emissions and displayed the highest increase (19.2 per cent) compared to 1990, followed by agriculture (7.4 per cent), industrial processes (4.6 per cent), waste (2.3 per cent) and solvent and other product use (0.1 per cent). The most important GHG in the United States of America was CO₂, contributing to 84.1 per cent of total national GHG emissions.

140. Despite the projected substantial increase in total emissions by 26 per cent by 2012, the “with measures” projections in the CAR4 indicate that the United States of America should reduce its emission intensity by 18.6 per cent between 2002 and 2012, thus reaching its domestic emission intensity goal. This improvement is broadly similar to the 18.1 per cent emission intensity improvement achieved over the previous 10 years from 1992 to 2002. The projected increase of absolute emissions according to the “with measures” scenario is 24 per cent by 2010 and 36 per cent by 2020. The most recent projections published in the AEO 2008 after the in-country visit suggest that emission levels in 2020 could be significantly less (around 10 per cent) than the levels reported in the CAR4. This change was largely driven by the revised assumptions, including lower levels of GDP growth and higher oil and gas prices, and the projected effect on emission levels of the most recent energy bill, the EISA 2007.

141. The ERT noted that the voluntary approaches continue to account for around half of the federal climate change policy portfolio. However, the policy overview presented in the CAR4, makes it clear that market-driven approaches, or approaches that clearly address market barriers and concerns, are beginning to gain prominence. The ERT acknowledged that in 2007 the climate policy of the United States of America was reshaped to follow four streams: (1) regulations and mandates (‘market push’), for example the update of CAFE standards and the introduction of RFS; (2) incentive-based approaches (‘market pull’), for example tax incentives and loan guarantees; (3) partnerships with industry; and (4) technology development. The ERT noted with appreciation that the climate policies of the United States of America are starting increasingly to address CO₂ emissions for which, unlike gases such as CH₄, trends have increased by approximately 14 per cent since 1990.

142. Policymaking in the area of climate change in the United States of America, in addition to climate concerns and market considerations, has been primarily driven by air pollution concerns, especially in the transport and industrial sectors, whereas recently energy security concerns have become increasingly prominent. An attempt to address the concerns of energy security, and to some extent climate change concerns, was made in the EPCA 2005 and the EISA 2007. The EISA 2007 proposes the renewal of the fuel efficiency standards for automobiles, which have remained fairly steady for almost two decades. Preliminary estimates show that collectively, the mandates of the EISA 2007 would prevent 6 billion tonnes of GHG emissions by 2030. This translates to an overall emission reduction of about 520 Mt CO₂, or 7 per cent by 2030, compared to the current scenario.

143. Individual states are playing an increasingly important role in the development and implementation of the climate change policies in the United States of America, often developing initiatives that go beyond federal action, which builds the necessary momentum for the introduction of federal policies. The most notable developments at the state level have been the elaboration by 29 states of climate change plans; the adoption by 18 states of GHG targets; the introduction by 29 states (25, plus 4 voluntary standards) of ambitious RPS that are expected to result in significant GHG emission savings; the participation of almost 40 states in the creation of a climate registry; and over recent years the increasing promotion of cap-and-trade systems, including the RGGI (which is reducing emissions by 10 per cent by 2019 compared to 2009 levels) and the WCI (which is reducing emissions by 15 per cent by 2020 compared to 2005 levels). The ERT noted that the lack of a policy framework at the federal level in a number of areas makes the actions taken at the state level less efficient. This has a particularly negative impact on the implementation of the RPS, as these standards are implemented very differently in each state and their full potential cannot be realized. The ERT recommends that state initiatives be further emphasized in the CAR4, as their contribution to reducing overall GHG emissions in the United States of America may be significant.

144. In the CAR4, the United States of America provides comprehensive information on ongoing and potential impacts of climate variability and change, assessment of possible adaptation by key sectors, and measures that may be taken to reduce vulnerability. However, it does not provide an outline of the national action to implement provisions of the Convention on adaptation. The ERT was pleased to see that the CAR4 is now geared towards addressing high-priority research questions, with the main objective being to facilitate better scientific understanding of adaptation and encourage the incorporation of climate change into decision-making, which helps to avoid maladaptation. This marks some evolution to the approach outlined in the CAR3, in which emphasis was placed on reliance on the nation's wealth and technological progress to cope with adaptation, as opposed to adoption of specific adaptation policies.

145. The information provided in the CAR4 on the implementation of measures taken in the context of Article 4, paragraphs 3, 4 and 5, of the Convention is comprehensive and allows the reader to follow the main trends in providing support to the developing countries. Overall, the attention to activities that address vulnerability and adaptation is growing, compared to the emphasis in the past on mitigation, with actions and projects geared to furthering the knowledge and capacity to assess vulnerability to climate change, mobilizing adaptation action and building resilience through development assistance. However, assistance to developing countries that are particularly vulnerable to the adverse effects of climate change remains modest. Currently a new funding mechanism is being put in place, the Millennium Challenge Account for development assistance, which includes support for vulnerability and adaptation programmes. In terms of overall financial contribution flows, the United States of America has been decreasing its support to the GEF since 2003, however it has increased support to the World Bank. The contributions to other multilateral institutions, funds and programmes do not show a clear trend.

146. Regarding the link between technology transfer and financial assistance, the United States of America reiterated its strategy and focus to support technology transfer by building institutional capacities and good governance structures in developing countries, particularly in the large developing economies that have an increasing global share in GHG emissions. The ERT acknowledged with

appreciation the number of international initiatives led by the United States of America aimed at climate change technology transfer, including the Methane-to-Market Partnership that has a potential to deliver 180 Mt CO₂ savings by 2015, and the very recent initiative to set up a fund to facilitate technology transfer environmentally-sound and climate-friendly technologies with an initial portfolio of USD 3 billion. The Asia-Pacific Partnership is another example of an activity that is focused on deploying advanced technologies in developing countries.

147. The United States of America is among the leaders in research on climate and other global environment changes, as it funds a significant proportion of the world's climate change research. In the CAR4, the United States of America provided a wide range of information on its actions relating to research and systematic observation, addressing both domestic and international activities. There is a clear focus on technology research and development, including technology research and development for reducing emissions from energy end-use and energy supply and non-CO₂ gases; CCS; and measuring and monitoring GHG emissions.

148. Until recently, education and awareness activities depended for the most part on the willingness of the various agencies to take action. There is currently an effort to develop a more coordinated approach among agencies through the CCSP. A very important development in the area of education in the CAR4 is the increasing emphasis on formal education (such as the Climate Literacy Framework). Despite the existing number of interesting and promising activities, it is worth noting that so far there has not been a national climate change campaign on a large scale to inform citizens, or an overall federal framework that supports communication on climate change issues. The ERT noted that there is not a mechanism that allows the proper follow-up and evaluation of the outcomes of these activities and concerns about the protection of individual data is an issue.

Annex I**Documents and information used during the review****A. Reference documents**

“Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications of Annex I Parties”. FCCC/CP/1999/7. Available at: <<http://unfccc.int/resource/docs/cop5/07.pdf>>.

FCCC/IDR.3/USA. Report on the in-depth review of the third national communication of the United States of America. Available at: <<http://unfccc.int/resource/docs/idr/usa03.pdf>>.

FCCC/SBI/2006/INF.2. Synthesis of reports demonstrating progress in accordance with Article 3, paragraph 2, of the Kyoto Protocol. Available at: <<http://unfccc.int/resource/docs/2006/sbi/eng/inf02.pdf>>.

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B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Drew Nelson (DOS), Ms. Kate Larsen (DOS), Mr. Steve Eule (DOE), Mr. William Hohenstein (USDA) and Ms. Camille Mittelhotz (DOT), including additional material on policies and measures and estimates of their effects from Mr. Maurice LeFranc (EPA), Ms. Ashley King (EPA) and Ms. Christa Clapp (EPA).

Annex II**Acronyms and abbreviations**

CDM	clean development mechanisms	JI	joint implementation
CH ₄	methane	kg	kilogram (1 kg = 1 thousand grams)
CHP	combined heat and power	kWh	kilowatt hour
CO ₂ eq	carbon dioxide equivalent	LULUCF	land use, land-use change and forestry
CO ₂	carbon dioxide	Mg	megagram (1 Mg = 1 tonne)
CRF	common reporting format	mg	milligram (1000 mg = 1 gram)
EC	European Community	Mtoe	millions of tonnes of oil equivalent
EIT	economy in transition	N ₂ O	nitrous oxide
EMAS	Environmental Management and Audit Scheme	CAR3	third national communication
ERT	expert review team	CAR4	fourth national communication
ETS	emissions trading scheme	NGO	non-governmental organization
EU	European Union	Nm ³	standard cubic meter
GCOS	Global Climate Observing System	PFCs	perfluorocarbons
GDP	gross domestic product	PPP	purchasing power parities
GEF	Global Environment Facility	RDP	Report demonstrating progress under the Kyoto Protocol
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the weighted sum of CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs and SF ₆ without GHG emissions and removals from LULUCF	RES	renewable energy sources
GWP	global warming potential	SF ₆	sulphur hexafluoride
GWP	global warming potential	SO ₂	sulphur dioxide
HFCs	hydrofluorocarbons	Tg	teragram (1 Tg = 1 million tonnes)
IDR	in-depth review	toe	tonnes of oil equivalent
IEA	International Energy Agency	TPES	total primary energy supply
IPCC	Intergovernmental Panel on Climate Change	UNFCCC	United Nations Framework Convention on Climate Change
ISO	International Organization for Standardization	USD	US dollar
		VAT	value-added tax
