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

Parties included in Annex I to the Convention are requested, in accordance with decision 10/CP.13, to submit a fifth national communication to the secretariat by 1 January 2010. This report presents the results of the in-depth review of the fifth national communication of the United States of America conducted by an expert review team in accordance with the relevant provisions of the Convention.

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I. Introduction and summary

A. Introduction

1. For the United States of America the Convention entered into force on 21 March 1994. Under the Copenhagen Accord, the United States submitted a greenhouse gas (GHG) emissions reduction target in the range of 17 per cent below its 2005 emissions level by 2020, depending on the final energy and climate legislation enacted in the United States.

2. This report covers the in-country in-depth review (IDR) of the fifth national communication (NC5) of the United States, coordinated by the UNFCCC secretariat, in accordance with decision 10/CP.13. The review took place from 12 to 16 March 2012 in Washington DC, United States, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: Mr. Nagmeldin G. Elhassan (Sudan), Mr. Jim Penman (United Kingdom), Mr. Marcelo Rocha (Brazil) and Mr. Julien Vincent (France). Mr. Elhassan and Mr. Penman were the lead reviewers. The review was coordinated by Ms. Sylvie Marchand and Ms. Katia Simeonova (UNFCCC secretariat).

3. During the IDR, the expert review team (ERT) examined each section of the NC5. In accordance with procedures for review, including in-depth reviews, as defined in decisions 2/CP.1 and 9/CP.2, a draft version of this report was communicated to the Government of the United States, 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' NC5 mostly complies 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 United States considered most of the recommendations provided in the report of the IDR of its fourth national communication (NC4).[1] The ERT commended the United States for its improved reporting.

1. Completeness

5. The NC5 covers all sections required by the UNFCCC reporting guidelines. However, the following mandatory elements were missing from, or only partly reported in, the NC5: projections presented on a sectoral basis, to the extent possible, using the same sectoral categories used in the policies and measures section, in particular, non-energy carbon dioxide (CO_2) emissions by sector and relevant information on factors and activities driving the expected emission trends, especially for non-CO_2 and non-energy CO_2 emission projections (see para. 90 below); clarification on how the United States has determined financial resources are 'new and additional' (para. 125 below); activities for financing access by developing countries to 'hard' or 'soft' environmentally-sound technologies (see para. 139 below); and a clear distinction between activities related to technology transfer undertaken by the public sector and those undertaken by the private sector (para. 139 below). Information on the missing items was sought by the ERT during the in-country visit and was provided by the United States. The ERT recommends that the United States

[1] FCCC/IDR.4/USA.

enhance the completeness of its reporting by providing the missing information in its next NC.

2. Transparency

6. The ERT acknowledged that the United States' NC5 provided clear information on most aspects of the implementation of the Convention. The ERT noted that the NC5 is structured following the outline contained in the annex to the UNFCCC reporting guidelines. During the review, the ERT formulated a number of recommendations that could help to further increase the transparency of the United States' reporting on national circumstances (see paras. 9 and 10 below), policies and measures (PaMs) (see paras. 19–22 below), projections and total effects of policies and measures (see paras. 92, 93, 97, 99 and 110 below), financial resources and technology transfer (see para. 127 below), and research and systematic observation (see para. 145 and 154 below). The ERT acknowledged the openness with which the United States responded to questions during the review.

3. Timeliness

7. The NC5 was submitted on 28 May 2010, after the deadline of 1 January 2010 mandated by decision 10/CP.13. The ERT noted with concern the delay in the submission of the NC5.

II. Technical assessment of the reviewed elements

A. National circumstances relevant to greenhouse gas emissions and removals, including legislative arrangements and administrative procedures

8. In its NC5, the United States has provided a concise description of its national circumstances and has elaborated on the framework legislation and key policy documents on climate change. Further technical assessment of the institutional and legislative arrangements for the coordination and implementation of PaMs are provided in chapter II.B.I of this report.

National circumstances

9. In its NC5, the United States has provided a description of its national circumstances, and information on how these national circumstances affect GHG emissions and removals in the United States and how changes in national circumstances affect GHG emissions and removals over time. Information was provided on the government structure, population, geography, climate and relevant economic sectors of the country. The information on the government structure in NC5 does not provide a complete description of the institutions involved in climate change policies and actions. Extensive information and clarifications on this matter were provided to the ERT during the in-country visit. The ERT encourages the United States in its next submission, to enhance its description of the institutions involved in climate policymaking including roles, responsibilities and coordination mechanisms.

10. The ERT noted that the main drivers of GHG emission trends in the United States include significant population and economic growth. Between 1990 and 2009, the country's population grew by around 23 per cent, which is one of the highest rates among advanced economies. During the same period, the economy of the United States grew by around 64 per cent and the total primary energy supply (TPES) grew by about 13.4 per cent. Oil

remained the most important fuel in the primary energy mix and continued to grow, driven by the continued increase in the demand for transportation. Recent years have seen an increased production of shale gas that has visibly increased its share in the TPES, mainly by displacing a percentage of the coal used in electricity generation. Overall, between 1990 and 2009, these changes resulted in a decrease in the emissions intensity of the economy by about 35 per cent per unit of gross domestic product (GDP), and in emissions per capita by about 13 per cent. The ERT acknowledges the improvement in the description of how national circumstances are affecting GHG emissions in NC5 compared with NC4 and encourages the United States to continue enhancing the description of, and the relationship between national circumstances and GHG emissions/removals. Table 1 provides some indicators relevant to the development of GHG emissions and removals in the United States since 1990.

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

	1990	*1995*	*2000*	*2005*	*2009*	*Change (%)*		
						1990–2000	*2000–2009*	*1990–2009*
Population (million)	250.18	266.59	282.41	296.04	307.53	12.88	8.89	22.92
GDP (2000 USD billion using PPP)	7 063.99	8 001.95	9 898.80	11 150.37	11 591.77	40.13	17.10	64.10
TPES (Mtoe)	1 915.00	2 067.21	2 273.33	2 318.86	2 172.11	18.71	–4.45	13.43
GDP per capita (2000 USD thousand using PPP)	28.24	30.02	35.05	37.67	37.69	24.14	7.54	33.49
TPES per capita (toe)	7.65	7.75	8.05	7.83	7.06	5.16	–12.26	–7.73
GHG emissions without LULUCF (Tg CO_2 eq)	6 161.46	6 528.27	7 072.45	7 178.66	6 587.69	14.79	–6.85	6.92
GHG emissions with LULUCF (Tg CO_2 eq)	5 293.37	5 727.30	6 424.13	6 118.28	5 545.72	21.36	–13.67	4.77
CO_2 emissions per capita (Mg)	20.35	20.31	21.13	20.60	17.86	3.79	–15.46	–12.26
CO_2 emissions per GDP unit (kg per 2000 USD using PPP)	0.72	0.68	0.60	0.55	0.47	–16.39	–21.39	–34.28
GHG emissions per capita (Mg CO_2 eq)	24.63	24.49	25.04	24.25	21.42	1.69	–14.46	–13.02
GHG emissions per GDP unit (kg CO_2 eq per 2000 USD using PPP)	0.87	0.82	0.71	0.64	0.57	–18.09	–20.46	–34.84

Sources: (1) GHG emissions data: the United States' 2012 greenhouse gas inventory submission; (2) Population, GDP and TPES data: International Energy Agency.

Note: The ratios per capita and per GDP unit are calculated relative to GHG emissions without LULUCF; the ratios are calculated using the exact (non-rounded) values and may therefore differ from a ratio calculated with the rounded numbers provided in the table.

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.

11. As noted in the previous in-depth review report, the political and institutional system in the United States renders the climate change policymaking process complex and difficult. The Executive Branch of the Government, represented by the President, his Cabinet and the Executive Office is central in the development and implementation of climate policy. The Legislative Branch, which consists of the House of Representatives and the Senate is the primary law-making body. The passing of new legislation, including new climate and energy legislation, requires support from both chambers of the Congress and

the President who signs the relevant bills into law. For example, although the support needed to enact the legislation of a GHG emissions cap-and-trade system received support from the House of Representatives in 2009, it did not pass the Senate. Finally, the Judicial Branch plays a significant role in defining the jurisdiction of the Executive Departments and interpreting the application of climate and energy policies under existing laws.

12. In addition to policies implemented at the federal level, many states have implemented climate and clean energy policies that go far beyond these federal policies. For example, starting from January 2009, several north-eastern and mid-Atlantic states are covered by the first mandatory market-based cap-and-trade system that is designed to reduce GHG emissions. In 2007, five western states launched the Western Climate Initiative (WCI) that aims to cap emissions from the electricity sector and now represents a partnership between California and Canadian provinces. Mandatory renewable portfolio standards (RPS) were introduced in many states and experience gained from the implementation of these policies at the state level can have a catalytic role in the design and implementation of relevant policies at the federal level.

13. The NC5 provides, in the body of the report and in an annex, summary information on GHG emission trends for the period 1990–2007. This information is consistent with the 2009 national GHG inventory submission. During the review, the United States presented to the ERT information on the draft 2012 annual GHG inventory, including data up to 2010, which was subsequently officially reported on 13 April 2012 to the UNFCCC secretariat as part of the United States' 2012 national inventory report submission. The in-depth review report takes this information into account in so far as possible.

14. The ERT acknowledged, with appreciation, the improvement in the Party's inventory relating the use of higher tier methods for methane (CH_4) and nitrous oxide (N_2O) from fuel combustion for electricity generation, and N_2O from agricultural soils. This led to significant changes in the GHG emission estimates compared with the previous submissions. The ERT noted that the Environmental Protection Agency (EPA) launched the Greenhouse Gas Reporting Program, which requires large facilities for all source categories to report accurate and timely GHG emissions inventory data. The ERT commends the United States for the improvement in its methods and also for establishing the Greenhouse Gas Reporting Program. The latter is expected to contribute to further improvements in the quality of the United States' GHG inventory and to better inform future policy decisions.

15. In 2010, the total GHG emissions excluding and including emissions and removals from land use, land-use change and forestry (LULUCF) were 10.4 per cent and 8.6 per cent higher than those in 1990, respectively. Not accounting for LULUCF, the increase since 1990 is mainly attributed to CO_2 emissions, which increased by about 11.9 per cent over this period; emissions of CH_4 decreased by 0.6 per cent; and emissions of N_2O decreased by 4 per cent. Total emissions of fluorinated gases increased significantly during the same period by about 58.2 per cent from their 1990 level, in which hydrofluorocarbons (HFCs) increased by 233.0 per cent and perfluorocarbons (PFCs) decreased by 72.6 per cent while sulphur hexafluoride (SF_6) decreased by 57.0 per cent. Despite the increase in HFC emissions, overall, fluorinated gases still only accounted for a small share of the total emissions excluding LULUCF, around 2 per cent in 2010.

16. The ERT noted that the last three years of data reported in the 2012 GHG inventory submission, which were not reported in the NC5, show that from the peak year in 2007, total GHG emissions excluding LULUCF fell by 2.7 per cent in 2008 followed by an additional drop of 6.2 per cent in 2009, and then rose by 3.3 per cent in 2010. The corresponding data including LULUCF show falls of 3.0 per cent and 7.0 per cent in 2008 and 2009, respectively, followed by an increase of 3.6 per cent in 2010. The decreases between 2005 and 2010 excluding and including LULUCF were 5.2 per cent and 6.1 per cent, respectively. Emissions of CO_2 were responsible for about 95 per cent of the changes

since 2007, with the single most important source category responsible for the year-on-year changes being transport in 2008, and electricity generation in 2009 and 2010.

17. Historically, fossil fuel combustion has been the main source of CO_2 emissions in the United States. In 2010, 85 per cent of the energy consumed in the country was from fossil fuel combustion. Between 1990 and 2010, CO_2 emissions from this source increased by 13.5 per cent, driven primarily by domestic economic growth and increases in emissions from electricity generation and transportation activities. In the long term, population, economic growth, energy price fluctuations, seasonal temperature and technology development are among the main factors influencing the level of CO_2 emissions from fuel combustion. Table 2 provides an overview of GHG emissions by sector from 1990 to 2010.

Table 2
Greenhouse gas emissions by sector in the United States of America, 1990–2010

Sector	*GHG emissions (Tg CO_2 eq)*							*Change (%)*		*Shares[a] by sector (%)*	
	1990	*1995*	*2000*	*2005*	*2008*	*2009*	*2010*	*1990–2010*	*2000–2010*	*1990*	*2010*
1. Energy	5 287.7	5 609.3	6 167.4	6 282.4	6 125.4	5 752.7	5 933.5	12.2	3.1	85.8	87.2
A1. Energy industries	1 837.0	1 968.0	2 318.5	2 431.5	2 390.5	2 175.7	2 289.7	24.6	5.2	29.8	33.7
A2. Manufacturing industries and construction	852.5	875.4	848.8	822.8	812.6	732.2	783.9	–8.0	7.1	13.8	11.5
A3. Transport	1 484.9	1 633.5	1 836.1	1 907.8	1 791.4	1 729.4	1 746.5	17.6	1.0	24.1	25.7
A4.–A5. Other	760.4	782.9	825.5	808.2	782.9	756.1	756.7	–0.5	0.1	12.3	11.1
B. Fugitive emissions	352.9	349.6	338.6	312.2	348.0	359.3	356.7	1.1	–0.7	5.7	5.2
2. Industrial processes	313.9	336.5	349.6	330.1	319.1	268.2	303.4	–3.4	13.1	5.1	4.5
3. Solvent and other product use	4.4	4.6	4.9	4.4	4.4	4.4	4.4	–0.4	–	0.1	0.1
4. Agriculture	387.8	416.3	415.3	424.6	433.8	426.4	428.4	10.5	0.5	6.3	6.3
5. LULUCF	–868.1	–801.0	–648.3	–1 060.4	–1 060.0	–1 042.0	–1 055.1	21.5	1.3		
6. Waste	167.7	161.6	135.3	137.2	138.2	136.0	132.5	–21.0	–2.6	2.7	1.9
GHG total with LULUCF	**5 293.4**	**5 727.3**	**6 424.1**	**6 118.3**	**5 960.9**	**5 545.7**	**5 747.1**	**8.6**	**3.6**		
GHG total without LULUCF	**6 161.5**	**6 528.3**	**7 072.4**	**7 178.7**	**7 020.9**	**6 587.7**	**6 802.2**	**10.4**	**3.3**	**100.0**	**100.0**
International bunker fuels	113.0	100.9	99.5	110.9	135.1	123.6	129.2	14.3	4.5		

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.

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

[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 that was offset by GHG removals through LULUCF. Unless otherwise specified, the term 'total GHG emissions' refers to the aggregated national GHG emissions excluding LULUCF.

B. Policies and measures

18. As required by the UNFCCC reporting guidelines, the United States has provided in its NC5 a comprehensive and well-organized account of its package of PaMs implemented, adopted and planned in order to fulfil its commitments under the Convention. The textual description of the principal PaMs is presented by sector and, where relevant, by gas, and is supplemented by a summary table. Cross-cutting programmes and measures were also presented. The United States provided some information on how it believes PaMs are modifying longer-term trends in GHG emissions and the progress made since the submission of the previous NC. Overall, the NC5 included a PaMs package on a much more ambitious scale than that in the NC4, which relied mainly on voluntary measures.

19. However, the ERT noted that the NC5 did not provide the information that the UNFCCC reporting guidelines ask Parties to provide on the institutional arrangements, and the methods used for monitoring and evaluating the progress of PaMs in mitigating GHG emissions over time. The United States mentioned during the review week that monitoring and evaluation of actual effects of PaMs over time is under consideration.

20. The ERT noted that although the NC5 did not provide information on how the quantitative effects of individual PaMs were estimated, additional information was provided during the review. The NC5 specified that the expected mitigation effects of individual PaMs reported for 2010, 2015 and 2020 did not take into account the potential synergies and interactions between PaMs which can result in the double-counting of mitigation effects. As such, the quantitative estimates provided in NC5 may represent overestimations of the effect of each PaM. Information on these matters was provided during the review. The ERT encourages the United States to explore estimation methods designed to help in avoiding the double-counting of mitigation effects, such as the estimation of a collection of PaMs combined in a single model where synergies and interactions are, to the extent possible, taken into account.

21. The ERT recalls that the recommendations about combining polices to estimate the sectoral effects and concerning methods used to estimate, monitor and evaluate the effects of polices, were among those made in the NC4 review.

22. The ERT noted that the NC5 provided some information on costs and cost savings associated with policies, but that how costs were determined was unclear. The ERT also noted that an estimate of the social cost of carbon was taken into account in some PaMs. The ERT encourages the United States to consider whether costs and benefits of polices can be defined in a systematic way and reported in future NCs.

23. Powerful co-benefits in terms of job creation, economic transformation, reduced oil dependence, and protection of national heritage are clearly identified in the NC5, and co-benefits are sometimes linked to specific climate and energy policies, such as weatherization. Conversely, PaMs for regulating other pollutants can have co-benefits for GHG emissions mitigation. For example, the United States informed the ERT that although more important factors include slowing the growth of electricity demand and reducing natural gas prices, the new regulations controlling mercury and other hazardous pollutants have also increased the likelihood of the retirement of coal- or oil-fired power plants and their replacement by those run on natural gas or other cleaner energy sources. The ERT encourages the United States to identify co-benefits more systematically and report thereon in future NCs.

24. The NC5 provided information on PaMs introduced since NC4. The ERT noted that PaMs already implemented and reported in NC4 have not been discontinued, and that there is nothing to report on PaMs that increase emissions.

25. At the UNFCCC Conference of the Parties (COP) at its fifteenth session in 2009, the United States proposed a GHG emission reduction target in the range of 17 per cent below its 2005 emissions level by 2020, depending on enacted energy and climate legislation, recognizing that the final target would be reported to the secretariat in the light of the enacted legislation. In the longer term, the United States expects to put its economy on a path consistent with a reduction of its emissions by more than 80 per cent by 2050 compared with its 2005 emissions level.

26. The NC5 reported a proposed comprehensive economy-wide energy and climate legislation, the American Clean Energy and Security (ACES) Act also known as the Waxman-Markey Bill, which if enacted would have contained the 2020 and 2050 targets for the United States. To achieve these legislated targets, the Act proposed a cap-and-trade system that would have imposed a limit on the amount of GHG emissions in the United

States and set a market where the permits to emit, distributed to firms, would have been traded in a similar fashion to the European Union's Emissions Trading System. The cap on emissions would have been tightened over the 2012–2050 period to help to ensure that the target would be met. The proposed legislation also foresaw a number of key elements such as enhancing energy efficiency and reducing reliance on oil, stimulating innovation in clean coal technology, accelerating the use of renewable sources of energy, and speeding up economic recovery and job growth, in reshaping the manufacturing sector to respond to the demand for clean energy.

27. Though the ACES Act passed in the House of Representatives, it was later defeated in the Senate in 2010 and the ACES legislation containing the targets and tools to achieve them was not enacted. Furthermore, the United States stated during the review week that it seems unlikely, in the short term at least that a comprehensive piece of legislation including a cap-and-trade system at the federal level will be enacted. As a result, energy and climate policy in the United States relies currently on the use of a range of existing statutory authorities and new regulations, policies, and programmes, as well as actions at the subnational level. Nonetheless, although the reduction target in the range of 17 per cent below 2005 level by 2020 is a not a legally binding international and national commitment, the United States reiterated its reduction commitment at subsequent COPs and during the review week.

28. The climate and energy policy framework in the United States is based on three key pillars: the Clean Air Act (CAA), the American Recovery and Reinvestment Act (ARRA) and the Energy Independence and Security Act (EISA). The CAA was enacted in 1963 to control air pollution and Congress has adopted major revisions to the law several times. In 2007, the United States Supreme Court ruled that the act's definition of an air pollutant encompasses GHGs. The EPA recently undertook several key steps to regulate GHG emissions (see the next section). The ARRA was enacted in 2009 in response to the 2008 economic downturn and appropriates investments for, among others, developing new clean energy technologies and helping to combat climate change. The EISA, enacted in 2007, aims at increasing energy efficiency and the availability of renewable resources, and was extensively discussed in the IDR of NC4 where further information can be found. Table 3 provides a summary of information on the main PaMs of the United States reported in NC5 and based on updated information provided during the review. The NC5 also provided information on other Acts and PaMs at the national, state and city levels that are currently implemented.

Table 3
Summary of information on policies and measures reported in the fifth national communication and updated during the review

Major policies and measures	*Examples/comments*
Policy framework and cross-sectoral measures	
Clean Air Act (1970, 1977 and 1990)	Law that defines the responsibilities of the Environmental Protection Agency for protecting and improving the nation's air quality and the stratospheric ozone layer
American Recovery and Reinvestment Act (2009)	Law enacted as a response to the 2008 economic crisis, which aims, in part, to spur technological advances in science and health, and to invest in environmental protection and other infrastructures that will provide long-term economic benefits
Energy Independence and Security Act (2007)	Law under which many provisions are designed to increase energy efficiency and the availability of renewable energy

Major policies and measures	*Examples/comments*
Executive Order 13514	Sets sustainability goals for federal agencies focusing on improving environmental, energy and economic performance
Policies and measures by sector	
Energy	
Prevention of Significant Deterioration (PSD); Title V Operating Permit Programs: the Tailoring Rule	Requires large new and modified facilities to obtain pre-construction permits (under the PSD Program) reflecting the use of the best available control technologies to limit greenhouse gas (GHG) emissions. Requires large facilities to obtain operating permits (under Title V of the Clean Air Act (CAA)) that include all their CAA requirements, including GHG requirements. Focuses these permitting programmes on large sources (through provisions of the Tailoring Rule)
Proposed Performance Standard Rule for New Fossil Fuel-fired Electric Utility Generating Units	Would limit CO_2 emissions from new fossil-fuel-fired electricity generating units that generate electricity for sale and have a generating capacity larger than 25 MW. Existing sources would not be affected
Renewable Energy Production Incentive	Provides financial incentives for electricity generated by new qualifying renewable energy generation, cost-sharing incentives for research, development, deployment and demonstration (RDD&D) renewable energy technology manufacturing, and 50 % matching grants for small-scale renewable projects
Renewable Portfolio Standard (Renewable Energy Standards)	Provides states with a mechanism to increase renewable energy generation using a market-based approach. Establishes requirements for electric utilities and other retail electric providers to serve a specified minimum percentage (or absolute amount) of customer load with eligible sources of renewable electricity
Biomass Program	Develops a portfolio of research, development and demonstration (RD&D) geared toward biomass feedstocks and conversion technologies. Includes development and deployment of infrastructure and opportunities for market penetration of bio-based fuels and products (55.2 Mt)
Wind Energy Development Program	Provides opportunities for and encourages use of federal public lands for development of wind energy
Nuclear Power Programs	Provides risk insurance against construction and operational delays beyond the control of the plants' sponsors and against liability claims from nuclear incidents. Also provides loan guarantees for new plants and research and development (R&D) support for advanced nuclear technologies (14.4 Mt)
Solar Energy Technologies Program	Supports R&D and deployment of cost-effective technologies toward growing the use of solar energy throughout the nation and the world. Seeks to make solar electricity cost-competitive with conventional forms of electricity by 2015 (2.5 Mt)
SunShot Initiative	Aims at widespread, large-scale adoption of solar energy across America through supporting innovation in this area
Energy Star-labelling Programs: Residential, Commercial, Industry	Labelling programmes to boost the adoption of energy efficient products, practices and services through valuable partnerships, objective measurement tools and consumer education
Coal Technologies Program	Seeks to develop and demonstrate technologies that can increase operating and capture efficiency, and permanently store GHGs in new commercial-scale plants or existing plants. Also includes tax credits (23.1 Mt)

Major policies and measures	*Examples/comments*
Transport	
Renewable Fuel Standards	Implements the Energy Independence and Security Act 2007 changes, including an increased total volume of renewable fuel used in transport, as well as new specific volume standards for cellulosic biofuel, biomass-based diesel, and advanced biofuel in the total volume. Also includes new definitions and criteria for both renewable fuels and the feedstocks used to produce them (138 Mt)
Corporate Average Fuel Economy and Greenhouse Gas Emission Standards	Regulations that aim at achieving GHG emission reductions through the increased fuel efficiency of vehicles. From the fifth national communication (NC5): light-duty trucks and passenger cars (model years (MYs): 2005–2011). After NC5: passenger cars, light-duty trucks and medium-duty passenger vehicles (MYs: 2012–2016); medium- and heavy-duty vehicles (MYs: 2012–2018); and light-duty trucks and passenger cars (MYs: 2017–2025)
Fuel Economy and Environmental Label	Labelling programme for new generation vehicles that provides information on vehicles' fuel economy, energy use, fuel costs and environmental impacts
Federal Transit Investments for Greenhouse Gas and Energy Reduction	Works with public transportation agencies to implement new strategies for reducing GHG emissions and/or reducing energy use within transit operations. Strategies can be implemented through operational or technological enhancements or innovations
Industrial processes	
Significant New Alternatives Policy Program	Facilitates a smooth transition away from ozone-depleting chemicals in industrial and consumer sectors (243 Mt)
Natural Gas STAR Program	Reduces methane emissions from natural gas systems in the United States through the widespread adoption of industry best-management practices (46.9 Mt)
Agriculture and Forestry	
Conservation Reserve Program	Encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to native grasses, wildlife plantings, trees, filter strips or riparian buffers to improve soil, water, wildlife and other natural resources (53 Mt)
Environmental Quality Incentives Program	Offers innovation grants to livestock producers and owners of working farmlands to accelerate the development, transfer, and adoption of innovative technologies and approaches, including those that deliver GHG benefits and improve the quality of nutrient management systems (14.2 Mt)
Waste	
Stringent Landfill Rule	Reduces methane/landfill gas emissions from United States landfills (9.9 Mt)
Landfill Methane Outreach Program	Reduces methane emissions from United States landfills through cost-effective means (30.8 Mt)

Note: The greenhouse gas reduction estimates, given for some measures (in parentheses), are reductions in carbon dioxide or CO_2 eq for the year 2020 as provided in the fifth national communication.

1. Policy framework and cross-sectoral measures

29. United States-wide climate legislation requires support from both chambers of Congress and must also be signed by the President. The main federal entities that have authority to implement legislation on energy and the environment in the United States are

the EPA, on air pollution matters including GHGs; the Department of Energy (DoE), on energy-related matters; and the Department of Transportation (DoT), on fuel-related matters. For many of the climate-related issues, jurisdiction for policymaking is shared by federal, state and local governments. Policy levers at the state and local levels exist in all economic sectors including, among others, GHG emission reduction goals, renewable portfolio standards, building codes and appliance standards, and emerging integrated transport and infrastructure planning.

30. At the federal level, climate policy in the United States is developed through a cooperative inter-agency process that involves the Executive Office of the President (Office of Energy and Climate Change, Domestic Policy Council, National Economic Council, National Security Council, Office of Science and Technology Policy, Council of Environmental Quality and the Office of Management and Budget) and a number of departments and agencies including the EPA, the DoE, the State Department, the Department of Agriculture, DoT and the Department of Interior. In addition, departments and agencies are responsible for implementing existing laws passed by Congress that apply to GHGs or set energy policy.

31. As for reporting to the UNFCCC secretariat, the State Department plays a central coordination role in the climate change area including the preparation and submission of the NCs. The EPA leads the technical inter-agency work in the preparation of the annual GHG inventory reports and the State Department makes the formal submission to the UNFCCC secretariat.

32. The 2009 ARRA, one of the three pillars of the Administration's approach to meeting the GHG emission reduction targets, provides tax breaks and targeted investment over the period 2009 to 2012 intended to stimulate the economy of the United States, reduce oil dependence and cut the pollution that causes global warming. The clean technology component of ARRA made available for disbursement through grants about USD 35 billion over the 2009–2012 period. This is an unprecedented incentive equivalent to about 10 times the annual budget of the DoE for funding clean energy innovation. Total ARRA incentives for clean energy, including also tax incentives and loans, exceeded USD 90 billion. ARRA also led to a USD 17 billion funding authorization for transit and high-speed rail investments. Separately quantified effects of the ARRA are not available. According to the information provided to the ERT during the review, together with the effect of the economic downturn in the 2010s and the increase in the shale gas in the TPES, ARRA is expected to contribute to an emission decrease of around 6 per cent in 2020 below the baseline decrease of 1.5 per cent.

33. The CAA, another pillar of the Administration's approach, is an important law that regulates air pollution, which is relevant to the bottom-up climate change policy process. Application of the CAA to GHG emissions required establishment of a threat to public health and welfare. In 2007, the United States Supreme Court ruled that GHGs are air pollutants under the CAA (Massachusetts v. the EPA), which meant that the EPA had statutory authority to regulate GHG emissions. Then, the EPA issued an 'Endangerment Finding', which stated that current and projected levels of six GHGs threaten public health and welfare, and that motor vehicles contribute to the threat. These findings required the EPA to regulate motor vehicle GHG emissions, and the EPA has proceeded to do so. Once GHGs were regulated pollutants, the act required stationary sources to obtain pre-construction permits based on the use of the best available control technology (see paras. 40–44 and 55–56 below). Most recently, the EPA has proposed performance standards for carbon pollution from new fossil-fuel-fired power plants.

34. The ERT noted the challenge in achieving the 2020 target in the absence of the anticipated cap-and-trade system as part of a comprehensive United States-wide energy and climate piece of legislation. The ERT also noted that achieving the goal from the bottom up

would require further effort using the existing framework as a basis. During the in-country visit, United States officials mentioned that the technical potential for emission reductions remains unchanged in the absence of a cap-and-trade system. They also highlighted that the reductions in GHG emissions from previous years and the projected reductions in energy-related emissions are not solely attributable to the economic down-turn but reflect also factors conducive to achieving further emission reductions while deploying this potential. These factors include higher oil prices and further penetration of shale gas into energy markets, provided this does not drive out other low-carbon and carbon-free energy sources, including renewables.

2. Policies and measures in the energy sector

35. Altogether, emissions from the energy sector accounted for about 87 per cent of total GHG emissions in the United States in 2010. Between 1990 and 2010, GHG emissions from this sector increased by about 12.2 per cent. After a steady increase up to 2007, emissions dropped by 8.6 per cent between 2007–2009 and increased by 3.1 per cent from 2009 to 2010. The drop in emissions over 2007–2009 was driven by lower economic output leading to lower energy consumption, mainly in the transport sector, fuel switching away from coal to natural gas, higher oil prices and an increase in the use of non-fossil energy sources. After a low point in 2009, comparable to the emissions level in 1996, emissions rose in 2010 mainly due to a growth in economic output stimulated by an increase in energy consumption across all sectors and related fossil fuel combustion.

36. Together, petroleum, natural gas and coal accounted for 78 per cent of the total energy production of the United States in 2010 while nuclear energy contributed about 11 per cent. Renewable sources, including biomass, represented 11 per cent of total production. The Energy Information Administration (EIA) Annual Energy Outlook (AEO) 2012 early release projections for 2035 suggest that total primary energy production could rise by 25 per cent from its 2010 level and that these shares could reach 74 per cent for petroleum, natural gas and coal respectively, and 10 per cent for nuclear energy. Renewable sources, including biomass, could account for about 16 per cent of total energy production. In absolute terms, the largest increases in energy production are expected to come from natural gas and biomass.

37. Climate actions in the United States are deployed in the context of the Administration's efforts to reduce the country's dependence on imported oil; to promote energy efficiency; and to change the energy mix towards cleaner sources. To that end, the first goal of the recent 2011 Strategic Plan of the DoE is to catalyse the timely, material and efficient transformation of the nation's energy system, and to secure United States leadership in clean energy technologies. To put this into effect, in its 2012 update to the 2011 Strategic Plan, the DoE has redefined its goal statements include the following: save low income families money and energy through weatherization retrofits; reduce consumer energy use and costs for household appliances; reduce the cost of batteries for electric drive vehicles to help increase the market for plug-in hybrids and all electric vehicles and thereby reduce petroleum use and greenhouse gas emissions; and make solar energy as cheap as traditional sources of electricity.

38. ***Energy supply***. The NC5 sets out specific PaMs affecting energy supply, most of them targeting renewable energy sources or transport; both are discussed in their respective sections below. In addition to PaMs proposed in NC5 that were based on voluntary and incentive-based or research and information actions, the EPA recently took significant steps by addressing the largest stationary sources of emissions from the energy supply sector. The Supreme Court ruling (2007) and findings (2009), which lead the EPA to regulate GHGs from mobile sources implied that the EPA also had to regulate emissions from

stationary sources (see the Tailoring Rule and the New Source Performance Standards in paras. 40 and 43 below).

39. The EPA has good knowledge of the distribution of emissions by type of stationary source because of information gathered under the Greenhouse Gas Reporting Rule (GGRR), put into effect under the legislative umbrella of a request from Congress in the 2008 Consolidated Appropriations Act. The rule requires reporting of GHG emissions by all facilities that release annual emissions equal to at least 25,000 tonnes (t) CO_2 eq, and covers some 80 per cent of total United States emissions. In January 2012, the EPA made public the first set of data gathered under the GGRR. The information is relevant to regulation under the CAA, whether directly or by states, and the major increase in transparency of emissions reporting that it represents may lead to voluntary action even in the absence of regulation.

40. Being legally required by the CAA to oblige large stationary sources to obtain a permit before construction or major modifications, the EPA decided to address these sources through the Prevention of Significant Deterioration (PSD) and Title V Operating Permit Programs. But since the thresholds for the acceptable level of GHG pollution were the same as for any other pollutant under the CAA – 91 to 227 t CO_2 eq per year[2] – the number of permits required would have overwhelmed the capacity of permitting authorities and delayed issuance of pre-construction permits for new facilities. The EPA Tailoring Rule was designed to prevent this outcome. As a result, only the largest new and modified sources, such as power plants, refineries and cement manufacturers, are currently required to obtain pre-construction permits.

41. After the completion of the three phases of implementation of the rule, the EPA estimates that facilities responsible for nearly 70 per cent[3] of national GHG emissions from stationary sources will be subject to permitting requirements. There are three phase-in steps under the Tailoring Rule: (i) 1 January–30 June 2011 – only new sources, or modifications to existing ones, that would trigger PSD for another pollutant anyway and that are expected to emit at least 68,039 t CO_2 eq per year are included; (ii) 1 July 2011–30 June 2013 – all new sources are expected to emit at least 90,718 t CO_2 eq per year and modifications that would add at least 68,039 t CO_2 eq per year are included; and (iii) July 2012 – streamlining of the permitting process and the thresholds are maintained.

42. To obtain a permit, industrial facilities need to install the best available control technology (BACT) that is based on the maximum degree of control that can be achieved. Other conditions include air quality and impact assessment analyses. As each facility is different, it requires a case-by-case decision that considers energy, environmental and economic impact. Examples of BACT include fuel cleaning and innovative fuel combustion techniques. The AEO2012 early release did not include the amount of GHGs expected to be avoided by the implementation of the PSD. As of 10 June 2012, several dozen large industrial sources of GHGs – such as cement plants, power plants, refineries and steel mills – had received permits under these programmes.

43. The EPA took another significant step in March 2012 when it proposed a New Source Performance Standard Rule for new fossil fuel-fired electric utility generating units (EGUs) such as boilers, integrated gasification combined cycle units and stationary combined cycle turbine units. New EGUs covered under this proposal are those that generate electricity for sale and must have a generating capacity larger than 25 MW. The standards of performance will require new EGUs to meet a CO_2 emissions rate of 454.5

[2] The range 91 to 227 t is equivalent to 100 to 250 short tonnes per year.

[3] See page 3 of <http://www.epa.gov/nsr/ghgdocs/ghgpermittingguidance.pdf>. Paragraph 41 quotes the limits in metric tonnes; in short tonnes the equivalents are 75,000 and 100,000 tonnes per year respectively.

kg/MWh of electricity generated on a gross basis. Compliance can either be assessed over a rolling 12-month period or over a 30-year average and examples of available technology complying with the standard include natural gas combined cycle generation with no additional GHG control or coal-fired generation using carbon capture and storage (CCS).

44. Under the proposed rule, the standard has to be reviewed every eight years and the impact assessment of the EPA therefore covered the period up to 2020. The modelling of the EPA performed for the assessment suggested that in the absence of the rule (base case), most of the new fossil-fuel fired EGUs constructed up to 2020 would be using natural gas. Only under specific favourable market conditions and availability of funding would coal-fired units with CCS be built. The rule, therefore, provides some certainty over future conditions of the United States electricity market. Consistent with this, the EPA does not expect the proposed standards to result in significant additional CO_2 emission reductions relative to the base case, nor are energy impacts, quantified benefits, costs or economic impacts projected by 2020. However, based on a social cost of carbon analysis carried out by the EPA, a transition from coal to natural gas-fired power plants would mainly result in health benefits. The EPA is also preparing GHG standards for oil refineries (Clean Energy Standard Act) that are planned to be released later in 2012.

45. The NC5 identified programmes and partnerships in energy supply implemented by the EPA affecting CO_2 emissions, such as Combined Heat and Power Partnership, and non-CO_2 emissions, such as the Coalbed Methane Outreach Program and the Natural Gas Star Program. These programmes, many dating back to the 1990s, have achieved considerable penetration into the industries concerned, though they are information and voluntary programmes. Overall, the ERT noted that increased natural gas utilization will tend to increase fugitive CH_4 emissions, and that an effective PaMs framework to mitigate these emissions will be essential in establishing the low emissions credibility of this expanding energy source in addition to addressing effectively other environmental concerns over shale gas.

46. ***Renewable energy sources***. The NC5 reported that about 9 per cent of United States electricity generation came from renewable sources. The AEO2012 update reported that this share had increased to 10 per cent in 2010 (comprising of 6 per cent conventional hydropower and 4 per cent other renewables) and is projected to increase to 16 per cent by 2035. In the NC5, the PaMs supporting the development and use of renewable energy sources included the DoE and EPA programmes in support of a range of technologies (biomass, geothermal, nuclear, solar power and wind).

47. Among the DoE programmes, the Renewable Energy Production Incentive offers financial incentives for producing electricity using renewable sources. It also provides cost-sharing incentives for research, development, demonstration and deployment of renewable energy technology manufacturing, and grants matching up to 50 per cent for small-scale renewable projects. The Biomass Program provides loan guarantees and support payments designed to ensure sufficient bio-refinery capacity to meet the Renewable Fuels Standard introduced under the 2007 Energy Independence and Security Act. This standard requires the use of 136.3 billion litres of biofuels by 2022, including 79.5 billion litres of cellulosic ethanol or other advanced biofuels.

48. In addition, the Geothermal Technologies Program is intended to overcome technical, institutional and market barriers to deployment. The Wind Energy Program undertakes research to reduce the cost of wind power, which is now cost effective in some areas of the United States. As a result, the Renewables Portfolio Standards introduced by many states lead to an installed wind capacity of about 47 GW in the United States as of January 2012. The Solar Technologies Program supports research and development (R&D) with the aim of achieving cost-competitiveness by 2015. The Nuclear Power Programs undertake research in support of Generation IV technologies, plus insurance against risks

beyond the control of operators and loan guarantees. The effect of these DoE programmes is estimated at around 29 Tg CO_2 emissions avoided in 2010 and 140 Tg CO_2 in 2020.

49. The Clean Energy Supply Programs of the EPA are partnerships with businesses, universities, state and local governments and other organizations to encourage combined heat and power, and other green generation sources. As part of these programmes, partners make annual reports to the EPA on performance, and the EPA provides technical assistance, general information and recognition, where appropriate. Other programmes that support renewable energy innovation are described in the section on research and systematic observation (See paras. 144–155 below). The effect of these programmes is expected to result in around 18 Tg CO_2 emissions avoided in 2010 and 73 Tg CO_2 in 2020.

50. ***Energy efficiency***. GHG emissions from energy end-use sectors (residential, commercial and institutional) continue to be targeted by voluntary measures and programmes, and to a lesser extent by regulations and standards. In terms of identified emissions savings, the Energy Star Program of the EPA is one of the most significant end use efficiency measures identified in the NC5. The Energy Star Programs boost the adoption of energy efficient products, practices and services through valuable partnerships, objective measurement tools and consumer education. Through the implementation of strict performance standards, the Energy Star-labelling Program delivers cost effective energy efficiency for, at present, 65 categories spanning consumer electronics; office, heating, ventilation, air conditioning and commercial food-processing equipment; and lighting, the building envelope, appliances and other equipment. Savings generated from the programme are estimated from data on the market dynamics of the sales of products with and without the Energy Star label. Product specifications are regularly updated and, since 2011, subject to third-party certification in coordination with the appliance testing programme of the DoE described in the next paragraph. Energy Star labelling has achieved international recognition and therefore helps to improve efficiency standards beyond the United States. The Energy Star Program also provides a trusted source of information for consumers and businesses to leverage when investing in home improvement, purchasing efficient new homes, enhancing the efficiency of public and private buildings, designing efficient buildings and improving the efficiency of industrial facilities.

51. The DoE Appliances and Commercial Equipment Standards Program, Appliance Efficiency Standards and Lighting Energy Efficiency Standards develop test procedures and statutory minimum standards for over 40 categories of end-use equipment. The DoE is required to set a standard corresponding to the maximum improvement in energy efficiency that is technologically feasible and economically justifiable. The gradual improvement in the energy efficiency of incandescent light bulbs and other technologies is one consequence of the standards. The economic justification for the policy took into account the social cost of carbon in assessing the impact of the proposed regulations. Regulation by the DoE and the Energy Star Program of the EPA are complementary, the latter has wider coverage, which applies while the DoE develops mandatory standards. The DoE also provides verification and enforcement in support of the Energy Star Program.

52. ***Residential and commercial sectors***. The DoE promotes building energy efficiency through the development of model, or exemplar, building energy codes, intended to influence mandatory codes which may be adopted at the state level, and to produce energy-saving improvements in new residential and commercial construction of between 3 per cent and 6 per cent every triennium until 2025. The Energy Star Program addresses energy efficiency in both the new construction marketplace and in improvements to existing homes. Through the Energy Star Certified Homes Program, the EPA works with the new residential construction industry to improve the energy efficiency of homes being built today. In the home improvement marketplace, the EPA educates and empowers homeowners with unbiased information about the actions they can take to improve their home's energy

efficiency. Through the Building America Program, the DoE also undertakes research on on-site power integration, and provides a portal to advise on low energy building. Also, the Net-Zero Commercial Building Initiative under the EISA, provides tools to design marketable net-zero buildings by 2025. The resulting buildings will generate as much energy as they consume using advanced efficiency technologies and on-site power generation systems, such as solar and geothermal energy. The DoE also provides weatherization assistance to low-income households.

53. ***Transport sector***. In 2010, emissions from the transport sector were the second largest source of GHGs, after those from electricity generation, comprising 27 per cent of total emissions. Total GHG emissions from the transport sector increased by about 17.6 per cent between 1990 and 2010. However, this overall growth masks a net decrease of approximately 9 per cent in emissions between 2005–2010 due to an increase in fuel prices and the economic down-turn.

54. Most of the PaMs targeted at the transport sector that were reported in the NC5 were voluntary, research and information-based programmes. However, the reported PaMs that are expected to deliver by far the most sizeable emission reductions are regulations. The first of these regulations is the Renewable Fuel Standard (RFS), under the Energy Independence and Security Act of 2007 that requires that a total volume of 136 billion litres of renewable fuel for transport be used by 2022. EPA rules include statutory life cycle emission thresholds designed to ensure significant emission savings from the RFS. According to the AEO2012, biofuel use in 2010 was about 49.2 billion litres and projections suggest that the volume used in 2022 will not reach the legislated target but that the goal could be achieved by 2035.

55. Regulatory measures reported in NC5 also included regulations that aimed at improving fuel economy for vehicles. The initial Corporate Average Fuel Economy (CAFE) Standards targeted light-duty trucks and passenger cars for model years (MYs) up to and including 2011. In 2009, the EPA and the DoT had jointly proposed the National Policy to Establish Vehicle GHG Emissions Standards, which anticipated fuel economy standards for passenger cars, light-duty trucks and medium-duty passenger vehicles for MYs 2012–2016. These regulations were finalized in April 2010 as the Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy (CAFE/GHG) Standards Rule. These tighter CAFE/GHG standards for passenger vehicles were a milestone achievement in the United States and specifically intended to reduce fuel consumption and GHG emissions from fuel combustion. Building on the first stage of the national programme, the DoT and the EPA have proposed fuel economy/GHG emission standards for light-duty vehicles for the MYs of 2017 and beyond that would result in additional fuel savings and GHG emission reductions.

56. CAFE standards reinforce a trend towards greater fuel efficiency in cars and light-duty trucks. Standards that have been finalized for MYs 2012–2016 light duty vehicles are estimated to require approximately a 4 per cent average annual improvement in the fuel economy of these vehicles from MYs 2012 to 2016. Total program calendar year impacts in 2020 attributable to vehicles manufactured to meet the MYs 2012–2016 standards (assuming MY 2016 standards continue indefinitely beyond 2016) were estimated at 42.8 billion litres of fuel savings and 141.9 Mt CO2 eq. These estimates are relative to a baseline set by the CAFE standard rule previous to the one current at the time. In determining the level of the standards for each model year, the DoT takes into account a number of factors, including technological feasibility and economic practicability. The DoT also considers the potential environmental impacts of the standards, including GHG emission reductions. Proposed standards for model year 2017 and beyond will also require average improvements of approximately 4 per cent annually through to 2025.

57. The EPA and the DoT recently finalized the first fuel efficiency/GHG emission standards for medium- and heavy-duty trucks pursuant to the Energy Independence and Security Act and the CAA. These joint rules apply to MYs 2014–2018 vehicles, with total lifetime fuel savings attributable to those vehicles estimated at about 83.3 billion litres of oil, which translates to about 270 Mt CO_2. The medium- and heavy-duty truck standards and the passenger vehicle standard (from 2017 and beyond) are not included in the revised energy projections of the EIA because they have not yet been finalized. The ERT noted that comparisons with vehicle efficiency internationally indicate that there may be scope for further tightening of the rules in order to match international standards.

58. In addition to regulation, the EPA and the DoT have introduced fuel economy labels on some MY 2012 vehicles, and, in prospect, on all MY 2013 light-duty vehicles. These labels provide fuel consumption, cost savings and smog ratings data, a range of comparison, which includes advanced technologies.

59. The work of the DoE on technological innovation contains elements covering fuel cells and batteries, and other advanced automotive technologies. Also, the trend reflects to some extent the effect from the ARRA given that a large part of it went into the vehicle manufacturing industry and in many cases it was used as an incentive to stimulate efficiency and innovation.

60. Though not a regulatory PaM, SmartWay is a partnership programme between the EPA and freight carriers whereby the latter commit to improved performance benchmarks and provide data to track achievements. The EPA provides technical information including ranking of vehicle performance, and grants and financing that make it easier to acquire more efficient fuel-saving equipment.

61. The ERT noted that while most federal PaMs after NC5 aimed predominantly at regulation, information and technological development, other PaMs, such as the infrastructure and encouragement of modal shift, are largely the responsibility of state and local authorities. The Federal Transit Administration of the DoT nevertheless provides grants to communities of the order of USD 10 billion per year for public transport investment, and supports transport authorities via the Transit Investments for Greenhouse Gas and Energy Reduction Program. Some of these grant programmes incorporate rating criteria for projects that address GHG emissions including reduction in vehicle miles travelled.

62. ***International aviation and maritime transportation***. Emissions from international bunker fuels in the United States increased by about 14 per cent in 1990–2010 and accounted for about 2 per cent of total United States GHG emissions in 2010. Two PaMs reported in NC5 address the aviation sector specifically. The Aviation Fuel Efficiency, Renewable Fuels and Market Measures, and the Commercial Aviation Alternative Fuels Initiatives are both research-based PaMs aiming to improve technological and operational procedures as well as fuel efficiency in order to reduce GHG emissions from aviation.

63. The United States is working through the International Civil Aviation Organisation (ICAO) and the International Maritime Organisation. The United States is strongly supportive of the ICAO-stated ambition of working towards carbon neutral growth in international aviation by 2020, and implementing technical and operational measures to realise the ambition. Consistent with this, the Federal Aviation Administration (FAA) of the DoT has introduced GHG reduction goals as part of its consideration of Next Generation Air Transport Systems. It is expected that operational measures will make the most significant contribution at first, with technological improvements becoming more important in the longer term. FAA is also developing alternative jet fuels through the Commercial Aviation Alternative Fuels Initiative, a coalition of airlines, aircraft and engine

manufacturers, energy producers, researchers, international participants and United States Government agencies.

64. Although marine transportation is not mentioned in NC5, the ERT was informed that the Maritime Administration of the DoT has, under the provisions of the Energy Independence and Security Act of 2007, initiated the Marine Highways Program, which identifies 11 corridors where the modal shift to water transportation offers significant environmental or other advantages. This programme provides some grant assistance, and designates promising projects with the expectation of preferential treatment in future federal assistance, and initiatives, which are promising but require further development.

65. ***Industrial sector***. In 2010, fossil fuel related GHG emissions from industry accounted for around 20 per cent of the total emissions of the United States, ranking third after electricity generation and transport over total emissions. Since 1990, GHG emissions from industry have (steadily) decreased by 11 per cent, due to a general economic transformation from manufacturing to service activities in the United States, fuel switching and improvements in energy efficiency.

66. In the NC5, before the 2009 endangerment findings of the EPA on GHGs, all the PaMs reported for the industry sector targeted non-CO_2 emissions like CH_4, HFCs and PFCs and consisted of voluntary or information measures. However, as highlighted earlier, the EPA started developing new regulations for large stationary sources in 2010 under the CAA. For stationary sources, CAA provisions for GHGs are, under existing legislative authority, being initially extended to new industrial facilities. The act provides authority for existing facilities to be regulated at the state level consistent with EPA guidelines. See paragraphs 40 to 42 above for a more detailed description of the Prevention of Significant Deterioration and Title V Operating Permit Programs, and the Tailoring Rule, which also apply to large industrial stationary sources other than those in the energy supply sector, given that they meet the emissions thresholds.

67. The innovative work of the DoE on clean technologies covers industrial energy efficiency. The DoE undertakes industry-specific and cross-cutting research on research, development, demonstration and deployment to increase efficiency, focusing on energy intensive industries. The Industrial Technologies Program (ITP) of the DoE under the Save Energy Now Program works with industry to identify opportunities for energy saving and improving plant efficiency. The ITP had a stated target of reducing United States industrial energy intensity by 25 per cent over 10 years. The DoE also funds 26 industrial assessment centres (IACs) linked to engineering departments at United States universities to provide advice to small- and medium-sized companies, and to train future energy engineers. There is also an IAC website with information from (at the time of the in-country visit) 13,000 previous assessments.

68. The Energy Star Program of the EPA that aims at enhancing industrial energy efficiency has been extended to include the provision of industry energy guides, performance indicators and plant labels. The programme covers some 16 industrial sectors for which industry-specific energy management tools and resources are provided. Examples of facilities involved in the programme include automobile assembly plants, cement plants, petroleum refineries, pharmaceutical manufacturing plants, and food and drink processing plants. The NC5 estimated that the Energy Star Program had prevented 23 Tg CO_2 eq in 2007, and could avoid 18.1 and 36.6 Tg CO_2 eq, respectively, in 2010 and 2020. The EPA had reported in NC5 that 48 plants had earned the Energy Star label and in early 2012, at the time of the in-country review, the number had increased to 112 Energy Star labelled plants.

3. Policies and measures in other sectors

69. In 2010, excluding LULUCF, GHG emissions from the non-energy sectors constituted about 13 per cent of total emissions of the United States. Industrial processes, solvent use, agriculture and waste accounted for 34.9, 0.50, 49.3 and 15.3 per cent of the non-energy total, respectively. Total emissions from non-energy sectors in 2010 were some 0.6 per cent lower than in 1990, up by 2 per cent from 2009.

70. ***Industrial processes***. Emissions from industrial processes in 2010 represented about 4.5 per cent of total GHG emissions in the United States. They had a broad plateau between 1996 and 2000, and peaked again in 2007. Emissions are now some 3.4 per cent lower than in 1990 and 8 per cent lower than in 2005. The reasons for this are lower emissions from iron and steel production resulting from the decrease in the domestic industrial input, and abatement of nitrous oxide emissions at adipic acid production plants. Emissions of HFCs, PFCs and SF_6 have increased overall. This trend is mainly due to the increased use and emissions of HFCs and certain PFCs, which are replacing ozone-depleting substances that are being phased out globally by the Montreal Protocol and in the United States under the provisions of the CAA. While many of the ozone-depleting substances are also GHGs, their emissions are not included in the totals here as required by the UNFCCC reporting guidelines.

71. All the PaMs identified in the NC5 for non-energy industrial process emissions are implemented by the EPA and all are voluntary with the exception of the Significant New Alternatives Program (SNAP), which is a regulation under the provisions of the CAA. Some other industrial processes, such as cement or iron and steel manufacture seem likely candidates for early regulation under the stationary source provisions of the CAA.

72. The ERT noted that because of the strong upward trend in emissions of HFCs used to substitute ozone-depleting substances, implementation of SNAP so as to maintain emissions at or below 2005 levels could make a two or three percentage point contribution towards meeting the 17 per cent target. The ERT also noted that following the endangerment finding, the provisions of the CAA could presumably be extended to regulate point source emissions such as nitrous oxide from nitric and adipic acid production (where not already abated), hydrofluorocarbon-23 from hydrochlorofluorocarbon-22 production.

73. ***Agriculture***. GHG emissions from agriculture accounted for about 6.3 per cent of total emissions in 2010, which is some 10.5 per cent above those in 1990 and 1 per cent higher than that in 2005. A shift to on-site manure management, rather than spread, has contributed to the upward trends. The ERT noted that the projected increase in emissions from agriculture to 2020 is about 0.24 per cent of total United States emissions in 2005, 0.05 percentage points from methane and 0.19 percentage points from N_2O.

74. Among the PaMs reported in NC5, the Conservation Reserve Program (CRP), the Environmental Quality Incentives Program (EQIP) and the Rural Energy for America Program (REAP) are the three largest agriculture and LULUCF sector programmes. CRP is an incentive for farmers to place highly erodible cropland or other environmentally sensitive acreage into vegetative cover (native grasses, wildlife plantings, trees, etc.) for 10 to 15 years. Incentives can take the form of technical assistance, annual rental payments or cost-share assistance. Among the benefits expected are the increased storage of carbon in soil and new biomass; and avoided CO_2 emissions from fossil fuel combustion and N_2O emissions from reduced fertilizer use. But the main effect is on soil and biomass carbon pools, and therefore comes under LULUCF. The United States Department of Agriculture (USDA) has estimated that CRP resulted in amounts of 50, 52 and 51 Tg CO_2 eq GHG emissions avoided in 2007, 2010 and 2011, respectively.

75. EQIP covers both the agriculture and LULUCF sectors. It proposes conservation practices to accelerate the development, transfer, and adoption of innovative technologies

and approaches to improve soil, water, plant, animal and air for livestock producers and owners of working farmlands that have natural resource concerns. Incentives provided in the form of technical assistance and innovation grants are expected to deliver GHG benefits. During the in-country visit, the USDA updated its estimation of actual GHG mitigation values for 2010 at 3.87 Tg CO_2 eq.

76. Finally, REAP provides loans and grants to rural residents, farms and businesses for energy audits and renewable energy systems, including methane recovery and usage and biorefinery construction. This programme is expected to result in energy efficiency gains and reduced methane emissions. The effects in terms of GHG emissions avoided were not available at the time of the in-country visit.

77. ***LULUCF***. Estimated removals increased by just under 22 per cent over the period 1990 to 2010, and decreased by about 1 per cent between 2005 and 2009. These trends are driven mainly by forest sinks, and the reduction in removals is due to lower additions to the harvested wood products pool because of a decline in housing construction. There is no corresponding increase in forest biomass pools, which appeared unusual to the ERT, though it could be an artefact of age-class structure.

78. The main PaMs affecting LULUCF are the components of the CRP, EQIP and similar agricultural programmes which take land out of production for periods of typically 10 to 20 years and thereby increase biomass and soil carbon stocks. The ERT noted the importance of tracking the land and associated carbon stocks affected via the inventory, since return to production would usually be expected to lead to reversal of gains in the pools affected. Small net removals are also expected from a range of programmes that are implemented by the USDA that aim at promoting conservation and restoring wetlands, grasslands, natural habitat, forests, woodlands and rangelands. These include the Conservation Stewardship Program, Wetland Reserve Program, Grassland Reserve Program, Wildlife Habitat Incentive Program, Enhancing Ecosystem Services on Forestland, Grasslands, Parks and Wildlife Reserves and the Healthy Forest Initiative.

79. ***Waste management***. In 2010, GHG emissions from the waste sector accounted for about 1.9 per cent of total emissions in the United States with a marked decrease of about 31 per cent since 1990 and a decrease of about 3.4 per cent since 2005. Although N_2O emissions have risen every year since 1990, landfill methane, as the largest source, is the main driver of the overall trend. Between 1990 to 2010, CH_4 emissions from landfills declined by about 27 per cent and can be attributed to many factors, including changes in waste composition, an increase in the amount of landfill gas collected and combusted, a higher rate of composting, and increased rates of recovery for degradable materials.

80. The Landfill Rule under the EPA has been implemented by the states since 1998. The Landfill Rule requires large landfills to capture and combust their landfill gas emissions. The EPA also has two voluntary programmes: the Landfill Methane Outreach Program (LMOP) aiming to reduce methane emissions through cost-effective means, and the WasteWise Program aiming to encourage recycling and reduce waste generation at source. During the review week, United States officials mentioned that the LMOP had facilitated 580 projects, a quadrupling since 1994, and that strong corporate interest continues in the use of landfill gas. According to NC5, it is expected that the Landfill Rule, the LMOP and the WasteWise Programs will continue to deliver significant reductions up to 2020.

4. Policies and measures at the state and city levels

81. The PaMs in NC5 discuss federal funding and grant programmes that assist communities in carrying out transportation improvements and services that can help reduce vehicle miles travelled and GHG emissions. In addition to transit grants, PaMs reported in

NC5 and during the review week include the Congestion Mitigation and Air Quality Improvement Program and the funding of bicycle-pedestrian improvements. Moreover, the Transportation Improvements Generating Economic Recovery Program, initiated by ARRA and continued by later budget appropriations, provides funds for sustainable transportation activities. The Interagency Partnership for Sustainable Communities works to align federal transportation, environmental protection and housing policies.

82. The ERT found, both in the NC5 and as part of an update during the review, that there is a large and growing number of PaMs and emission reduction targets at state and city levels. This also extends to states, which have a large economic reliance on coal production.

83. Table 4 summarizes the main PaMs current at the time of the visit by the expert review team. As of June 2012, 23 states had state-wide targets; 38 states had a climate action plan; 12 states were participating in regional initiatives; 38 states had renewable portfolio standards; 23 had low-carbon fuel standards; and 15 states had appliance efficiency standards. Key policy frameworks and levers at state and local levels are state-wide targets, emissions trading schemes, RPS (RPS, now adopted by 39 states), energy efficiency resource standards, building energy codes, emerging integrated transport and infrastructure planning including promotion of cycling and walking, especially with the shift in the focus of urban development from the urban fringe to city centres, and the rise of the concept of walkable neighbourhoods. The AEO2012 update includes the effect of several measures implemented at the state level, such as the trading schemes, the RPS and the appliance efficiency standards.

84. States will have responsibility for the application of CAA provisions to existing facilities. States can also lead federal action, as demonstrated by the part played by the vehicle efficiency standards in California in reducing the carbon intensity of motor fuel. States can also lead federal action, as demonstrated by the part played by the vehicle efficiency standards in California in reducing the carbon intensity of motor fuel. This is also demonstrated by the role of the Regional Greenhouse Gas Initiative (RGGI) and California in piloting emissions trading schemes, including experience with auctioning allowances, maintaining consistency across participating states or provinces, tracking allowances and compliance arrangements, and/or the use of revenues, including for energy efficiency.

85. During the in-country visit, representatives from states and cities emphasized the need to improve the models available to provide more robust and transparent estimates of the GHG reductions expected from PaMs at all levels, and to assess the comparability of effort. This is viewed as an issue both at state level as well as at the national level. Several states are currently working together under the North America 2050 Initiative on this issue and are interested in engaging the federal agencies of the United States.

86. The Conference of United States Mayors and the National League of Cities also mentioned that although building codes, transport infrastructure and alternative fuels were areas for action at the city level, progress on wider sustainability would benefit from state and federal coordination. Specific examples of action at the city level were from Philadelphia, which has an action plan to reduce its GHG emissions to 20 per cent below its 1990 level by 2015, and Portland with a goal of 80 per cent emission reduction by 2050. Examples of activities undertaken included the benchmarking of buildings' energy efficiency, projects for measuring and disclosing GHG emissions, programmes to curb vehicle miles travelled, investments in public transport, the adoption of procurement goals for renewable energy by municipalities, especially for local, integrated land-use planning and eco-districts, which take integration further to include power supply and building energy use.

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

Policy/Measure/Programme	*Participating states*
Climate action	
GHG targets	AZ CA CO CT FL HI IL MA MD ME MN MI MT NH NJ NM NY OR RI UT VA VT WA
Climate Action Plan	AK AL AR AZ CA CO CT DE FL HI IA ID IL KS KY MA MD ME MN MI MO MT NC NH NJ NM NV NY OR PA RI SC TN UT VA VT WA WI
Participation in regional initiatives	CA CT DE MA MD ME NH NJ NY PA RI VT
GHG inventory	All except ND and NE
GHG registry	AL AZ CA CO CT DE FL GA HI IA ID IL KS KY MA MD ME MN MI MO MT NC NH NJ NM NV NY OH OK OR PA RI SC TN TX UT VA VT WA WI WV WY
Carbon cap/offset for power plants	CA CT DE FL IL MA MD ME MT NH NY OR RI VT WA
Energy sector	
Renewable portfolio standard	AK AZ CA CO CT DE FL HI IA IL KS MA MD ME MI MN MO MT NC ND NH NJ NM NV NY OH OK OR PA RI SD TX UT VA VT WA WI WV
Energy efficiency resource standard	AR AZ CA CO CT DE FL HI IA IL IN MA MD ME MI MN NC ND NM NV NY OH OK OR PA RI SD TX UT VA VT WA WI WV
Clean energy for state facilities	AL AR AZ CA CO CT DE FL GA HI ID IA IL IN KY LA MA MD ME MI MN MO MT NH NJ NM NV NY NC OH OK OR PA RI SC SD TN TX UT VA VT WA WI
Net metering: monitoring of net electricity generation outflow	AR AZ CA CO CT DE FL GA HI IA ID IL IN KS KY LA MA MD ME MI MN MO MT NC ND NE NH NJ NM NV NY OH OK OR PA RI SC TX UT VA VT WA WI WV WY
Transportation	
Vehicle GHG standards	AZ CA CT DE MA MD ME NJ NM NY OR PA RI VT WA
Mandates, incentives for biofuels	AK AL AR AZ CA CO CT FL GA HI IA ID IL IN KS KY LA MA MD ME MI MN MO MS MT NC ND NE NH NM NY OH OK OR PA RI SC SD TN TX VA VT WA WI
Low-carbon fuel standard	CA CT DE MA MD ME NH NJ NY OR PA RI VT WA
Medium- and heavy-duty vehicles	AL AR AZ CA CO CT DE FL GA HI IL IN KS MA MD ME MI MN MO NC NE NH NJ NM NV NY OH OK OR PA RI SC TX UT VA VT WA WI WV
Buildings	
Energy codes – residential	AK AR CA CO CT DE FL GA IA ID IN KY LA MA MD MI MN MT NC NE NH NJ NM NV NY OH OK OR PA RI SC TN TX UT VA VT WA WI WV
Energy codes – commercial	AR CA CT DE FL GA IA ID IL IN KS KY LA MA MD ME MI MN MT NC NE NH NJ NM NV NY OH OK OR PA RI SC TX UT VA VT WA WI WV
Appliance efficiency standards	AZ CA CT FL MA MD MN NH NJ NV NY OR RI VT WA
Property assessed clean energy	CA CO FL GA HI IL LA MA MD ME MI MN MO NH NC NM NV NY OH OK OR TX VA VT WI
Green building standards for state buildings	AL, AR, AZ, CA, CO, CT, DE, FL, GA, HI, IA, ID, IL, IN, KY, LA, MA, MD, ME, MI, MN, MO, MT, NC, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI

Source: Adapted from the Center for Climate and Energy Solutions, 27 June 2012. See < http://www.c2es.org/docUploads/All-State-Initiatives_0.pdf >.

Abbreviations: GHG = greenhouse gas, AK = Alaska, AL = Alabama, AR = Arkansas, AZ = Arizona, CA = California, CO = Colorado, CT = Connecticut, DE = Delaware, FL = Florida, GA = Georgia, HI = Hawaii, IA = Iowa, ID = Idaho, IL = Illinois, IN = Indiana, KS = Kansas, KY = Kentucky, LA = Louisiana, MA = Massachusetts, MD = Maryland, ME = Maine, MI = Michigan, MN = Minnesota, MO = Missouri, MS = Mississippi, MT = Montana, NC = North Carolina, ND = North Dakota, NE = Nebraska, NH = New Hampshire, NJ = New Jersey, NM = New Mexico, NV = Nevada, NY = New York, OH = Ohio, OK = Oklahoma, OR = Oregon, PA = Pennsylvania, RI = Rhode Island, SC = South Carolina, SD = South Dakota, TN = Tennessee, TX = Texas, UT = Utah, VA = Virginia, VT = Vermont, WA = Washington, WI = Wisconsin, WV = West Virginia, WY = Wyoming.

C. Projections and the total effect of policies and measures

87. The NC5 contains information on projections of GHG emissions and removals, following the Intergovernmental Panel on Climate Change (IPCC) sector and source categories for a 'with measures' scenario. It also contains an estimate of the total effect of policies and measures for the year 2020 based on the EIA April 2009 update of the DoE of the AEO2009. New projections based on AEO2012 results for energy-related CO_2 emissions were provided to the ERT by the EIA during the review week. Emissions for other sectors had not been updated since NC5. Updates of projections for LULUCF and for non-CO_2 gases were planned for late 2012 or early 2013.

1. Projections overview, methodology and key assumptions

88. The GHG emission projections provided in NC5 include a 'with measures' scenario (described as 'business as usual'), which is presented relative to the actual inventory data for 2000, 2005 and 2007. Projections are reported on a five-year basis for 2010, 2015 and 2020, and estimates of long-term projections of emissions by 2050 are also provided. Except for non-energy CO_2 emissions, the projections are presented on a sectoral basis as required by the UNFCCC reporting guidelines. Emissions are also presented on a gas-by-gas basis for CO_2, CH_4, N_2O, PFCs, HFCs and SF_6. In addition, emission projections are also provided in an aggregated format for the national total, using global warming potential values from the Second Assessment Report of the Intergovernmental Panel on Climate Change (IPCC 1996). Emission projections related to fuel sold to ships and aircrafts engaged in international transport were reported separately and were not included in the total. A figure illustrating these projections was also provided.

89. The ERT commends the United States for improving the reporting of its GHG emission projections compared with NC4. In particular, the projections reported in NC5 differentiate F-gases by type of products (PFCs, HFCs and SF_6). GHG emission projections from international bunkers are considered separately and are not included in the total emissions.

90. However, the ERT noted that the United States did not provide the following mandatory elements of the UNFCCC reporting guidelines, or the information provided was not complete: projections presented on a sectoral basis, to the extent possible, using the same sectoral categories used in the policies and measures section, and on a gas-by-gas basis, in particular, for non-energy CO_2 (e.g. energy industries, fugitive emissions, manufacturing industries, waste, etc.); relevant information on factors and activities relevant to projections were only partly provided for non-energy CO_2 and non-CO_2 gases. The following non-mandatory elements were not provided: the 'without measures' and 'with additional measures' projection scenarios were not explicitly presented; the total effect of PaMs was not reported for 2010 and 2015; and indirect GHG emission projections were not provided. The information describing the projection models used, their strengths and weaknesses as well as the sensitivity of the results to key assumptions provided in the NC5 was limited. More information was provided during the review.

91. The ERT recommends that the United States provide, in its next NC, projections for non-energy CO_2 emissions by main sectors and present information on factors and activities relevant to projections for non-CO_2 and non-energy CO_2 emissions as required by the UNFCCC reporting guidelines.

92. The ERT encourages the United States to report in its next NC information on the 'without measures' and 'with additional measures' scenarios, or to explain why they did not do so. It was clarified during the review week, that the total effect of PaMs reported in the text of NC5 was calculated as the difference between NC4 and NC5 'with measures' GHG emission projection scenarios. In doing this, changes due to economic outlook and fuel prices were disaggregated from changes due to newly implemented and anticipated policies and measures by comparing them with the sensitivity scenarios of the projections used for NC4 with lower macroeconomic growth and higher oil prices, more closely matching the updated expectations of NC5. The ERT noted that in this context, the NC4 projections could be considered as 'without measures' projections and encourages the United States to provide more background information on how the share of GHG emission reductions attributed to PaMs was derived with regard to other factors and drivers. The ERT noted that the assumed underlying economic and energy drivers between NC4 and NC5 are not consistent and that using this approach is unlikely to ensure consistency, thus comparability of both scenarios.

93. The ERT also encourages the United States to improve the transparency of its projections and underlying assumptions by providing more information on energy consumption trends and/or any changes in the energy supply mix; to report more detailed information on the models used, their strengths and weaknesses as well as sensitivity analyses (apart from energy for which background information is available), and to estimate and report projections of the indirect GHG emissions given that projections of sulphur dioxide, nitrogen oxides emissions from electricity power production are already calculated by the model used for the energy projections (see para. 97 below).

94. As noted above, the United States only reported a 'with measures' scenario in NC5, which presented GHG emission projections until 2020, taking into account all policies and measures that had been implemented as of 31 March 2009. The key policies included are the ARRA, the Energy Independence and Security Act of 2007, various state vehicle technology programmes, the RPS at the state level and the RGGI in north-eastern and mid-Atlantic states.

95. Several organizations are involved in the emissions projection process. The EPA is responsible for the compilation of projections for the purposes of NC5 using information provided from the different agencies. The energy-related CO_2 emissions were estimated by the EIA of the DoE and published in the AEO2009. These projections were then adjusted by the EPA to match the IPCC sector definitions and by subtracting emissions from international bunker fuels, and from United States territories from the national totals. With the exception of LULUCF, non-energy CO_2 and non-CO_2 emission projections came from the EPA report 'Global Anthropogenic Non-CO_2 GHG 1990-2020' (EPA/Office of Atmospheric Programs 2006). As these projections were published before the publication of the 2009 GHG inventory used in NC5, they have been adjusted to be consistent with this inventory. LULUCF projections were estimated by the USDA.

96. Several models are used to estimate projections for the different sectors. Energy-related CO_2 emissions were projected using the National Energy Modelling System (NEMS) developed by the Office of Integrated Analysis and Forecasting, EIA. The NEMS model is based on a market-based approach to energy analysis. It has modules representing fuel supply markets, conversion sectors, and end-use consumption sectors. It balances energy supply and demand, and accounts for economic competition among the various energy fuels and sources. It accounts for macroeconomic feedback and international