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## JAPAN

Report on the in-depth review of the second national communication of Japan

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## I. INTRODUCTION AND NATIONAL CIRCUMSTANCES

1. Japan ratified the UNFCCC on 28 May 1993. Its first national communication (NC1) was submitted to the secretariat on 20 September 1994 and the second national communication (NC2) on 1 December 1997. The in-depth review of the NC2 was conducted between December 1998 and August 1999 and included a visit to Tokyo from 30 November to 4 December 1998. The team comprised Mr. James Magezi-Akiiki (Uganda), Mr. Sandor Molnar (Hungary), Mr. Anthony Beck (Australia) and Ms. June Budhoomam (UNFCCC secretariat, coordinator). The in-depth review was coordinated by the government of Japan, and key stakeholders in the business community and non-governmental organizations.

2. In October 1990, Japan adopted its Action Programme to Arrest Global Warming. Under the Programme, the Government adopted the following targets for stabilization of carbon dioxide (CO<sub>2</sub>) and other greenhouse gas (GHG) emissions:

(a) Emissions of CO<sub>2</sub> should be stabilized on a per capita basis in the year 2000 and beyond at 1990 levels;

(b) Efforts should also be made to stabilize total CO<sub>2</sub> emissions in 2000 and beyond at about the same level as in 1990;

(c) Emissions of methane (CH<sub>4</sub>) should not exceed the 1990 level;

(d) As far as possible, emissions of nitrous oxide (N<sub>2</sub>O) and other GHGs should not be increased.

3. These targets, which do not include carbon sinks, are not legally binding but additional measures were introduced to achieve them. Japan has clearly succeeded in becoming one of the world's most energy efficient economies, with a low ratio of carbon dioxide to gross domestic product (GDP) of 0.62, below the average of 0.96 for countries of the Organisation for Economic Co-operation and Development (OECD), and the country with the lowest energy intensity.

4. Real GDP in 1995 was ¥467 trillion, the second highest GDP of OECD countries after the United States of America. With a population of 126 million and almost 80 per cent of its territory covered by forests and agricultural land, Japan has the highest population density among OECD countries, estimated at 337 inhabitants per sq km in 1995. A transition has been in progress from agriculture to urbanization since the 1960s. As of 1995, 64.5 per cent of the population lived in metropolitan areas, a trend that is on the rise.

5. Global environmental issues feature high among the priorities of the Government of Japan, and several ministries are involved in climate change mitigation efforts, given that the Action Programme does not have its own funding but draws on the core budgets of the ministries implementing the policies and measures. The Council of Ministers, established in 1989, oversees the implementation of this Programme. The Cabinet in turn is responsible to the Diet, wherein lie the legislative powers of the Government. Since the introduction of the Basic

Environment Law in 1993, a number of institutional developments have taken place to improve the integration of climate change concerns into sectoral policies. In December 1997, the Global Warming Prevention Headquarters was established. Through the Headquarters, the Government will promote and oversee comprehensive measures to prevent global warming. Of singular importance was the adoption of the "Guideline of Measures to Prevent Global Warming" in June 1998, which includes principles for achieving the 6 per cent reduction commitment under the Kyoto Protocol. Based on the Guideline, a range of new measures has been introduced and others are planned. In addition, the Kyoto Initiative was formulated in December 1997, which consists of strengthening environmental support to developing countries in climate-change related projects.

6. The Law for the Promotion of Measures to Cope with Global Warming came into force in April 1999. This law is the first with the explicit objective of combatting global warming. It requires action plans to be established by the national and local governments and sets in place the process to develop policies with the participation of all sectors of the Japanese community. The law was formulated in such a way, that when combined with other existing programmes, including energy conservation under the revised 1998 Law on the Rational Use of Energy, it will promote public reporting of plans and the status of their implementation, by the national Government and local authorities as well as businesses, which emit large volumes of greenhouse gases.

7. Under the law, Government is also required to formulate and publish a basic policy covering the measures to be taken by the central government, local governments, business sectors and citizens. It also provides a framework for the measures that need to be adopted by all sectors, including sink-related measures, clearly identifying the role of the national government in setting the basic policy direction for response measures and monitoring their effectiveness periodically. It promotes voluntary efforts of relevant social actors as much as possible but does not set quantitative targets, either for total national emissions or for emissions from individual sectors. Overall coordination and management of the law at the national level will be the responsibility of the Environment Agency, with other agencies and ministries having responsibility for particular elements of the programme under their portfolio.

8. The review team was informed that the basic policies were expected to be formulated by April 1999, after which time they would be deliberated upon by the Central Environmental Council. Each department participating in the programme will be required to mobilize funding for implementing the policies defined. Climate change policies will be reviewed annually at the Cabinet level by the Global Warming Prevention Headquarters on Measures to Arrest Global Warming.

9. Japan's GHG emissions are still rising. Based on 1996 data, absolute CO<sub>2</sub> emissions were 9.9 per cent above 1990 levels, and 7.8 per cent above on a per capita basis. Overall, Japan will not achieve the aim stated in Article 4.2 (b) of the UNFCCC to return individually or jointly to their 1990 levels anthropogenic emissions of CO<sub>2</sub> and other greenhouse gases not controlled by the Montreal Protocol. With the signing of the Kyoto Protocol, Japan has accepted a more stringent emission reduction target of 6 per cent below 1990 levels between 2008 and 2012.

Recognizing the importance of the Kyoto Protocol and the leading role that Japan sees itself as playing, the Government has made additional significant moves to enhance its domestic response to greenhouse gas emissions since the preparation of the NC2.

## II. INVENTORIES OF ANTHROPOGENIC EMISSIONS AND REMOVALS

10. The NC2 contains inventory data for emissions of the direct GHGs carbon dioxide, methane and nitrous oxide, and the indirect GHGs carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), and non-methane volatile organic compounds (NMVOCs). Information was also presented for CO<sub>2</sub> removals by sinks over the period 1990 to 1994 inclusive, and through 1995 for CO<sub>2</sub>, the new gases, substitutes not controlled by the Montreal Protocol, perfluorocarbons hydrocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF<sub>6</sub>). Data on international bunker fuel were treated separately. The methods of calculating and reporting these inventories are in accordance with the 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories. Data are presented for the fiscal year which runs from April to March. The national experts explained that fitting statistics into a calendar year is difficult because it requires restructuring the national statistical system across all sectors for the country as a whole.

11. The review team noted the significant improvements made to inventory data in the NC2 compared to the NC1. Notable changes included provision of potential emissions of HFCs, PFCs, the exclusion of biomass CO<sub>2</sub> from total CO<sub>2</sub> emissions, the application of the IPCC default methodology for the land-use change and forestry sector, utilizing a more detailed calculation for CH<sub>4</sub> from waste disposal, and estimating uncertainties associated with the emissions data. In addition, revisions were made to the base year data (1990) based on the recommendations made during the previous in-depth review, the application of the IPCC 1996 Guidelines and recent research findings on the emissions and removal of greenhouse gases. The changes to the overall emissions of the main direct GHGs and precursors for 1990 are as follows: CO<sub>2</sub> and NMVOCs were revised downward by 4 and 5 per cent respectively, while CH<sub>4</sub>, N<sub>2</sub>O, NO<sub>x</sub> and CO were revised upward by 14, 219, 17 and 38 per cent respectively.

12. During the review, the team commended the work undertaken in preparing the inventory and estimates of energy-related emissions and the new gases, and in the methods used for estimating emissions in the agriculture, land-use change and forestry and waste sectors in particular. The preparation of the Japanese national greenhouse gas inventory, is coordinated by the Environment Agency in collaboration with MITI, the Ministry of Agriculture, Forestry and Fisheries, the Ministry of Health and Welfare, the Ministry of Transport, and other national authorities. In 1996, an ad hoc expert committee on the national inventories was established to oversee the technical and scientific aspects of preparing the inventory. The Law for the Promotion of Measures to Cope with Global Warming which was established in October 1998 also states that the methodology for calculating total GHG emissions shall be defined by government ordinance.

13. Although the NC2 did not give specific values for emission factors, these were provided to the team during the review. For most of the sectors, the IPCC default factors are applied.

Country-specific emission factors are applied only to several specific sectors. Scientific work is continuing on improving emission factors to suit national circumstances in the agriculture sector, specifically for CH<sub>4</sub> from soils and rice cultivation. In the NC2, the method of calculating emissions from rice cultivation deviates from the IPCC Guidelines, in that paddy fields are classified according to soil types and not by irrigation regime as recommended. Supported by the Global Environmental Research Fund, national research institutes have conducted a programme to re-examine the inventory and in particular the methodology, for the land-use change and forestry sector.

14. The quality of GHG estimates is categorized as “high”, “medium” or “low”, in keeping with the IPCC Guidelines. In the case of energy-related CO<sub>2</sub>, estimates were rated as “high”, but “medium” for land-use change and forestry. Estimates of activity data for all sources of CH<sub>4</sub> were considered “low”, except for energy industries, enteric fermentation and waste, which were ranked as “medium”. Estimates of N<sub>2</sub>O emissions from industrial processes and transport were ranked as “high” and “medium”, respectively, and “low” for all other categories.

#### **A. Carbon dioxide**

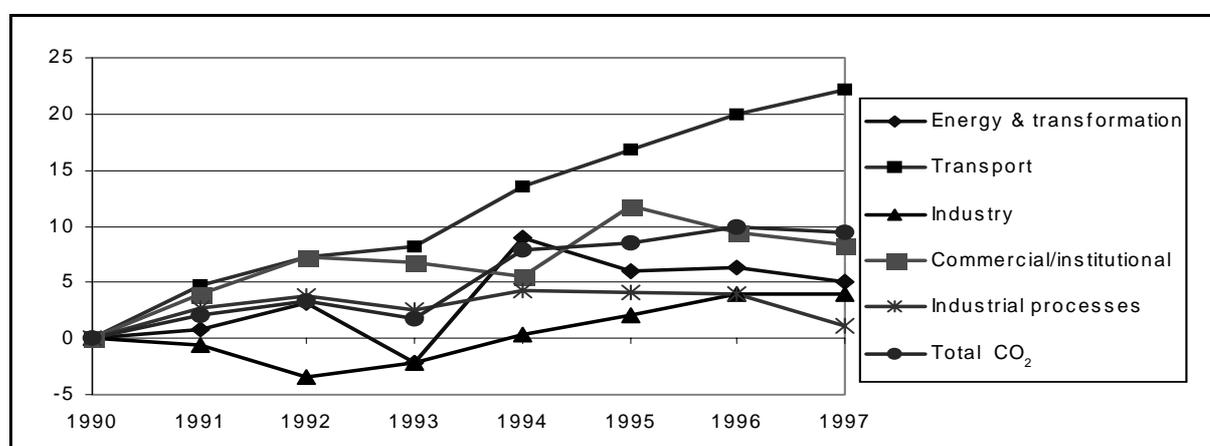
15. Data presented in table 1 indicate that CO<sub>2</sub> emissions from fiscal year (FY) 1990 up to FY 1996 increased every year except for 1993, when Japan experienced a cool summer and hence less energy demand. The energy and transformation sector was the largest contributor to overall CO<sub>2</sub> emissions until 1997, when it decreased to 28.9 per cent compared to 30.2 per cent in 1990. Of Japan’s total CO<sub>2</sub> emissions, estimated at 1,230,831 Gg in 1997, energy and transformation sector made the largest contribution accounting for 28.9 per cent, followed by industry with 28.6 per cent. The team was informed that CO<sub>2</sub> emissions originating from ‘statistical differences’ in energy statistics, which reflect the difference between supply side energy consumption estimation and demand side energy consumption estimations, are classified into the IPCC category 1A5 ‘Other’.

16. CO<sub>2</sub> emissions from international bunkers (marine and aviation), estimated at 30,806 Gg in 1990, rose to 36,639 Gg in 1997, a 19 per cent increase. Between the NC1 and the NC2, the estimate of total CO<sub>2</sub> emissions in 1990 was revised downward from 1,170,000 Gg to 1,124,532 Gg. Most of this reduction resulted from methodological improvements in the preparation of the inventory. The share of CO<sub>2</sub> removal by forests was approximately 8 per cent of total emissions between 1990 and 1995. As the carbon content of soils is given only for forests, the CO<sub>2</sub> estimate from soils is considered to be an underestimate. The inventory experts explained that work is still in progress on emission factors and methodology for the land-use change and forestry sector and that data for this category may change in the near future as new factors become available.

**Table 1. Carbon dioxide emissions and removals by sector, 1990-1997 (Gg)**

	1990	1991	1992	1993	1994	1995	1996	1997
Energy & transformation	339 065	341 875	349 569	331 734	369 357	359 462	360 460	356 396
Transport	205 633	215 313	220 473	222 474	233 425	240 292	246 847	251 376
Industry	339 378	337 429	327 837	332 247	340 796	346 257	352 791	352 957
Commercial/institutional	158 298	164 617	169 764	168 962	166 964	177 029	173 139	171 551
Industrial processes	58 795	60 381	60 998	60 333	61 303	61 236	61 079	59 501
Other	23 363	28 230	33 669	28 093	40 843	34 111	92 859	39 050
<b>Total</b>	<b>1 124 532</b>	<b>1 147 845</b>	<b>1 162 310</b>	<b>1 143 843</b>	<b>1 213 940</b>	<b>1 219 418</b>	<b>1 235 593</b>	<b>1 230 831</b>
Land-use change and forestry	-83 903	-83 865	-85 568	-90 084	-93 545	-96 705	-	-

Figure I. Carbon dioxide emissions, percentage change from 1990, by sector



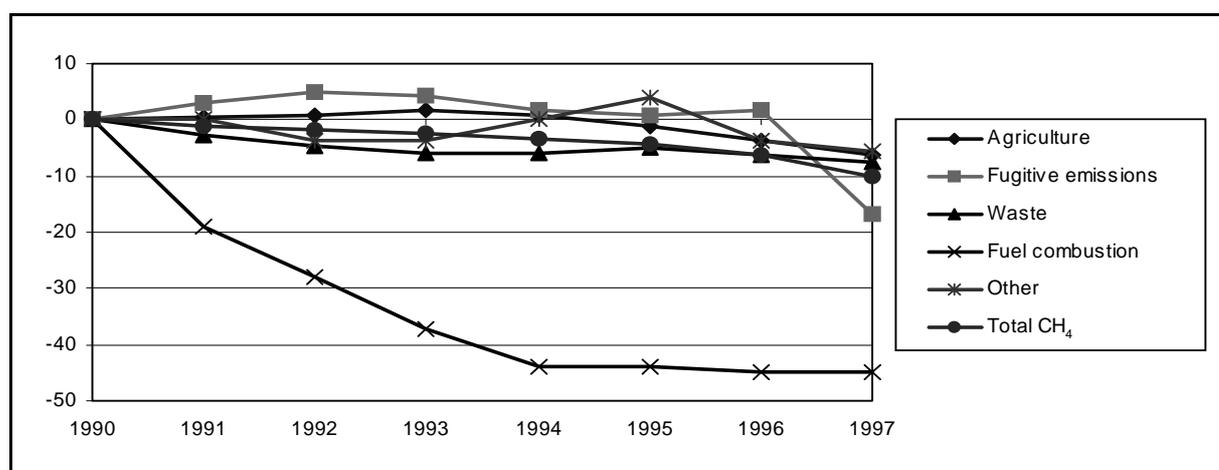
## B. Methane

17. As indicated in the revised inventory data presented in table 2, total CH<sub>4</sub> emissions (1,389 Gg) in 1997 were 10 per cent below the 1990 level of 1,543 Gg. This reflected a marked decrease in emissions from landfills and coal mines, resulting from both a reduction in the amount of organic waste going to landfills and a decline in the amount of coal mined. There has also been a substantial increase in CH<sub>4</sub> captured from landfills for electricity generation in the last two years. CH<sub>4</sub> emissions from rice cultivation and enteric fermentation dominated agriculture emissions. Emissions from rice production that showed a slight increase from 1990 to 1994, have been decreasing since 1994. National experts explained that, as paddy production is declining, the emissions trend is expected to continue decreasing in the future.

**Table 2. Methane emissions by sector, 1990-1997 (Gg)**

	1990	1991	1992	1993	1994	1995	1996	1997
Agriculture	842	845	849	855	848	831	810	789
Fugitive emissions	166	171	174	173	169	167	169	138
Waste	394	383	376	371	370	374	369	364
Fuel combustion	89	72	64	56	50	50	49	49
Other	52	52	50	50	52	55	50	49
<b>Total</b>	<b>1 543</b>	<b>1 523</b>	<b>1 513</b>	<b>1 505</b>	<b>1 489</b>	<b>1 477</b>	<b>1447</b>	<b>1 389</b>

Figure II. Methane emissions, percentage change from 1990, by sector



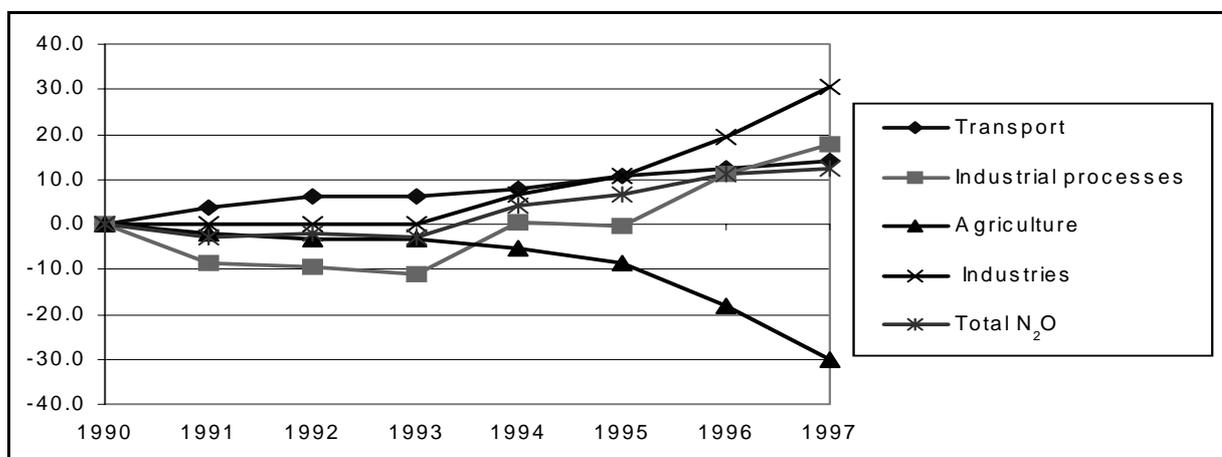
### C. Nitrous oxide

18. Emissions of N<sub>2</sub>O were estimated at 58.4 Gg in 1990 (see table 3) and increased by 12.5 per cent between 1990 and 1997 to 65.7 Gg. Although emissions from specific industries were reported as doubling in this period, total N<sub>2</sub>O emissions from industry increased by 17.6 per cent between 1990 and 1997. N<sub>2</sub>O emissions from adipic acid production were expected to be reduced in 1999 with the installation of N<sub>2</sub>O removal equipment. Emissions from transport increased by 14 per cent over the same period due to an increase in fuel demand for transport and the use of catalytic convertors in vehicles. A significant reduction of 30 per cent in N<sub>2</sub>O emissions between 1990 and 1997 was registered in agriculture (see figure III), owing mainly to a reduction in the application of fertilizers.

**Table 3. Nitrous oxide emissions by sector, 1990-1997 (Gg)**

	1990	1991	1992	1993	1994	1995	1996	1997
Transport	12.9	13.4	13.7	13.7	13.9	14.3	14.5	14.7
Industrial	23.9	21.8	21.6	21.2	24.0	23.8	26.6	28.1
Agriculture	9.3	9.1	9.0	9.0	8.8	8.5	7.6	6.5
Industry	4.6	4.6	4.6	4.6	4.9	5.1	5.5	6.0
<b>Total</b>	<b>58.4</b>	<b>56.7</b>	<b>57.2</b>	<b>56.8</b>	<b>60.9</b>	<b>62.2</b>	<b>64.8</b>	<b>65.7</b>

Figure III. Nitrous oxide emissions, percentage change from 1990, by sector



#### D. HFCs, PFCs and SF<sub>6</sub>

19. The NC2 provided data only for potential emissions of the three new gases. The team was informed that data on actual emissions are available only for usage which is assumed to relate directly to emissions. HFCs have been introduced as substitutes for ozone-depleting substances and are mainly used in cooling equipment, including air conditioners in vehicles, while PFCs have been used for about 20 years as an etching gas in semiconductors and in inert liquids. Emission estimates for HFCs and PFCs reflect production data only, and exclude import and export of equipment containing these gases. HFC emissions were 1.6 Gg in 1990, rising to 13.5 Gg in 1997. Emissions of PFCs were around 0.8 Gg in 1990 and were considerably higher at 2.2 Gg in 1997, while emissions of SF<sub>6</sub> were estimated at 1.6 Gg in 1990 and reached a level of 2.1 Gg in 1997.

### III. POLICIES AND MEASURES

20. Japan's NC2 outlined a comprehensive programme of policies and measures aimed at reducing GHG emissions, especially for key sectors such as industry, energy, the residential sector and transport. In line with the 1995 UNFCCC reporting guidelines, the policies are described in relation to the broader policy context of the Action Programme to Arrest Global Warming, which in turn was an element of the Basic Environment Plan, approved by the Cabinet in December 1994. Little information was provided in the NC2 on the costs associated with policies, the extent of implementation or the specific impact on mitigating GHGs. The lack of either sectoral or measure-by-measure CO<sub>2</sub> reduction targets, as well as the scarcity of budget figures, makes it difficult to gauge Japan's progress and determine government priorities or the scale of investment and funding regarding climate change mitigation policies and measures.

21. In spite of these difficulties, the review team noted that several improvements were made in preparing the NC2 by incorporating many of the recommendations of the first review. These included a more comprehensive description of policies and measures in general and for the

private sector in particular. Policies and measures on sink enhancement, waste and the new gases HFCs, PFCs and SF<sub>6</sub>, were also introduced in the NC2. National officials recognized that some improvement is still needed in presenting a quantitative description of the anticipated effects or current status of policies and measures, as well as the development and implementation of a monitoring system for assessing progress in reducing GHG emissions. They further stated that these issues will be addressed under the Guideline.

22. Japan's Action Programme consists of a comprehensive list of sectoral measures - for energy transformation, industry, commercial and residential sectors and transport. The overall emphasis of the programme is on more stringent energy efficiency standards, most of which are voluntary, government-supported research in new technology development and government subsidies for the introduction and commercialization of new energy sources. Measures also relate to enhancing carbon sinks, conducting research, undertaking observation and monitoring, promoting technical development and dissemination of information, raising public awareness and fostering international cooperation. Under the Programme it is required that progress reports regarding all measures be submitted annually to the Council of Ministers for Global Environment Conservation. In FY 1996, reports were submitted for 406 measures.

#### **A. Energy**

23. The underlying goals of Japan's energy policy are to attain energy security, economic growth and environmental protection. Japan imports 80 per cent of its energy, an extremely high percentage for an OECD country. Through its efforts to reduce its dependence on imported energy, Japan experienced a dramatic decline in its oil dependency from 77 per cent of total energy supply in 1973 to 56 per cent in 1997, this decline being attributed to the development of alternative fuels, especially nuclear energy, and energy conservation by the industrial sector. By way of guidelines to achieve these goals, the Advisory Committee for Energy, an advisory body to MITI, prepared an energy supply and demand outlook in June 1994 to curb CO<sub>2</sub> emissions, as outlined in the Action Programme. Specifically, in terms of supply, the outlook envisages that Japan must reduce its oil dependency to about 48 per cent of total energy supply by 2010, to be achieved by concentrating on three specific policies: increasing nuclear power generation, conserving energy and increasing the share of renewable energy and natural gas in its energy balance. For energy demand, the outlook projects that annual energy consumption growth must be limited to about 1 per cent by 2010, mainly through energy conservation measures.

24. Japan is the world's third largest generator of nuclear power after the United States and France. Nuclear power is the key element in the Government's strategy to increase energy security, displace oil, meet the growing demand for electricity and reduce CO<sub>2</sub> emissions. Since the commissioning of the first commercial nuclear power plant in 1966, Japan's nuclear power generation has achieved stable growth. In 1997 nuclear power accounted for 12 per cent of the country's energy supply and 34 per cent of its electricity supply. There were 50 nuclear power reactors in operation, totalling 42.5 GW of installed capacity and 301 TWh of electricity generated. In the long-term programme, the targeted contribution of nuclear power is estimated at 480 TWh of electricity, equivalent to a plant capacity of 66 to 70 GW. To meet the target,

Japan must commission about 16 to 20 more nuclear power reactors, each having a plant capacity of 1.3 GW.

25. Under its revised nuclear policy, the Government will seek to strengthen public confidence in nuclear power generation and to foster the understanding and cooperation of local residents in relation to the construction of nuclear power plants. The task of meeting this target is unprecedented, both in terms of the number of new plants required and the short time-frame available. Clearly, early progress will be necessary in securing new sites as the lead time for siting nuclear power plants in Japan is usually longer than scheduled. During the review, two instances were cited where sites for new nuclear plants had recently been approved. One involved a remote community which will benefit substantially from associated government subsidies as well as the development of new industries. The other was a site where a number of nuclear plants are already located. It was pointed out to the review team that new technology is making these power plants smaller and better suited for co-location with existing power plants. On the other hand, presentations from environmental non-governmental organizations indicated the growing concern of the community regarding the use and expansion of nuclear power in Japan.

26. Japan, the largest coal importing country in the world, accounted for 30 per cent of global imports in 1995, all of which were used to satisfy 95 per cent of national demand for coal. Coal accounted for 16.6 per cent of primary energy supply in 1990 and dropped to 14 per cent in 1996, with steam coal for electricity generation constituting 50 per cent of this demand and coking coal the rest. Since 1992, the Government has been implementing its 10-year coal policy in which new technology such as the fluidized bed is expected to allow coal to replace part of the oil demand. As a result of structural adjustment in the energy sector as a whole, domestic coal production fell from 55.4 million tons in 1960 to 8 million tons in 1995; this figure is expected to decline even further in the future and may in all likelihood result in a decrease in both CO<sub>2</sub> and CH<sub>4</sub> emissions.

27. Natural gas features prominently in the Government's priorities to reduce CO<sub>2</sub> emissions, after nuclear power and coal. In 1996 the share of gas in the supply balance rose to 11 per cent from a level of 10 per cent in 1990. Currently, Japan is the world's largest importer of liquefied natural gas (LNG), with imports accounting for about 96 per cent of Japan's natural gas supply. One third of LNG imports are used for power generation. The first steps towards liberalization of the gas supply industry were taken in March 1995, when the revised Gas Utility Industry Law came into effect. As a result, domestic gas suppliers and large volume customers can now freely negotiate conditions for supplying gas. In addition, amendments adopted to that law promote, but do not require open access to transmission facilities. The national gas grid currently services only 5 per cent of Japan's total land area and 21 per cent of urban areas, and as such demonstrates a large potential for expansion and greater penetration of gas in the energy supply.

28. In April 1996, the petroleum sector also underwent reform whereby the importation of petroleum products was opened to anyone, as long as the importer fulfils the security of supply requirements (the stockpiling of at least 70 days' equivalent of the previous 12 months' import) and the quality control obligation for environmental safety. At the same time, the Gasoline

Retail Business Law was revised, thereby lifting restrictions on the establishment of gasoline stations. The previous system limited competition in the gasoline retail sector, thus contributing to the high price of gasoline. However, due to deregulation measures, the price of petroleum products decreased. Gasoline prices fell from ¥122/litre in 1994 to ¥104/litre in 1996 but are still higher in Japan than in most other OECD countries.

29. As part of the overall structural reform of Japan's economy, the electricity sector has undergone change. The main objective was to reduce costs through improved efficiency in the production, transmission, distribution and supply of electricity. Electricity supply is dominated by 10 privately owned, vertically integrated regional utilities with monopoly rights and control of transmission and distribution within their service territories. In December 1995, the amended Electricity Utility Industry Law took effect, allowing independent power producers (IPPs - those with autogeneration facilities) to enter the power generation market. The law also abolished the requirement of government approval for electricity wholesale, such that any power producer can participate in a tender to sell electricity to power companies. In January 1996, new electricity retail prices were set by the Government, and a "yardstick system" was introduced as an incentive to enhance efficiency in tariff management, whereby prices were reduced by 4.2 per cent on average. This, added to the fact that IPPs are tending to focus on the use of coal and residual fuels, suggests that reform in the sector may result in an increase in GHG emissions. The Government, in an effort to curb this trend, has instructed utilities, with the exception of oil-fired plants already under construction, to adopt one of the principles of the International Energy Agency (IEA) action plan of not constructing oil-fired plants. The Japan Development Bank is providing loans and other financial assistance to promote the diversification of energy sources for power generation, toward renewable energy sources.

## **B. Industry**

30. Growth rate of Japan's final energy consumption has been decreasing since 1994. Industry accounted for 29 per cent of total CO<sub>2</sub> emissions in 1997. The NC2 mentions that the single most significant measure to reduce energy consumption and limit CO<sub>2</sub> emissions from industry is the voluntary action plans of the Japan Federation of Economic Organizations (Keidanren), the largest industry association. These action plans are projected by Keidanren to reduce CO<sub>2</sub> emissions from industry to below 1990 levels by saving 17 million tonnes of oil equivalent of energy in the industrial sector, between 1990 and 2010. However, while reductions have been achieved to date for energy consumption per unit of output, CO<sub>2</sub> emissions in FY 1997 were 3 per cent higher than in 1990. Discussions with the Keidanren confirmed the growing scope of the voluntary action programme. An annual in-house review of the plan prepared by the Keidanren in 1998 assessed the progress of measures taken over the year following the announcement of the voluntary action plan in June 1997.

31. The Keidanren review found that 39 industries and 140 industry groups were participating in the voluntary action programme. Of the 39 industries participating, 30 had established quantitative targets for reducing their CO<sub>2</sub> emissions and associated measures. Of these, 28 belonged to the industrial and energy conversion sectors and are currently covered in forecasts of quantitative targets for industry as a whole. The Keidanren review also concluded

that the industrial and energy-conversion sectors will get special attention in defining further GHG mitigation measures, given that in FY 1990 these two sectors generated approximately 42 per cent of national CO<sub>2</sub> emissions. New technologies such as high-efficiency industrial furnaces, which can improve energy use by about 10-30 per cent, and next generation high-efficiency boilers, which can improve boiler efficiency by at least 17 per cent, will be applied.

32. Following the Keidanren review, two new industries are participating in the action plan, established targets have been revised for two industries, and additional measures are being taken to deal with non-CO<sub>2</sub> GHGs (three industries) and targets are being newly established for 2010 (two industries). The Keidanren review has also added to and updated the specific policies of industry - targets and measures - to reflect, among other things, modifications to meet Japan's target under the Kyoto Protocol. To enhance the effectiveness of voluntary actions Advisory Councils of Ministers will review the progress achieved and ensure the feasibility of action plans developed by industry for energy saving and reduction of CO<sub>2</sub> emissions by 2010.

33. The review team recognized the extent of participation in the voluntary action programme across major companies and industries but noted the Keidanren's observations about the difficulty of promoting further energy conservation measures, as most industries are already very efficient. It also noted that the voluntary action plan mainly covers large industrial and energy-conversion enterprises. Some of the commercial and small and medium enterprises will be covered under the revised Law on the Rational Use of Energy, as well as the closely monitoring of the voluntary action programme to ensure that it is more effective in contributing to meeting national emission reduction goals.

### **C. Transport**

34. CO<sub>2</sub> emissions from the transport sector are reported in the NC2 as steadily increasing, accounting for 20 per cent of total CO<sub>2</sub> emissions in 1997. In light of this situation, the Council for Transport Policy prepared a report in April 1997, entitled "Addressing the Problems of Global Warming in the Transport Sector". In addition, the 1998 Guideline of Measures to Prevent Global Warming was formulated to achieve the 6 per cent reduction target under the Kyoto Protocol. In this report policy and measures for the transport sector were formulated based on the following four principles:

- (a) Promoting technological development of energy-saving, low fuel consumption cars and providing economic incentives for environmentally friendly car ownership by reforming the automobile tax system;
- (b) Promoting eco-driving by raising the awareness of drivers of the need to conserve energy;
- (c) Promoting and further improving public transport systems;

(d) Promoting more efficient logistics by utilizing the Intelligent Transportation System to improve truck transport efficiency.

35. In parallel with the enforcement of the 1999 revised Law on the Rational Use of Energy is the Energy-Saving Law, which was amended in June 1998. This law addresses the improvement of energy efficiency standards for automobiles, household electrical appliances and office equipment by introducing the "Top Runners Approach", which aims to attain standards meeting or exceeding the highest energy efficiency of products commercialized in a sector. With the revised law, fuel efficiency targets have been set for automobiles which aim for improvements in fuel consumption of 15 to 20 per cent over 1995 levels by FY 2010. These are expected to come into force by April 1999 and would include gasoline-fuelled cars and trucks with a gross vehicle weight of 2.5 tons, and diesel-powered motor vehicles. The Government also intends to take measures to improve energy intensity by about 7 per cent for railways and for aircraft and 3 per cent for ships by 2010, compared to FY 1995. The review team noted the potential effectiveness of the "Top Runners Approach" and the significant energy savings of 16.4 Mtoe that these measures were required to deliver between 1999 and 2010. If double counting is to be avoided, this saving would have to be additional to savings estimated for other measures such as the voluntary action plans, future technology development and improved transportation and traffic efficiency. In March 1999, a notification was already issued for the adoption of the "Top Runners Approach" and subsidies will be provided for the introduction of clean-energy and low-emission vehicles. ¥8 billion will be provided for the FY 2000 budget.

#### **D. Commercial and residential sectors**

36. The commercial and residential sectors accounted for about 14 and 12 per cent, respectively, of total CO<sub>2</sub> emissions in 1997. Emissions from these sectors have been on a continuous upward trend as fuel use for heating and cooling is on the rise. The measures being taken to reduce emissions from these sectors include an improvement in the energy efficiency of buildings and houses, appliances and office equipment; introducing cogeneration technologies for establishing district heat supply systems, introducing solar cells for small capacity power generation installations and alleviating the heat island phenomenon by planting greenery. By end-1998, the efficiency standards for heat insulation of houses and buildings had been strengthened, aiming for a 20 per cent reduction in energy consumption for heating and cooling in houses and a 10 per cent reduction for other buildings. The Housing Loan Corporation and the Japan Development Bank are also providing loans at preferential interest rates for the construction of homes and buildings that incorporate energy-saving measures. In 1998, MITI established a new subsidy programme for the commercial sector, targeting machines and systems that would achieve significant energy savings. Systems include air-conditioning systems which use ice to conserve energy, and light-emitting diodes with a 50 per cent improvement in energy use compared to fluorescent lights.

### **E. Renewable energy**

37. The NC2 specified seven measures for promoting the use of renewable energy through technologies such as photovoltaic power and solar hot-water in the residential and commercial sectors, waste power generation and fuel cells. It is notable that, in 1997, 20 MW of wind power and 950 MW of solar electricity were generated. During the review, the team was briefed on other initiatives to promote renewable energy as defined under the “Basic Guideline for New Energy Introduction”, which was adopted by the Ministerial Council for Comprehensive Energy Measures in December 1994. Later, in 1997, the Law on the Promotion of the Use of New Energy was introduced to accelerate the introduction of new energy sources. In an effort to encourage the private sector in the development of renewables, the Government provided subsidies to business enterprises which utilize wind energy, waste and cogeneration for generating its electricity. This support was estimated at ¥5.4 billion in 1998 and is expected to increase in the coming years. Then in 1998, with the introduction of the Basic Guideline for Promoting Global Warming Protection, there is a stipulation that wind power capacity will increase from 20 MW installed capacity in 1997 to 300 MW by 2010, photovoltaics from 91MW in 1997 to 5000 MW by 2010, and the recovery of the black liquid used in the pulp and paper industry will increase from the 1996 level of 4.9 giga litres of oil equivalent to 5.9 giga litres of oil equivalent by 2010. These measures will be accompanied by financial and tax incentives amounting to ¥58 billion between 1996 and 2010 for investing in fuel switching.

38. Of particular interest is the development of photovoltaic power generation, which reached 91 MW in FY 1997. In order to achieve market viability, a subsidy system was introduced for home-operated photovoltaic systems. Since its introduction in 1998, 8,200 applications have been received. Japan is also conducting field tests on phosphoric acid and molten carbonate fuel cells. Although the phosphoric acid fuel cells are still in a pilot phase, they are currently generating 30 MW of electricity in Japan, which is more than in any other country.

39. Being a geologically active region, Japan is endowed with extensive geothermal resources. As of March 1999 it currently has 17 geothermal plants totalling 533 MW of power capacity. The New Energy and Industrial Technology Development Organization is surveying new sites, developing new prospecting technologies such as a binary cycle power plant, and conducting research on extracting heat energy from hot dry rock.

### **F. Agriculture**

40. In 1997 the agricultural sector accounted for about 57 per cent of total CH<sub>4</sub> emissions in Japan. Most of these emissions were derived from enteric fermentation in livestock, manure management and rice paddy farming. Although there are no specific measures currently being implemented for climate change purposes exclusively, the team was briefed on several measures under consideration. CO<sub>2</sub> emissions in agriculture are being controlled by improving the energy efficiency of farming equipment and processes and conducting research and development on energy efficient technologies. From FY 1997/8, technical co-operation schemes have been introduced, including schemes to assist farmers who adopt appropriate water management and

organic material application in order to reduce methane emission from rice paddy fields and who use slow release fertilizers to reduce nitrous oxide emission from dry fields. Efforts are also being made to formulate standards for fertilizer use nationally. A project to promote the application of slow-release fertilizer will reduce the workforce used for fertilizer application and is already being implemented in 30 districts in 13 prefectures, as of FY 1997.

### **G. Waste**

41. The NC2 listed important policies for reducing CH<sub>4</sub> emissions from waste. Most of the waste-generated CH<sub>4</sub> originates in landfills, accounting for 24 per cent of total CH<sub>4</sub> produced in 1995, while CH<sub>4</sub> recovered from sewage treatment amounted to 27 Gg. Under the Basic Guideline, plans are under way to double the recovery of CH<sub>4</sub> from sewage by 2010. Although waste disposal is regulated by the Waste Management Law, a number of new policies were adopted under the 1998 Basic Guideline, to broaden the responsibility of waste producers and to recycle, in order to meet the new target of maintaining CH<sub>4</sub> emissions at their present levels.

42. Under the plan for developing waste disposal facilities of 1996, all waste incinerators are constructed close to power plants for utilization of the waste heat. To this end, the Ministry of Health and Welfare provides subsidies to municipal governments for the construction of incinerators in power plants. In 1997, 117 such incinerators were already installed, which represents 38 per cent of incineration capacity. Under the Guideline, a 55 per cent capacity rate is to be attained by FY 2002. In 1998, to achieve this goal, the Government mandated prefectures to establish plans for the large-scale incineration of waste and recovery of waste heat from these installations. In 1995, 890 MWh of electricity were generated from waste and this is expected to increase to 5000 MWh by 2010. The team was informed that, as space for final disposal of waste is running short, the waste processing method is shifting from landfills to incineration and by 2005 waste will cease to go to landfills. In addition, the Manual for the Preparation of Implementation Plans for Sewerage Systems for the Prevention of Global Warming is expected to be completed in 1999, to serve as a guide to industries in reducing N<sub>2</sub>O emissions by incinerating sludge. The Manual for the Planning for Sewerage System for the Prevention of Global Warming was completed in 1999, for example to serve as a guide to industries in reducing N<sub>2</sub>O emissions by incinerating sludge.

### **H. Forestry**

43. The NC2 reported that 67 per cent of Japan's land area is covered by forest, which was estimated to absorb 98 million tons of CO<sub>2</sub> annually, as of 1995. A nation-wide forest plan is prepared every five years which sets goals for the sector for a 15-year period. The last survey estimated total forest area as having been constant at approximately 25 million hectares since 1970. About 58 per cent of forests is privately owned. Given that the potential to increase forest coverage is limited, no specific climate-change related policies in this sector were mentioned in the NC2. However, there are continuing efforts to conserve the forests and to encourage reforestation, thinning, and overall improvement via forest management. In accordance with the Basic Plan for Forest Resources and Long Range Demand and Supply Projection for

Important Forest Products, various plans for the systematic conservation of forests are being pursued, including regional forest plans, which are formulated by prefectural governors on a 10-year basis, local forest improvement plans, which are formulated by cities, towns and villages, and forest management plans, which are formulated by forest owners for five-year periods.

44. An important element of the Guideline for Promotion of Efforts to Prevent Global Warming is the promotion of better forest management to increase the density and productivity of forests. Afforestation is promoted on abandoned agricultural land while more careful and sustainable forestry is promoted through agreements among stakeholders. More extensive urban greenery will also be promoted with the cooperation of Government and the private sector. Under the five-year plan for road improvement, efforts are geared to achieving 51 per cent greening along the road side, and from 2000 work will begin on greening 5 per cent of the land area near ports and harbours. While such policies will have multiple benefits, the contribution of these carbon sinks to meeting Japan's Kyoto Protocol target is uncertain, given that about 0.3 per cent of CO<sub>2</sub> emissions will account for net removal by sinks relating to afforestation and reforestation as specified in the Protocol. It is also estimated that around the year 2010 the amount of net removal by sinks in all of Japan's forests, etc. will be about 3.7 per cent. Officials noted during the review visit that it is too early to evaluate the effects of policy change in the forest sector on CO<sub>2</sub> emissions.

#### I. New gases

45. The NC2 reported four policies to control emissions of HFCs, PFCs and SF<sub>6</sub> and limit their use, including adopting closed systems, promoting recovery, reuse and destruction of these gases, and developing alternative substances and technologies. During the review, the team learned that recovery of these gases is not mandatory at present and there is still no law that prevents the release of ozone-depleting substances. Industry is slow in reacting and implementing recovery systems for these gases. However, in 1998, the Government allocated ¥59 billion over a ten-year period to promote the development of alternative technologies and under the Basic Guideline the increase in emissions of the new gases is to be limited to about 2 per cent by 2010. New alternatives will be investigated for refrigerants, cleaners and foaming agents. In addition, substitutes for SF<sub>6</sub> are already under investigation. Research is also under way to develop systems for recovering, destroying and rendering harmless HFC-23, a by-product in the manufacture of HCFC-22 in industrial processes, and alternative processes for etching gases (PFCs), which are used in producing electronic devices, are currently being studied.

46. Under the Law for the Promotion of Measures to Cope with Global Warming, work has been initiated on defining the mechanism of implementation, i.e. action plans. The law will also promote public reporting of plans for climate change abatement and the status of their implementation by the national government and local authorities as well as businesses which emit large volumes of GHGs. For the central and local government agencies, announcing their plan and its implementation status will be mandatory. The business sector will be encouraged to do the same. Local governments will also develop a common methodology to measure and

monitor the effects of measures at the prefecture, city, town and village level. The team felt that with this law, Japan will be better able to gauge its progress in meeting its national target to reduce GHG emissions and the relative contribution of policies and measures in doing so.

#### **IV. PROJECTIONS AND ESTIMATES OF THE EFFECTS OF MEASURES**

47. The NC2 presented projections for the three direct greenhouse gases, CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O, supported by a comprehensive set of figures for the projected emissions and the key assumptions made for most variables. The forecast is based on past trends and is referred to as a “standard scenario”, which does not take into consideration the possible effects of new policies and measures. An important omission was the failure to provide “with measures” projections. The projections team explained that a “with measures” scenario was not presented in the NC2 as studies were still being done at the time of its preparation. One exception was the effects of measures to enhance sinks, which were projected, accompanied by all key assumptions. Projections of other greenhouse gases such as nitrogen oxides (NO<sub>x</sub>), carbon monoxide (CO) and PFCs, HFCs and SF<sub>6</sub>, were not presented due to the lack of information. Most of the discussion during the review concentrated on the projections methodology and improvements since the preparation of the NC2.

48. As with the inventory data, projections are presented by fiscal year (1 April to 31 March). In projecting CO<sub>2</sub> emissions, the Government’s latest economic growth forecast and data on population growth were used, provided by the Economic Council and the Ministry of Health and Welfare, respectively. Data for industry were taken from the interim report of the Subcommittee for the Industrial Structure Council. The ministries of transport and agriculture provided their own estimates of emissions for these two sectors.

49. Projections for the energy sector prepared by MITI are based on Japan’s long-term energy supply and demand outlook, which is based on regression estimation methods comprising over 200 equations for each subsector, including industry, transport, the residential and commercial sectors and other energy consumption data. Regression analysis was done for the period 1960-1996 and the team was informed that the analysis is revised annually to reflect the changing conditions in trade and energy markets, and equations are modified every 10 years to improve the accuracy of the analysis. At a sectoral level, questionnaires are sent to industries to determine the demand growth for the different commodities, and for households a small sample is surveyed biannually by MITI to determine energy end-uses. These data are subsequently fed into the model. The national experts responsible for projections stated that the model is useful for short-term projections of two to three years but that they had reservations on projection results to 2010.

50. The outlook has been revised since submission of the NC2, the current version having been authorized in June 1998 by the Advisory Committee for Energy, Subcommittee for Energy Supply and Demand, acting under the auspices of MITI. Several experts were involved in providing and checking the key assumptions influencing the future emission trends with regard to GDP, population growth, exchange rates, fuel prices, energy intensity, number of households,

production of major raw materials, indices of industrial production, floor space and volume of transport. The outlook is based fundamentally on economic growth, energy security and environmental considerations. It incorporates the Action Programme to Arrest Global Warming and presents two scenarios for energy development in Japan, namely the “business as usual” scenario and “policy case” scenario including energy conservation measures, assuming an economic growth rate of 2 per cent annually until 2010 and a stabilization of CO<sub>2</sub> emissions from the energy sector at 6 per cent over 1990 levels. On the demand side, growth of energy consumption to 2010 must be kept at approximately 1 per cent annually, by intensifying energy conservation measures.

51. On the supply side in the “policy case” scenario, added nuclear capacity, a further decrease in oil dependency and further promotion of natural gas and new and renewable energy sources are planned to allow energy emissions to decrease from 314 Mt C in FY 1996 to the same level as in 1990 (287 Mt C) by 2010. It is estimated that coal supply will reach a level of 124 million tons in FY 2010. Coal use in power production is expected to increase in the short and medium term, based on increased imports, and then to level off as nuclear capacity increases. Oil is projected to continue its dominance in total primary energy supply for 2010, accounting for 47 per cent although it would have decreased its share from 55 per cent in FY 1996. Nuclear power capacity will increase in terms of plant capacity from 12 per cent in 1996 to 17 per cent in 2010. Natural gas use is projected to increase to 13 per cent, a 2 per cent increase over 1996.

52. While the NC2 did not assess the impact of liberalization of the energy sector on future emission trends, the team was briefed extensively on this issue during the review. The team gathered that, in general, the trend of emissions for electricity generation would mirror to a certain extent the increased use of LNG in place of oil and coal. In the short term, emissions are expected to grow slightly as a result of the increased use of natural gas, but in the long term they are expected to decrease as a result of the change in fuel mix to less carbon-intensive fuels and the increase in nuclear plant capacity. The share of renewables will increase only marginally to 1 per cent by 2010. As for electricity prices, a decline in real terms at an annual rate of 1 per cent is expected between 1996 and 2020, resulting in a 20 per cent reduction by 2020 and hence upward pressure on demand and GHG emissions.

53. Based on recent technological and economic trends, MITI experts explained that the large-scale energy conservation investment and improved productivity of all economic sectors, are expected to keep final energy consumption stable towards 2010, with energy savings amounting to 52 Mtoe between 1996 and 2010 based mainly on technology improvements. This should make it possible to keep Japanese final energy consumption in FY 2010 equivalent to that of FY 1996. Although the industry sector has achieved one of the highest efficiency levels among OECD countries, increased efforts are projected to achieve a further saving of 19.4 Mtoe by 2010, as a result of strengthening the law on energy conservation, voluntary agreements, by industries, energy conservation in medium-sized factories and technology improvements in the iron and steel and paper industries.

54. The energy-saving potential in the residential and commercial sectors has been estimated at 16.1 Mtoe. These savings are expected to come primarily from an improvement in the energy efficiency of household appliances and improved insulation in buildings as a result of a recently introduced set of efficiency standards for home and office equipment and buildings. Changes in lifestyle through public awareness campaigns on the use of air conditioning are also expected to have a significant impact on energy use.

55. Policies in transport may result in an energy saving of 16 Mtoe by 2010, and a subsequent reduction in CO<sub>2</sub> emissions. The largest impact is expected to come from further improvement in automobile fuel economy, an improvement in traffic efficiency and a shift from road to rail transport to meet the increasing demand for passenger and freight movement. Energy demand is also expected to be suppressed through the deployment of the clean energy vehicle programme, which will move from 29,000 units in 1998 to 3,400,000 in 2010 as a result of a basic policy for promoting new energy. Energy conservation campaigns directed at citizens will also be conducted.

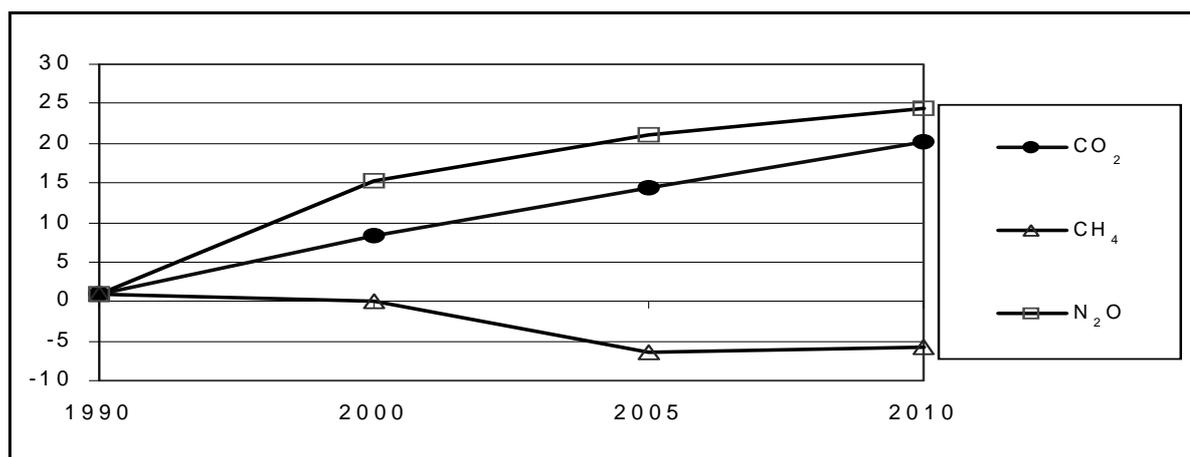
56. Although the NC2 did not indicate how sensitive the projection was to changes in key assumptions, this was explained during the week of the review. Crude oil prices, GDP and population were the three main variables used for conducting the sensitivity analysis. Crude oil prices are estimated at US\$ 22 per barrel in 1996 increasing to US\$ 30 per barrel in 2010, signifying an annual increase of 2.4 per cent. Population figures, estimated at 126 million and 128 million in 1995 and 2010, respectively in the NC2, were unchanged in the analysis. GDP, originally estimated as increasing at 2.8 per cent annually between 1996 and 2000 and 1.9 per cent from 2001 to 2010, was adjusted to 3 per cent for 1996-2000 and 2.3 per cent for 2001-2010.

57. Based on the results of the regression analysis, the extrapolation of trends (see figure 4) indicates that emissions of both CO<sub>2</sub> and N<sub>2</sub>O are expected to exceed 1990 levels by 20 and 15 per cent, respectively, in 2010. CO<sub>2</sub> reaches a level of 1,353,000 Gg by 2010, while net removals by sinks are estimated to decline by 33 per cent to 67,192 Gg and 55,811 Gg of CO<sub>2</sub> in 2000 and 2010, respectively. N<sub>2</sub>O emissions increase to 120 Gg in 2000 and 130 Gg in 2010. Only CH<sub>4</sub> emissions are projected to fall by 6 per cent in 2010 to 1,487 Gg. Some of this reduction is expected to come from improvement in waste management. Emissions of CH<sub>4</sub> from rice are on the decline as the area of irrigated paddy is projected to decrease, while emissions from livestock are held constant since animal numbers (pigs and cattle) remain constant over the projection period.

58. With respect to the new measures proposed under the Guideline, the review team noted that a number of key policies and measures stand out as being fundamentally important to the success of Japan's emissions abatement efforts. Most of these revolve around energy conservation, technology improvements in industry, such as iron and steel and paper production, and energy efficiency improvement in transport. Estimates of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions under the new policy scenario for the Kyoto Protocol target demonstrate an emission reduction potential of 2.5 per cent in the energy sector from 1990 levels. Under the Guideline, a ceiling of

2 per cent has been placed on the increase in emissions of the new gases by 2010. The team was also informed that the contribution of sinks to CO<sub>2</sub> emission reductions was still under discussion and that data on this are still preliminary. However, discussions with the national team suggested that an annual reduction of 0.3 per cent in CO<sub>2</sub> emissions thanks to reforestation and afforestation is likely. On the other hand, it is also estimated that around the year 2010 the amount of net removal by sinks of all of Japan's forests, etc. will be about 3.7 per cent.

Figure IV. Projected emission trends for the main GHGs



## V. VULNERABILITY ASSESSMENT AND ADAPTATION MEASURES

59. The NC2 presented an extensive overview of areas where Japan is vulnerable to the expected impacts of climate change and it outlined comprehensively a number of adaptation strategies that can be pursued. The team felt that the NC2 complied adequately with the reporting requirements in this area. During the review, the team was informed that there is cross-sectoral coordination among institutions in carrying out the impact studies. The Environment Agency is responsible for carrying out the impacts assessment while the meteorological agency studies the effects of climate. Other ministries such as those of agriculture, forestry and fisheries, transport and health and welfare are directly responsible for studying the sectoral impacts of climate change.

60. It is clear from information presented in the NC2 that Japan is among those countries leading in the assessment of vulnerability to climate change. In carrying out research, particular emphasis is given to the unique Japanese meteorological conditions and there is complete coverage of all key sectors vulnerable to climate change. Preliminary results indicate that serious and wide-ranging effects are expected from higher sea levels, higher temperatures and from changing precipitation and typhoon patterns due to climate change. Studies have been conducted on the effects of sea-level rise along the coast and on hydrological systems. The team was informed of the potential negative impacts on agriculture, especially on rice, maize and wheat yields, and of a possible decrease in fish production.

61. It was also pointed out that the Japan Meteorological Agency was also trying to develop a regional climate model. A prototype has already been produced and preliminary results of simulated climatic parameters in and around Japan have been promising. The model will be developed further and then used for future regional predictions. In this way, Japan intends to facilitate adaptation to the potential impacts of climate change through contingency and ecosystem planning. National experts pointed out that present uncertainty associated with such impacts makes it difficult to determine their associated economic costs.

## **VI. RESEARCH AND SYSTEMATIC OBSERVATION**

62. The NC2 contains a very full summary of research, monitoring and observation activities in Japan. A substantial amount of funding is allocated to research as part of a comprehensive programme for the promotion of global environment research, monitoring and technology development, which is set by the Council of Ministers for Global Environment Conservation for each fiscal year. Other funds are provided by the Global Environment Research Fund of the Japan Environment Agency for the promotion of science and technology and there are government subsidies for scientific research.

63. Among the research projects being implemented are the quantitative evaluation of climate change using climate and mass-transportation models, and the assessment and prediction of the dynamics of carbon dioxide in terrestrial ecosystems. Japan also cooperates with international research bodies (e.g. the World Climate Research Programme, the International Geosphere-Biosphere Programme, the World Meteorological Organization, and with the IPCC on inventories) and provided ¥123,000,000 in 1998 for research on global environmental change in the Asia-Pacific region through the establishment of the Asian-Pacific Network for Global Change Research in August 1999. Among other things, the network will assist in the development of observation methods, utilization and dissemination of observation and monitoring data, and promotion of international linkages on the subjects studied.

64. The team was informed that Japan will focus on climate-related research efforts in strengthening research and development of advanced innovative environment-friendly and energy-efficient technologies, strengthening earth observation systems, improving the knowledge base on carbon sinks and forests and developing a regional climate model which will be used to improve the outputs of global coupled general circulation models.

65. To date, atmospheric and oceanographic observations, including observations of concentrations of GHGs, climate and the upper air and sea level, have been made. The Frontier Observational Research System for Global Change was also inaugurated in August 1999 for the collection, management and quality control assurance of atmospheric and oceanographic data. Research is also being conducted on the function of forest ecosystems as sources and sinks. Seven monitoring towers were built in several forested areas across the country and data on an evaluation of the CO<sub>2</sub> fixation capacity of forests have been collected since 1998.

## VII. FINANCIAL ASSISTANCE AND TECHNOLOGY TRANSFER

66. The NC2 provided a detailed and comprehensive description of action taken by Japan regarding financial cooperation and transfer of appropriate technology in the field of climate change and overall economic development. In 1989, the Council of Ministers for Global Environment Conservation decided that greater consideration would be given to environmental issues in providing official development assistance (ODA), and in keeping with this objective, Japan expanded its ODA on environmental projects to ¥1440 billion between 1992 and 1996. The team was also informed of Japan's comprehensive medium- to long-term plan for environmental cooperation called the "Initiatives for Sustainable Development Toward the 21<sup>st</sup> Century" (ISD), a plan of action which includes Japan's measures to combat climate change. Japan also proposed the "Green Initiative" to assist developing countries in technological development for energy saving and other climate change mitigation projects. Most of these technical cooperation activities are coordinated by the Japan International Cooperation Agency (JICA), the coordinating agency for bilateral activities.

67. The team learned that ODA was expanded in 1997 to ¥1.3 trillion, an increase of 10.2 per cent over the 1996 budget, with environmental ODA accounting for 20 per cent of all projects. Under this ODA budget, Japan will implement its Kyoto Initiative, which will focus exclusively on assisting developing countries in climate change issues. In 1998, there were 20 ongoing climate change ODA loans projects, targeting areas such as energy-saving technologies, new and renewable energy sources, forest conservation and afforestation, and many technical cooperation projects for capacity-building through seminars and training programmes. The ISD also includes the establishment of environmental centres for capacity-building in Chile, China, Egypt, Indonesia, Mexico and Thailand. Under the Kyoto Initiative, Japan will also train 3,000 people in developing countries in the fields of air pollution, waste disposal, energy-saving technologies and forest conservation, over the FY 1998-2002 period. JICA will be the main entity responsible for implementing training programmes in Japan and in developing countries. In 1998, 1,100 experts had already received training under the ISD.

68. To help developing countries achieve sustainable development while tackling the problems of climate change, under Kyoto Initiative, Japan provides ODA loans mostly on concessional terms of 0.75 per cent interest rate, with a 40-year repayment period, for climate change related projects. In addition, Japan has decided to cut the interest rate for middle-income countries to 1.8 per cent. Already, 22 projects have been approved under these schemes, totalling US\$ 2 million.

69. The NC2 covered Japan's multilateral assistance through international organizations, such as the World Bank, the Asian Development Bank, the United Nations Development Programme, the United Nations Environment Programme and the Global Environment Facility. Japan contributed US\$ 415 million to the Global Environment Facility during the 1994-1997 budget period, and committed an additional US\$ 413 million to the current 1998-2001 replenishment.

70. Japan established an inter-ministerial and inter-agency coordination committee for activities implemented jointly (AIJ), as well as a secretariat for that committee. Proposals were publicly solicited for the first round of projects and to date 16 AIJ projects have been approved by the committee and 3 projects were reported to UNFCCC. Notable projects include an energy conservation project in Thailand in the iron and steel industry, a waste heat recovery project in a pulp and paper mill in Indonesia, a coke dry quenching project in the steel industry and a project for small-sized coal boilers in homes, in China.

71. In order to establish future environmental ODA projects, the Japanese Government intends to hold a bilateral policy dialogue with developing countries, in cooperation with other developed nations and international organizations. Coordinated efforts are also envisaged with non-governmental organizations and more emphasis will be given to human resource development in the climate change field.

### **VIII. EDUCATION, TRAINING AND PUBLIC AWARENESS**

72. The NC2 gave detailed information on domestic programmes and the participation of Japan in international activities in the area of education, training and public awareness. While responsibility for most formal educational programmes rests with local governments in Japan, the central Government in 1998 initiated several activities related to climate change education, training and public awareness. Specific projects such as the Global Warming Awareness Campaigns and Global Warming Prevention Month focus on expanding public awareness activities through a broad range of media and including the designation of months for particular activities. Since 1998, February of each year has been designated as Energy Savings Month, June as Environment Month and December as Global Warming Prevention Month. Other initiatives included the Recycling Promotion Month and awareness campaigns for energy conservation and recycling. As awareness campaigns to promote greenery, the "Greenery Week" and the Greentown Month" are conducted on the government's initiative. Public relations campaigns on global warming are also conducted through the mass media, pamphlets and symposiums, focusing on easy-to-understand global warming mitigation measures. The costs involved and sources of funding, associated with all the above projects were clearly given for the different initiatives in this area. The budget for education and public awareness on climate change increased substantially from ¥340 million in 1991 to ¥3,242 million in 1997.

73. In 1997, Japan introduced the "four challenges" programme to involve citizens in efforts to arrest global warming. These challenges are: (1) household eco-books, (2) green offices and eco-shops, (3) drive less, walk more, and (4) stop idling. The Government has been supporting public campaigns conducted by environmental non-governmental organizations by providing funding through the "Japan Fund for the Global Environment" of the Japan Environment Corporation. Funds are allocated to the conservation of the local environment, the formation of the Global Environment Information Centre (GEIC) as a joint project of the United Nations University (UNU) and the Environment Agency, for the establishment of a registration system for environmental counsellors. Promotion of environmental education and learning has been

implemented in schools via the “Hands-on Environmental Learning” project, the formation of junior eco-clubs and various types of contests for school pupils.

74. Under the Guideline, introduced in 1998, measures are included to further raise awareness and disseminate information so as to promote climate-friendly lifestyles. In each prefecture, a centre for promoting activities to prevent global warming will be designated, and voluntary advisors will be appointed to give advice in that regard. Activities will include: stimulating public discussion about the introduction of daylight saving time; securing social conditions leading to promotion of the use of bicycles; improvement of structures for education, awareness raising and information dissemination; exemplary action by Government; expansion of greening activities of citizens and implementation of model projects which lead to innovation in social systems. In achieving this objective the Government intends to strengthen financial support to environmental non-governmental organizations as a means of ensuring their participation in this endeavour. The team was informed that there was no system or methodology in place for monitoring the effectiveness of awareness campaigns at the moment, and given that several different central government agencies and other stakeholders are directly involved in these initiatives, the team is of the opinion that greater coordination across government agencies will be needed to ensure that these programmes attain the results that are anticipated in changing public behaviour.

## IX. CONCLUSIONS

75. In general, the review team was of the opinion that Japan’s NC2 was more comprehensive than the NC1 and provided extensive information on all areas required by the guidelines for preparing national communications. The team also noted that there is an effective system in place for collecting activity data and overseeing the preparation of the inventories, including the employment and improvement of methodologies for determining GHG emissions. The team also felt that there is good coordination among all government agencies involved in climate change activities, and that they are all actively continuing their efforts to improve the database on GHGs where incomplete, and in developing national emission factors for inventory data. Much research is also in progress on the land-use change and forestry category and further improvements are expected as annual inventories are prepared.

76. Japan’s CO<sub>2</sub> emissions increased by 9.9 per cent between 1990 and 1996. This increase was largely driven by energy consumption rather than by changes in the fuel mix. CO<sub>2</sub> emissions are projected to exceed 1990 levels by 20 per cent in 2010. Similarly, N<sub>2</sub>O emissions are expected to be 15 per cent above 1990 levels by 2000, and to increase further by 2010. On the other hand, CH<sub>4</sub> emissions will level off to 1990 levels in 2000 owing to a marked decrease in emissions from agriculture and it is projected to fall by 6 per cent in 2010. In spite of policies implemented over the years, overall, these do not seem sufficient for Japan to achieve the goal of stabilizing CO<sub>2</sub> emissions at the 1990 level in 2000. For this reason, the Government in June 1998 adopted the Guideline of Measures to Prevent Global Warming, in an effort to adopt urgent measures for reducing GHG emissions towards the year 2010. In April 1999, both the Law on the Rational Use of Energy and the Law for the Promotion of Measures to Cope with Global

Warming also came into force, the latter being the first law to explicitly address climate change. Under the Guideline, financial incentives, such as subsidies, tax breaks, low interest rates and education and public awareness for citizens, are expected to play a dominant role in the CO<sub>2</sub> policy approach.

77. The team believes that these recent developments, announced since the NC2, considerably strengthen Japan's response to the greenhouse effect. However, the review team remains concerned about the need for a more systematic and rigorous approach to monitoring and assessing the effects of these policies and measures, as responsibility for implementing measures is spread across a large number of central and local government agencies. Also many measures rely on voluntary action on the part of business and citizens. Under these circumstances, monitoring and assessment will become even more important; such information, in addition to ensuring transparency for the domestic and international community, is required to ensure that national policies are on track.

78. Fundamental to the achievement of Japan's emission reduction targets are energy supply and demand policies which, according to the latest long-term energy supply and demand outlook, are projected to return Japan's energy sector CO<sub>2</sub> emissions to 1990 levels by 2010. Whilst most of these energy policies are being introduced primarily to reduce its dependence on fossil fuels, many of the new measures also focus on climate change. Japan already has high levels of taxation and further increases are now limited by concern about competitiveness. To meet its 2010 target, Japan intends to increase nuclear electricity by 50 per cent more than the present amount. However, public opposition to specific plant sitings still exists, in spite of information campaigns and the promise of compensatory payments and benefits to communities accepting facilities. Japan also intends to increase the use of renewables in its energy supply balance and to promote measures to limit emissions of the new gases through recovery and substitution.

79. On the demand side, drastic improvement of energy efficiency and strengthening efficiency standards, continue to be the focus of policies in the Action Programme to Arrest Global Warming. While industry has made strides in improving its energy intensity, emissions are increasing in the residential and transport sectors. This, added to the fact that building efficiency is essentially voluntary, would underline the importance of the Cabinet reviewing greenhouse policies annually, as anticipated in the Guideline, and introducing a stringent monitoring system to assess the performance of these sectors in abating GHG emissions.

80. Japan should be commended on the Kyoto Initiative, a programme which was formulated in December 1997 to strengthen environmental support to developing countries in climate-change related projects. The Initiative includes the establishment of environmental centres for capacity-building in several developing countries, and the intention is to train 3,000 persons annually.

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