UNITED NATIONS

Framework Convention on Climate Change

Distr.
RESTRICTED

FCCC/IDR.2/CZE
20 September 1999

ENGLISH ONLY

CZECH REPUBLIC

Report on the in-depth review of the second national communication of the Czech Republic

Review team:

Mr Cheng Hoon Ho (Singapore)
Espen Ronneberg (Marshall Islands)
Stelios Pesmajoglou (Greece)
Tina Dallman (UNFCCC secretariat, coordinator)

Also available on the World Wide Web (http://www.unfccc.de)

GE.99-

I. INTRODUCTION AND NATIONAL CIRCUMSTANCES

1. The Czech Republic ratified the United National Framework Convention on Climate Change (UNFCCC) on 7 October 1993 . Its first national communication (NC1) was submitted on 17 October 1994 and the second national communication (NC2) was submitted on 6 August 1998. The in-depth review was carried out between February 1999 and August 1999 and included a review team visit to Prague from 1 to 5 February 1999. The team consisted of Mr Cheng Hoon Ho (Singapore), Mr Espen Ronneberg (Marshall Islands), Mr Stelios Pesmajoglou (Greece) and Ms Tina Dallman (UNFCCC secretariat, coordinator). During the visit, the team met officials from government ministries and agencies, members of environmental non-governmental organizations and industry representatives.

2. The Czech Republic is a landlocked country in the middle of Europe, with a surface area of 78,864 km^2, lying in the upper reaches of the Labe, Odra and Danube river basins. It was established on 1 January1993 when the Czech and Slovak Federal Republics, formerly known as Czechoslovakia, divided. The population exceeds 10 million, of whom more than 1.2 million live in the capital Prague. It has a so-called 'Atlantic continental moderate climate' characterized by westerly winds and changeable weather throughout the year. Mean temperatures in the mountains and lowlands respectively range between 9ºC and 19ºC in the summer months and 7ºC and 0ºC in the winter months. Of the total area of the country, 67 per cent lies at an altitude below 500 m. The driest regions receive annual precipitation of around 410 mm, whilst in mountainous areas it is around 1,500 mm. Agricultural land accounted for over half of the country's land area in 1997. The forests are mostly coniferous and cover around a third of the country's land area, giving the Czech Republic the eighth largest forest coverage and the fourth largest growing stock volume (254 m^3/ha) in Europe.

3. The economy is undergoing transformation. In early 1991, the Czech and Slovak Federal Republic launched an extensive programme to move toward a more market-based economy. This was supported by agreement with the International Monetary Fund and a loan for structural changes from the World Bank. The main goal was to stabilize the country's economy, while introducing a number of structural and institutional reforms, such as trade reform, liberalization of prices, privatization of state enterprises, reforms of energy, including a substantial increase in the price of energy, and environmental protection policies. One of the first effects of changes occurring in the early 1990s was a reduction in output and a decline in exports to the countries of the former Soviet Union. As a result, gross domestic product (GDP) fell, in real terms, by about 16 per cent, compared to 1990, before recovery began in 1993. By 1997 real GDP was around the same level as in 1990 and per capita GDP was about 60 per cent of the Organisation for Economic Co-operation and Development (OECD) average. Despite the economy suffering from stagnation at the time of the review, the Czech Republic has one of the strongest economies in central and eastern Europe. Whilst the scale of the state involvement in the economy has declined significantly during the 1990s, the State still plays an important role, especially in subsidizing activities in the energy, agriculture and transport sectors.

4. The country has a long tradition of industrial activity. Around 1.6 million or one third of the working population was employed in manufacturing in 1990 and this figure fell to just over 1.4 million in 1997. The Czech Republic is paying for its legacy of heavy industry characterized by old and inefficient technologies, as investment in controlling environmental pollution rose from CK 579 billion in 1990 to CK 1,533 billion in 1996, an increase from 1.1 to 2.4 per cent of GDP. ($1 = 28,000 CK in 1990 and $1 = 27,145 CK in 1996.) About 0.4 million were employed in construction in the period 1990 to1997, whilst there was a significant increase in the number employed in wholesale and retail activities, from 0.5 million to 0.8 million, and a rapid decrease in those employed in agriculture from more than 0.4 million to less than 0.3 million. In general, there is a move away from manufacturing toward the provision of services.

5. Despite extensive efforts to switch from coal to gas, begun in 1992, brown coal still dominates the energy balance and is the main cause of environmental pollution. Total primary energy supply amounted to around 1,761,461 TJ in 1997, of which coal, coke and wood accounted for around 55 per cent, oil 19 per cent, gas 18 per cent, nuclear 8 per cent and hydroelectric power less than 0.5 per cent. Almost all of the coal consumed was from indigenous production, whereas oil and gas were predominantly imported. Of a total installed electricity generating capacity of 15,073 MW in 1997, 74 per cent was based on coal-fired plant, 14 per cent on hydroelectric power and 12 per cent on nuclear, accounting for 77 per cent, 4 per cent and 19 per cent of electricity generation, respectively. About 17 per cent of the 59,959 GWh of electricity produced in 1997 was exported, with the result that exports modestly exceeded the amount imported. Industry accounted for around 45 per cent of final energy consumption in 1997, the residential sector 22 per cent, transport 14 per cent and the public sector about 14 per cent.

6. Energy intensity, measured as total primary energy supply per unit of GDP, was 0.39 tonnes of oil equivalent (toe)/US$ 1,000 in 1996, among the highest in the OECD, even after falling sharply since 1992. Carbon dioxide (CO_2) emissions intensity, measured in terms of emissions per unit of GDP, has also been amongst the highest in the OECD during the 1990s and at 1.15 in 1996 was over twice the OECD Europe average of 0.55.

7. The Czech Republic joined the OECD in 1995 and, at the time of the review, was undergoing a preparatory process for accession to the European Community (EC). In practice, this requires it to bring much of its legislation into line with that in the EC, including environmental legislation, by 2003 with a view to joining in 2005. The effect on GHG mitigation may be mixed, as greater introduction of competition and lowering of prices in some sectors may increase consumption and hence emissions, whereas in other sectors the removal of subsidies and other distortions may result in fuel switching away from coal and changes in consumption patterns that lower emissions.

8. The Czech Republic is a parliamentary democracy. It has eight regional subdivisions each divided into districts. There are 77 of these, of which, 73 are administered by District Offices. The District Offices are state administrative bodies with general competence and are part of the Ministry of Interior. Prague, Brno, Ostrava and Pilsen are self-governing. Local

government consists of as many as 6,234 municipalities. Discussions on a new administrative structure should be finalised by 2000.

9. Climate change is a relatively new issue in the Czech Republic, whereas there have been serious concerns about air pollution for many years. Various measures adopted in the 1990s to tackle general environmental problems have also resulted in greenhouse gas (GHG) mitigation. The Ministry of the Environment was created in 1990 and the Czech Republic's first inter-ministerial commission on climate change was set up in early1994 in order to prepare the NC1, followed up by initial work on the emission inventory which then received support from the United States Country Study Program in 1994. A new inter-ministerial committee was established in November 1998 to draw up a climate change mitigation strategy for all sectors, in response to the Kyoto Protocol. The Committee serves as an advisory body to the Minister of the Environment which leads on Convention issues.

II. INVENTORIES OF ANTHROPOGENIC EMISSIONS AND REMOVALS

10. The Czech Republic does not have an emission inventory for the period before 1990, although it is clear that emissions would have been higher than in the 1990s. Due to the unavailability of earlier data, 1990 is used as the base year, without temperature or other adjustments. Much work has been done during the1990s to establish a GHG inventory. Early work in the period 1992 to 1993 was not based upon the Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories. In 1994 the United States Country Study Program provided assistance for further development of the inventory and in 1995 the Czech Hydrometeorological Institute (CHMI) took over the inventory work from the private non-profit organization SEVEN. At that time the inventory was prepared for the period 1990 to 1993 using IPCC methodology for the GHGs CO_2, methane (CH_4) and nitrous oxide (N_2O). In 1997 the new gases, sulphur hexafluoride (SF_6), hydrofluorocarbons (HFCs) and perfluorinated hydrocarbons (PFCs) were added to the inventory and the revised 1996 IPCC Guidelines were adopted, resulting in a revision of the whole CO_2 time series from 1990. During 1998 the CH_4 time series was also updated and, at the time of the review, there were plans to update the N_2O estimates for the period 1990 to 1995 by the end of 1999.

11. The NC2 contains information for the direct GHGs CO_2, CH_4, N_2O, HFCs and SF_6 and the indirect gases nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOC) and carbon monoxide (CO) over the period 1990 to 1995. During the review, information for 1996 and 1997 was additionally provided. The 1996 and 1997 inventory was compiled using software analogous to the latest IPCC software. An older spreadsheet model holds information on the 1990 to 1995 inventory, based on the old IPCC standard data and summary tables and the Czech Republic still reports data for the period 1990 to 1995 according to this reporting format.

12. The IPCC methodology has generally been employed for the inventory estimates for the period 1990 to 1997, exceptions being the estimate of NMVOC emissions that are based on CORINAIR methodology and emissions of NO_x and CO, which are taken from the national emissions register. For the later two gases, around 2,000 of the largest sources have direct

measurement of these emissions, whilst for about 20,000 smaller sources activity data and local emission factors are used. Emissions from 152 large sources with a thermal output exceeding 50 MW and from about 50 special technologies are measured continuously. Emission estimates for these gases have been reported in accordance with the IPCC sources and categories format.

13. The CHMI, in cooperation with KONECO Ltd, annually gathers the data needed to compile the GHG inventory. Most of the activity data are taken from official national statistics. By law, all companies with more than 10 employees must supply data to the Statistical Office. With the change from a centrally planned to a more decentralized economy, the system of compiling statistics is undergoing significant alterations to bring it into line with common international practices. Previously energy statistics, for example, were presented by organizational sector; thus the consumption of automotive fuels was categorized into agriculture, trade and service sectors etc. and only that consumed by public transport was allocated to the transport sector. The Czech Statistical Office now publishes energy balances using a transitional methodology, with partial inclusion of International Energy Agency (IEA) methodology. Official energy statistical data are adjusted during the course of the inventory estimation for the sake of further harmonization with IEA practices, which leads to differences of 1 to 5 per cent. Preliminary data are available for estimation of inventories with a time-lag of about 6 months, whilst final data is available with a time-lag of one to two years, depending on the sector.

14. The team queried whether blanks in the inventory tables were mainly due to zero emissions or a lack of information to estimate the emissions and were informed that, on the whole, they were due to negligible emissions from those sources. For 1997 data, shown in the sectoral and summary tables, the recommended symbols, 0, NO, NE and IE are used.

15. Uncertainty has been assessed on the basis of expert judgement. For CO_2 overall uncertainty is assumed to be in the range 7 to 10 per cent, for CH_4 it is thought to be less than 40 per cent and for N_2O in the range 70 to 100 per cent. Given that the inventory is dominated by CO_2 emissions, the overall uncertainty for the three gases combined is thought to be about 10 to 15 per cent.

16. An outdated global warming potential (GWP) value for CH_4 was used in estimating the aggregated GHG emissions presented in the NC2. Using the most recent value, total GHG emissions decreased from about 187,500 Gg in 1990 to reach a low of 142,700 Gg in 1995 and then increased to reach 151,400 Gg in 1997, a decrease of 19 per cent compared to 1990. Energy and transformation contributed 38 per cent of net GHG emissions in 1996, industry fuel combustion 29 per cent, the residential sector 8 per cent, transport 7 per cent, other forms of combustion 5 per cent, agriculture 6 per cent, fugitive emissions 4 per cent, industrial processes 2 per cent, waste around 1 per cent and land-use change and forestry -3 per cent.

A. Carbon dioxide

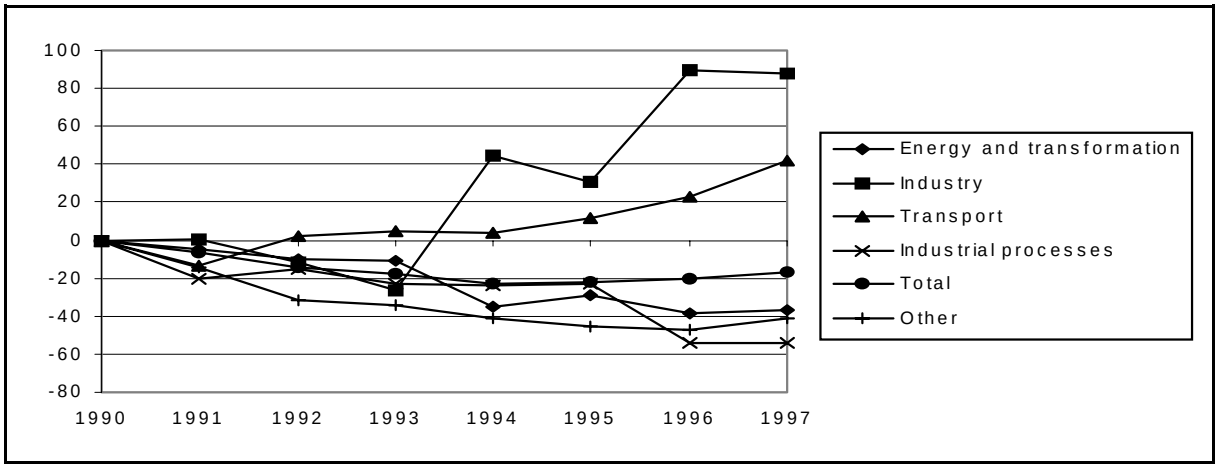
17. In 1997, CO_2 accounted for 86 per cent of total direct GHG emissions. The main contributor to emissions is fossil fuel combustion and, of this, 92 per cent is from stationary

sources and 8 per cent from mobile sources. The most important feedstock emissions in the 'industrial processes' sector come from cement production, which accounted for almost 2 per cent of total CO_2 emissions. Other emissions from fossil fuel feedstocks, such as those associated with coke production, are included under the fuel combustion category. By fuel type, 70 per cent of CO_2 emissions are attributed to brown and hard coal, 17 per cent to liquid fuels and 13 per cent to natural gas.

Table 1. Emissions of carbon dioxide, by source, 1990-1997 (Gg)

	1990	1991	1992	1993	1994	1995	1996	1997
Energy and transformation	94 090	89 976	84 461	83 746	61 373	66 574	57 818	59 180
Industry	23 104	23 250	20 340	16 985	33 368	30 124	43 867	43 341
Transport	7 959	6 869	8 143	8 314	8 260	8 912	9 760	11 303
Industrial processes	5 417	4 335	4 591	4 190	4 114	4 170	2 479	2 498
Waste	0	0	0	0	0	0	357	357
Other	34 948	29 908	23 948	22 948	20 634	19 039	18 121	20 358
Total	**165 518**	**154 338**	**141 392**	**136 183**	**127 749**	**128 819**	**132 402**	**137 037**
Land use change + forestry	-2 281	-5 027	-6 041	-5 643	-3 943	-5 454	- 4 479	-4 639

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



18. It can be observed in figure I that overall CO_2 emissions fell 20 per cent between 1990 and 1997. Emissions from energy transformation and industrial processes generally fell during this period, whereas emissions from industry and transport, after falling initially, grew. The increase in emissions from industry is attributable to the inclusion of emissions from centralised heat production in the industry sector after 1993. Previously these emissions were included in the energy and transformation sector.

19. From 1996 onward the inventory methods were changed to report CO_2 emissions from waste, solvents and international bunkers separately, but the whole time series has not been updated accordingly. (In table 1 the break in the waste time series can be observed.) The team

recommended that the inventory be recalculated in order to treat bunker fuel emissions, CO_2 from solvents and CO_2 from waste as well as emissions from the energy and transformation and industry sectors on a consistent basis for the period 1990 to 1997.

20. CO_2 emissions were estimated entirely using IPCC default emission factors. A comparison was made between country-specific and IPCC default emission factors for coal and lignite and they were found to have good agreement. The team were presented with the results of a comparison of the IPCC reference approach with the sectoral (tier 1) approach for the period 1990 to 1996. (Table 1 shows emission estimates based on the sectoral approach.) Differences in the approaches were typically less than 2 per cent in any one year and in two years the results were identical, which seemed somewhat unusual to the team. Officials believe that the IPCC reference approach is more accurate than the sectoral approach because the overall national energy statistics are considered as more accurate than the sectoral statistics.

21. Due to the historic importance of the forest and forest management, there are good basic data for the forest inventory. The growing stock volume of forest stands has increased over many decades due to enlargement of forest areas, prolongation of the rotation period and extension of protected forest. Annual fellings were reduced from 13.3 million m^3 in 1990 to 9.9 million m^3 in 1992 and then steadily rose to reach 13.5 million m^3 in 1997. Over this period, the annual forest increment increased from 17.0 million m^3 in 1990 to 18.2 million m^3 in 1997. National values were used in preference to IPCC default emission factors in the emissions calculations. The CHMI have done little work on the forest inventory since taking over from SEVEN in 1995 and note that estimates are highly uncertain.

B. Methane

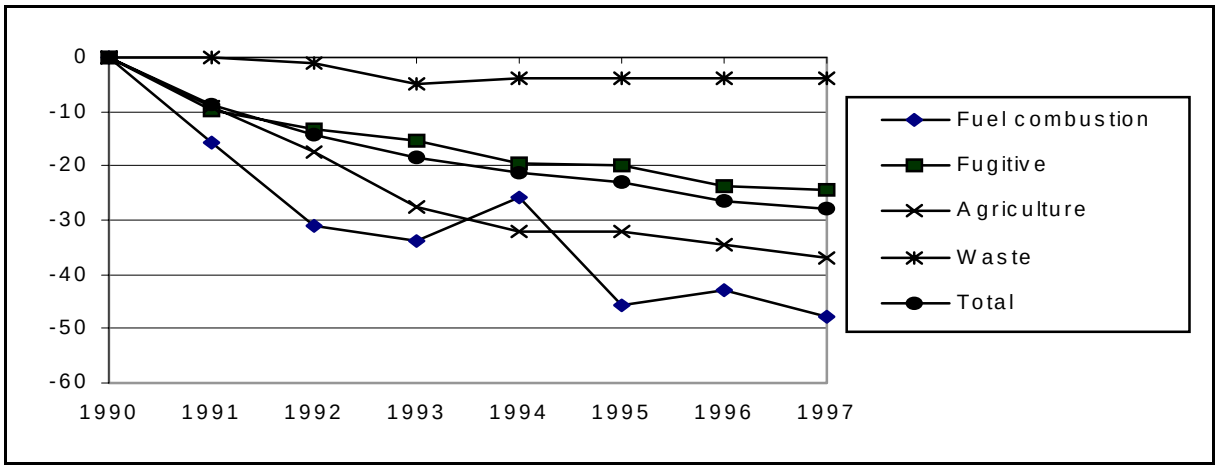
22. CH_4 accounted for about 8 per cent of total direct GHG emissions in 1997. Fugitive emissions, mainly from coal mining, were responsible for 52 per cent of the total, livestock 24 per cent, waste, including landfills and waste water 17 per cent and other sources, including residential combustion and industry, the final 7 per cent. Many of the CH_4 emission estimates are based on national emission factors.

23. It can be observed in table 2 that total CH_4 emissions fell by around 28 per cent between 1990 and 1997 and, underlying this, emissions from all sources declined. The reduction in emissions from agriculture is primarily attributable to the reduction in the number of livestock, owing to a decline in demand from countries of the former Soviet Union. Between 1992 and 1997 the number of cattle fell from around 2.5 million to 1.7 million, pig numbers were reduced from about 4.6 million to 4.0 million, and the number of sheep declined from 0.3 to 0.1 million, whilst stocks of other livestock were broadly stable.

Table 2. Emissions of methane, by source, 1990-1997 (Gg)

	1990	1991	1992	1993	1994	1995	1996	1997
Fuel combustion	59	50	41	39	44	32	34	31
Fugitive	394	356	342	333	317	315	301	298
Industrial processes	14	12	11	10	12	12	5	4
Agriculture	204	186	169	148	139	139	134	129
Land-use change + forestry	2	2	2	2	2	2	2	2
Waste	105	105	104	100	101	101	97	97
Total	**778**	**711**	**668**	**633**	**613**	**599**	**573**	**562**

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



24. The output of coal mining has fallen during the 1990s from around 20 million tonnes in 1990 to 15 million tonnes in 1996 with a resultant reduction in fugitive emissions from this source. Coal mining conditions also changed over time so that a specific emission factor has been calculated for each year. This calculation is possible as a result of CH_4 measurement in mines for safety reasons. Fugitive emissions from mines are thought to be estimated with a low uncertainty.

25. A legal obligation to prepare waste management programmes from 1991 onward led municipalities and enterprises to begin records of waste generation, but before 1998 there was no duty to report on waste generation and available information was based on voluntary data collection. The amount of municipal waste generated per capita in 1996 was below the OECD average, whereas the amount of industrial waste generated per unit of GDP was more than four times the OECD average. A study in 1996 measured CH_4 emissions from 60 landfills in order to obtain estimates of the appropriate emission factors, which resulted in a national estimate somewhat below the IPCC default value. Around 7 per cent of emissions from landfill were combusted at the time of the review as a result of gas collection.

26. There are two gas transmission systems in the Czech Republic with large volumes of gas crossing from the Russian Federation to markets in other countries. The leakage rate for cross-country transportation is estimated to be around 0.1 per cent and for local distribution of domestically consumed gas it is estimated at around 3 per cent, with corresponding emission factors.

27. In view of the gaps that exist in the knowledge about CH_4 emissions, a one-day conference was organized in May 1997 for which various research papers were prepared. Thereafter, better information was available on CH_4 from coal mining activities and gas transportation and the emission factors were revised accordingly.

C. Nitrous oxide

28. In 1997 approximately 6 per cent of total direct GHG emissions were accounted for by N_2O. Of total N_2O emissions, about 66 per cent were attributable to agriculture, including use of fertilizer and manure, 15 per cent to industrial processes, 7 per cent to transport, owing to the use of catalytic convertors in cars, and 7 per cent to the use of fluidized bed technology in fuel combustion. A mixture of IPCC default and national emission factors are used to estimate emissions. Officials noted that the emission factor for fuel combustion, taken from the older CORINAIR version, is unrealistically high and will need to be revised.

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

	1990	1991	1992	1993	1994	1995	1996	1997
Fuel combustion	20	19	17	17	17	16	4	4
Industrial processes	3	3	4	3	3	3	3	4
Agriculture	2	2	2	2	2	2	21	19
Total	**26**	**23**	**23**	**21**	**22**	**22**	**29**	**29**

29. Trends in N_2O emissions over time can be observed in table 3, but it should be noted that years 1990 to 1995 are estimated on the basis of the old IPCC Guidelines and the subsequent years using the revised IPCC Guidelines. Officials noted that corrections for the period 1990 to 1995 should be complete by the end of 1999.

30. As a result of the decline in the agricultural sector and changing farming practices, the consumption of nitrogen in industrial fertilizer fell from 86.3 kg per hectare in 1990 to 55.1 kg per hectare in 1997. The number of farms with so-called 'environmentally friendly agriculture' increased from 3 in 1990 to 211 in 1997, resulting in 0.5 per cent of agricultural soil area being managed in a way that should have had a small effect in reducing N_2O emissions from fertilizer use. A comparison was made between using IPCC default values for Western and Eastern Europe for emissions from agriculture and the difference for 1997 was only found to be around 4 per cent, so the Western European values have been employed in estimating emissions.

D. New gases (HFCs, PFCs and SF_6)

31. The inventory of the new gases was prepared as an output for a special project relating to the Montreal Protocol. The NC2 reports no emissions of PFCs in the period 1990 to 1995, modest emissions of SF_6 throughout and a small amount of HFC emissions in 1995. According to the latest data, potential emissions of HFCs, PFCs and SF_6, combined, on a CO_2 equivalent basis are estimated at 63.1 kt in 1995, 407.5 kt in 1996 and 415.8 kt in 1997. They are estimated to have accounted for only around 0.3 per cent of total direct GHG emissions in 1997.

32. There is no production of the new gases within the Czech Republic, so emission estimates are based on customs declarations. Gases contained within imported products such as air-conditioning systems in cars are not counted, aside from HFCs in refrigeration systems. PFCs are only imported for use as a cleaning medium. SF_6 is used in the production of electrical distribution equipment and as an insulator in double glazing.

33. For 1997, unlike previous years, it was not possible to separate out the volumes of HFC and PFC in customs declarations because of newly imposed confidentiality restrictions. So, it is not possible to take into account of the different GWPs associated with the various HFC gases and hence the inventory of the new gases is less accurate for this year. Officials noted that the inventory base year for the new gases will be 1995 because it is not possible to get earlier data.

III. POLICIES AND MEASURES

34. At the time of the review, work was under way on an updated strategy to mitigate climate change. The strategy gives priority to domestic actions and the application of policies and measures in all sectors. In May 1999, a document on a Strategy to Mitigate Climate Change in the Czech Republic was approved by the Government. This obliges the Minister responsible for energy, industry, transport and agriculture to set out significant measures in strategic policy documents for these sectors with the main aim being to achieve the Czech Republic's target reduction, agreed under the Kyoto Protocol, through domestic actions. The review focused more on changes since 1990 and implemented policies.

A. Cross-cutting issues

35. Whilst charges for air and water pollution had been in existence for many years, their importance increased after the parliament passed the 1991 Act of the Czech National Council on the State Administration for Air Protection and Charges for the Pollution of Air. This was to complement the 1991 Clean Air Act, designed to tackle most types of air pollution from various sources by setting emission standards to be met by the end of 1998. These standards were to be met by polluters with a thermal output in excess of 200 kWh per annum, being approximately 27,000 in number. The Czech Republic has also committed itself to reductions in sulphur dioxide (SO_2), volatile organic compounds (VOCs) and NO_x emissions through the Convention on Long-Range Transboundary Air Pollution. As a measure of the success of the legislation, total NO_x emissions fell by 43 per cent from 1990 to 1997, whilst total SO_2 emissions fell by

63 per cent. Compliance with the 1991 Clean Air Act is very high, with only about 5 per cent of sources facing difficulties, these being mostly smaller public sector buildings such as hospitals and schools. In 1997 a decree amended the emission limits in the Clean Air Act, which brought them broadly into line with those in the EC Large Combustion Plant Directive, but it went further than this to also address emissions from small combustion plant.

36. The State Environment Fund (SEF) was created in 1992 to provide supplemental funding for environmental policy. Its income is mainly derived from a system of pollution charges. Air management authorities may allow a rebate of up to 40 per cent of charges for operators demonstrating plans to reduce emissions. They can also impose penalties on operators not complying with the regulations. Air pollution charges per tonne are imposed on large and medium-sized polluters, varying on the basis of emissions of solid particulates, sulphur dioxide, nitrogen oxides, carbon monoxide, hydrocarbons and class I, II and III pollutants. Small sources using coal, coke and heating oil are charged on a kW basis. In 1997, over CK 1,000 million was collected in charges, of which over CK 485 million related to sulphur dioxide charges paid by 2,022 polluters. Whereas there has not been a significant change in the number of polluters since 1992, the tonnage of pollution has decreased substantially and the charges collected have more than halved. The Minister for the Environment determines the allocation of collected funds, acting on the advice of a council consisting of representatives of various government departments. While income for the SEF comes mostly from air pollution, its expenditure is also mostly related to the prevention of air pollution and a significant proportion also goes toward water improvement measures. In combatting air pollution, much of the funding has gone toward the installation of gas in towns and industry. Furthermore, from the state budget for environmental expenditure, between CK 200 million and CK 358 million has been provided annually for ‘fuel savings, thermal insulation and alternative resources’ which includes SEF funding.

37. Emission limits and timetables for compliance under the Clean Air Act are thought by officials to have been more influential than the system of pollution charges for reducing emissions. Also, as the marginal cost of pollution increases and the pollution charges are eroded by inflation, they will have a diminishing effect, unless revised.

38. Air quality legislation will have had an impact in reducing GHG emissions although in many instances there have been end-of-pipe measures without much change in the underlying processes.

B. Energy and transformation

39. Having already undergone many changes in the 1990s, the energy sector is still undergoing substantial change, now orientated toward accession to the EC. The main differences between the EC and Czech energy sector relate to price transparency, methods of state support and the level of competition in different sectors.

40. The 1991 Clean Air Act required the implementation of changes across the power sector by the end of 1998. The necessary rapid adjustment of the power generation system was facilitated by the economic recession and subsequent decrease in the demand for electricity in the first years after 1989. ČEZ is the Czech Republic's primary electricity generator and is responsible for the bulk of electricity generation and operation of the national transmission grid. In 1997 it produced over three quarters of the electricity consumed in the Czech Republic. In response to the 1991 Clean Air Act, it devised a programme including coal plant decommissioning, measures to reduce emissions from the remaining plants and completion of the Temelín nuclear power plant. Funding for the environment programme was secured through a loan agreement with the International Bank for Reconstruction and Development as, in part, the loan was to provide for thermal efficiency improvements at selected coal-fired plants, sulphur emission control measures and transmission system improvements. At the time of the review, ČEZ was confident that its goals under the Clean Air Act would be achieved such that, compared to 1993 levels, emissions of SO_2 should be reduced by 93 per cent and NO_x by 58 per cent by 2005.

41. The plan to decommission coal-fired plants resulted in a reduction in installed capacity of 1,115 MW by the end of 1997. Despite good progress in the implementation of the plan, the original phasing-out programme for coal had to be adjusted in the face of higher than expected electricity demand. It is expected that only 1,700 MW out of the originally anticipated 2,230 MW will be decommissioned by the end of 2000. This, in part, was due to an unprecedented purchase of electric home appliances as households equipped themselves to higher standards. Given the large sums invested in flue gas desulphurization equipment for the remaining coal plants, it is unlikely that many will be retired before the end of their technical lifespan. Such equipment can reduce efficiency and hence increase CO_2 emissions from these plants. The ČEZ environmental programme includes the completion of two 981 MW units at the Temelín nuclear power plant to replace obsolete coal-fired plant. The completion of the Temelín plant is encountering many difficulties, all related to the complicated and costly alteration of the original design to Western nuclear safety standards. As a result, completion has been delayed. The deadline for fuel loading of the first unit in April 1999 has already passed and further delays are possible. The commissioning of the two units could result in a considerable saving of CO_2, equivalent to 8 per cent of CO_2 emissions in 1995.

42. The capacity of hydroelectric power increased from 1,401 MW in 1992 to 2,135 MW in 1997 and electricity generation from this source increased from 1,638 kWh to 2,281 kWh. The possibilities for building new large-scale hydroelectric plants have been exhausted. Up to 800 small hydropower plants have been constructed in recent years, with state support. Studies have shown that the theoretical potential of renewable energy in the Czech Republic could be up to 30 per cent of total energy consumption and that 20 per cent could be economically feasible. Environmental policy contains the goal to increase the share of renewables to 12 per cent by 2010, in line with the EC goal. However, officials noted that, given current policies, only about 5 per cent can be expected by this date. This is a considerable challenge for the Czech Republic. The potential for wind and solar energy is poor, so emphasis is being given to biomass combustion and further increasing the number of small hydro-electric plants. However, biomass

combustion could cause problems in future compliance with emission limits on VOCs under the Convention on Long-Range Transboundary Air Pollution. Officials noted that new polices and measures to increase the share of renewables in the energy balance should be elaborated as part of the State Program of Energy Saving and Renewables Sources in conjunction with the EC.

43. The prices of electric power and gas are regulated by the State. Subsidies for electricity prices were not removed as rapidly as originally envisaged, for social reasons, such that, in nominal terms, by 1997 average electricity prices remained at the same level as in 1991, implying a fall in real prices. However, on 1 January 1998, the value added tax (VAT) on fuels was raised from 5 per cent to the general level of 22 per cent and unregulated prices for heating were introduced. Up to 1997 a lower rate of VAT applied to 'environmentally friendly' coal and electricity, but as of 1998 the full rate of 22 per cent has been applied to both. Energy prices for industry have been allowed to remain low by OECD standards.

44. The Czech Republic does not have any significant resources of natural gas, but it has a well developed transportation network and is diversifying its suppliers to include Norway, in addition to the Russian Federation. There has been an increasing trend in the number of gas consumers, rising from about 2.1 million in 1994 to almost 2.4 million in 1997 in line with a modest expansion of the transmission system and a more significant expansion of the distribution system.

45. The Czech Energy Agency, founded in 1995 and funded by the Ministry of Industry and Trade, aims to encourage energy-saving activities. In the period 1991 to 1995, it is estimated that 11,000 TJ of energy consumption was saved as a result of its activities. Its current programme includes the funding of demonstration projects for energy-saving technologies, the use of renewable energy for the household, industry, agriculture and transport sectors, renovation of renewables equipment, cogeneration demonstration, optimization of housing estate energy supply and education on energy-saving initiatives. The non-profit private Energy Efficiency Centre supports more efficient ways of using energy and its activities particularly relate to district heating and municipal energy projects.

46. The average consumption of energy per unit of heated space in the Czech Republic is approximately double that of most other European countries. For this reason, measures to reduce energy use for heating are gaining importance, especially as fuel and electricity prices approach average European levels. Stricter building insulation standards have been in effect since 1994 and whilst not legally binding, are generally observed for new construction. The Ministry of the Environment outlined its strategy for energy savings and renewables to the review team. The aim is to increase energy saving and also production of energy from renewable sources to annually reduce primary non-renewable energy consumption by 1.5 per cent, equivalent to 17 PJ per annum. This would be based on significant state provision of subsidies and long-term loans. In 1998 this goal was supported by CK 325 million from the Czech Energy Agency and CK 200 million from the SEF, and in 1999 the programme was provided with a further CK 700 million mostly from the same sources. Foreign support is also contributing to spending on energy efficiency and renewables. Significant increases in financial resources for the programme are

anticipated which, if realized, should lead to energy saving for heating of 36 PJ, the supply of about 24 PJ of energy for heating from renewable sources and 0.5 TWh of electricity from renewable sources. In terms of CO_2 emissions, after four years, the programme could result in a 7,100 Gg saving.

47. The Czech Republic has an extensive district heating system. Individual metering of heat consumption in buildings is not compulsory and often bills are shared between the individual dwellings within a building. Approximately 40 per cent of customers on the district heating networks have individual meters. Whilst significant funds have already been devoted to the conversion of brown coal heating in the residential sector to less polluting fuels, mostly electricity and gas, considerable funds are still needed to achieve the mass improvement required under EC harmonization criteria. The team noted that substantial investments have been made in converting heating to electricity, yet given the significant role of coal in generation, this is not likely to have much effect in limiting GHG emissions and could increase emissions in many cases.

C. Transport

48. The transport network, covering roads and rail, altered little during the1990s. The tonnage of goods transported by both road and rail declined in the period from 1992 to 1997. However, in terms of tonne-kilometres, although there was a decline by rail of around 28 per cent, for road there was a 54 per cent increase along with a significant increase in the number of commercial vehicles in operation. The number of passenger cars increased from 2.4 million in 1992 to over 3.5 million in 1997 resulting in around 35 cars per hundred of population, below the European average of about 40. In contrast, the number of buses and coaches fell from over 26,000 to below 21,000. In line with increased private transportation, the number of passengers transported by rail fell 30 per cent over the period.

49. The Czech Republic used to experience so called ‘tank tourism’, whereby drivers from neighbouring countries would cross the border to purchase fuel, but this is no longer the case due to changes in fuel prices. Officials noted that whilst, based on market exchange rates, fuel prices in the Czech Republic may be lower than elsewhere, on a purchasing power parity basis they are amongst the highest in the world, yet this appears to have little influence in stemming the growth of private car use.

50. The share of transport in total energy consumption and emissions has grown during the 1990s, primarily as a result of growing road transportation, yet the team noted there were no significant GHG mitigation measures in this sector. The establishment and enforcement of vehicle emission limits may have contributed to the early retirement of the oldest, worst polluting vehicles and thereby also led to some reduction in GHGs. Others measures may also help mitigate GHGs, paramount of which are, perhaps, the Government’s provision of subsidies for public transport and the reopening of previously closed railway lines. Expenditure on rail grew from CK 1,442 million in 1990 to CK 10,203 million in 1998, in nominal terms, of which less than half went toward infrastructure and rolling stock. In the freight sector, support is being

given to combined road/rail and road/water infrastructure projects, including subsidies and tax relief to transporters using these modes. Some measures are being implemented to ease traffic congestion in cities. For example, in Prague, park- and- ride schemes are being established to discourage car use. Under the transference of power, soon to be established, municipalities will be given competencies for regional transport services involving the implementation of similar measures. At the time of the review there were no measures to support the market penetration of gas or electric cars, although some of the necessary infrastructure was in place. A tax break has been given to the use of bio-oil in passenger cars and buses.

51. Transport policy is now heavily based upon the movement of the Czech Republic toward integration with the EC. The implication for the railway sector is the planned modernization of main railway corridors, whilst for the road system the key aim is to continue with the construction of motorways and express-ways. In relation to GHG mitigation, beneficial effects of policy development may include, *inter alia*, continued support of public transport, the enhancement of integrated passenger transport options and traffic calming measures in large cities. Whilst the efficiency of transport is expected to improve, the Ministry of Transport does not anticipate that the general upward trend in CO_2 emissions can be halted in the period to 2015. Furthermore, after a halving of NO_x emissions in the 10 years to 1997, emissions are likely to rise with growth in road traffic.

D. Forestry

52. The team were impressed by activities in the forestry sector where, according to the Helsinki criteria, forests are managed in accordance with the principles of sustainable development. Owing to a high level of activity in this sector, there appears to be a good forestry inventory.

53. The transformation of the economy since 1990 has impacted on the ownership structure of the forest. Whereas in 1990 almost all forest was state owned, the 1991 Land Act resulted in the return of many forests to previous owners. By 1997, 66 per cent of the forest was in state ownership, 12 per cent belonged to communities, 1 per cent to cooperatives and around 21 per cent was in private ownership. In that year, of the total forest, 60 per cent was categorized as commercial forestry, 3 per cent as protected and the remainder as providing 'special services' such as water management, soil conservation and recreation.

54. The sustainability of forests has been the main principle of all forestry-related legislation. The Forest Act places obligations on the Ministry of the Environment and district authorities to control forest management. Forest owners with holdings in excess of 50 hectares are obliged to manage their forests according to forest management guidelines or plans and pay for their elaboration. For smaller holdings the State funds the elaboration of these management guidelines. The State's regional forest management plans set compulsory provisions for maximum total felling, soil improvement, stabilization of tree species and regeneration. Whilst commercial forestry is becoming increasingly important, the Forest Act prevents significant felling of forests under 80 years of age. Under the Forest Act, the State provided CK 312 million

in 1997, mostly for forest management activities. Approximately CK 158 million went toward reforestation, CK 17 million for afforestation of agricultural lands and CK 28 million for the regeneration of forests damaged by air pollution. Due to the country's industrial history the forests have suffered the adverse impacts of air pollution. The effects of sulphur along with a varying climate, including frost, has caused serious damage.

55. Total forest area has been increasing in the Czech Republic since the end of the last century owing to forest management measures along with legal protection. The area of annual reforestation in the 1990s has been about 30,000 hectares, including replanting. The share of natural regeneration is steadily increasing, but is still low. Around 12 million m^3 of timber, mostly conifers, has been supplied each year in the 1990s.

E. Waste

56. Waste management was not legally provided for prior to 1991. Early legislation was not comprehensive. This situation was rectified by the 1998 Waste Management Act which focuses on waste prevention and also gives priority to recycling and incineration in preference to landfilling. It improves requirements for data collection and expands both the powers and duties of municipalities to manage waste.

57. Landfilling is the most common form of waste disposal. Most dumps have been aerobic in character, but thousands, which did not comply with the 1998 Waste Management Act's basic operating standards, have closed or are closing, and only those with anaerobic conditions will continue to operate, which implies an increase in emissions of CH_4. At the time of the review, new legislation was under preparation relating to the collection and utilization of CH_4 from landfills. This will ensure that gas collection and flaring or utilization is maintained even after a landfill's closure. The new legislation will require monitoring the amount of CH_4 released and will introduce threshold levels above which gas collection and flaring will be compulsory. Most of the major landfill sites already provide for gas collection and flaring. Many incinerators were closed in response to the 1991 Clean Air Act requirements such that only about 7 per cent of waste is incinerated in two cogeneration plants. A further new combined heat and power waste incineration plant is under construction.

58. There is little incentive for waste minimization, apart from fees which are paid by waste producers for depositing waste at most landfills and which depend upon the amount and category of the waste. However, the charges also leave less funds for waste producers to make investments in environmental technologies and, furthermore, are set at a level below the cost of recycling or incineration. There are some measures to support the recycling of waste. Prague and other major cities, for example, are introducing a system to sort municipal waste into the categories paper, glass and plastics.

F. Agriculture

59. Following the introduction of changes in property rights and legal relationships, the contribution of agriculture to GDP has dropped during the 1990s. The amount of arable land used has declined and the use of pesticides and fertilizer has also been reduced. The production of rapeseed oil has increased with the oil being used as a renewable source of energy. Significant reductions in livestock numbers also occurred during the 1990s as a result of the recession in the agricultural sector, with a subsequent reduction in CH_4 emissions.

60. Whilst changes in the agricultural sector have reduced GHG emissions, there have been no climate change related measures. As improvements occur in this sector, the encouragement of rational nitrogen fertilizer use should help to mitigate N_2O emissions.

IV. PROJECTIONS AND EFFECTS OF POLICIES AND MEASURES

61. The NC2 contains projections of CO_2, CH_4 and N_2O emissions from 1996 up to 2010. The review team was provided with additional information on the methods underlying these projections. It was also presented with a figure showing revised projections, estimated on a similar basis, as well as the latest electricity forecasts estimated separately by ČEZ. No estimations of the individual effects of measures were provided in relation to the projections. The team noted that there was not a single official projection of the macro-economy and consequently also GHG emissions and that there were differences between ministries in projections for various sectors. This is mainly due to several changes to the macro-economic projections for the Czech Republic in the last two years. The further development of the Czech economy will be an important variable affecting CO_2 trends.

62. Projections are typically based on a good understanding of historic relationships between key variables such as GDP, fuel prices and energy demand. In the case of the Czech Republic, the events of the early 1990s make it difficult to establish such relationships for a long time-series. Major political changes, begun in 1989, and the subsequent separation of Czechoslovakia into two countries will have affected the behavioural relationships between variables and also the ability to obtain consistent, comparable data over time. For these reasons, there is reluctance to provide long-term energy and emissions forecasts beyond 2010, as they are subject to great uncertainty, and projections are only regarded as reasonably robust to 2005.

63. The projections contained in the NC2 were primarily estimated by SEVEN on behalf of the Government. The team was informed that many of the assumptions that underlie the projections were simply based on their expert judgement. The projections are based on several steps. Firstly, economic growth is forecast. Officials noted that projections are highly sensitive to macroeconomic impacts and that the economy is not yet on a stable path, thereby creating great uncertainty. Secondly, demand for energy consumption is estimated, given assumptions about the future technology mix and other technical parameters. Due to developments in energy intensity, owing to industry restructuring and assumptions about the market penetration of new technology, final energy consumption grows more slowly than GDP. A prognosis of the

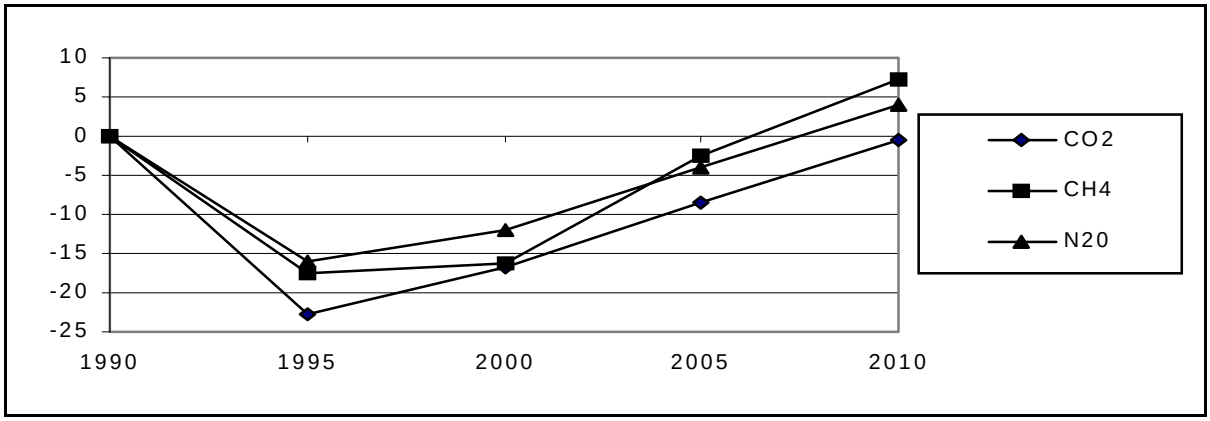
required production capacity to meet this demand is then calculated and, from this, GHG emissions are estimated. Imports and exports of electricity are expected to remain relatively low and stable in this analysis. Bottom-up technology models were employed, primarily MARKAL, which optimizes the choice of technology, based on least-cost solutions. Uncertainty in this final step is great because it is difficult to ascertain the lifespan of large-scale investments in generation plant and equipment used in manufacturing. The team noted that MARKAL is more typically used to assess different technology options as a policy-making tool than to make projections.

64. Two scenarios were considered, a favourable and unfavourable CO_2 development scenario. In both cases it was assumed that the Temelín nuclear power plant comes into operation in 2000, which now appears over-optimistic. It was also assumed that emission limits, under air pollution legislation, are complied with. Furthermore, population is forecast to be stable throughout the projection period and, in structural terms, there is an assumed shift away from manufacturing toward the provision of services, akin to many Western European economies. Assumptions about international fuel prices were included in the modelling work, but their influence is lessened by high reliance on domestically produced coal.

65. In the most unfavourable scenario, annual GDP growth of 4.7 per cent per annum and a lack of restructuring was assumed. This was similar to the assumptions used for the projections in the NC1. The favourable scenario results in lower emissions due to a lower GDP growth rate of 3 per cent per annum and higher assumed decreases in energy intensity, owing to restructuring and the effect of government programmes.

66. As shown in figure III, in the unfavourable scenario, by 2000, CO_2 emissions are 139 million tonnes or 17 per cent lower than in 1990, compared to an estimated 12 per cent reduction in the NC1. CO_2 emissions are then projected to grow to be 8 per cent lower than the 1990 level in 2005 and less than 1 per cent lower in 2010. In the favourable scenario, CO_2 emissions are stable in the period 1995 to 2000, at 29 per cent below the 1990 level before gradually increasing to reach a level 16 per cent below the 1990 level in 2010. Removals by sinks are expected to remain at their 1995 level throughout the forecast period.

Figure III. Projected emissions, percentage change from 1990



67. The team were presented with some information about updated GHG projections for CO_2, CH_4 and N_2O, combined, completed in December 1997, and covering the period to 2010. These were made in the context of the Swiss-World Bank study on a 'National Strategy for Joint Implementation in the Czech Republic'. The methodology employed was a modified version of that used to prepare the projections presented in the NC2 and is also based on low and high economic growth scenarios. The resultant projections showed GHGs to be in the range 85 to 90 per cent of the 1990 level by 2010, compared to the 80 to 100 per cent range given in the NC2.

68. The review team were presented with a separate prognosis of transport emissions. According to the Ministry of Transport, CO_2 emissions from transport could grow from around 10,100 Gg in the late 1990s to over 12,000 Gg in 2010, with the implementation of planned policies and measures, almost entirely due to increasing road transportation. In the absence of policies and measures CO_2 emissions could increase to 17,000 Gg, more than the 15,000 Gg in the unfavourable scenario presented in the NC2. Either scenario would increase transport's share of total CO_2 emissions over time. (Officials noted that the source categories and emission factors used by the Ministry of Transport in making these projections differ somewhat from those used to produce the projections for the NC2.)

69. The team were also provided with the projections for electricity demand shown in the latest ČEZ business plan. Electricity consumption increased rapidly in the period 1993 to 1995 and more slowly in 1996 and then fell in the following two years, mainly due to the economic recession. As a result, compared to the previous plan, projected electricity demand has been significantly revised downward. There has also been a deceleration in the rise of electricity tariffs compared to previous expectations.

70. The ČEZ base case forecast assumes the continued removal of price subsidies for residential electricity consumers, such that residential electricity prices rise by 30 per cent in 1999, by 15 per cent in 2000 and by 5 per cent per annum thereafter. This would bring residential prices into line with prices for commercial consumers at around CK 2.1 /kWh by 2001. Thereafter, prices for both sectors are expected to increase at 5 per cent per annum to 2005. Over this period, prices for industry are expected to remain flat at a lower level of around CK 1.6 /kWh. Electricity demand is forecast to increase to 53.7 TWh in 2000 and 57.7 TWh in 2005 compared to actual demand of 49.3 TWh in 1994 and expected demand of 52.4 TWh in 1998. Less than one third of the additional electricity demand during the period to 2005 is attributable to households.

71. ČEZ expects commercial operation of the first unit in Temelín to start in May 2001 and that of the second unit in September 2002. In the base case, no new coal-fired plants are required before 2010. In 2000, 69 per cent of electricity supply, in terms of TWh, should be met by coal, 28 per cent by nuclear and 3 per cent by hydroelectric. According to the business plan, by 2005 installed capacity of 12,386 MW will be made up by 6,792 MW of coal-fired, 3,722 MW of nuclear and 1,872 MW of hydro. Overall, it represents a doubling in the share of nuclear to 30 per cent of the installed capacity, compared to 1990, a reduction in coal-fired from

74 to 55 per cent and a 5 per cent increase in hydropower to 15 per cent. In 2005, it is projected that 51 per cent of electricity supply will be met by coal, 46 per cent by nuclear and 3 per cent by hydroelectric.

72. For ČEZ, the aggregate effect of improving the environmental performance of coal-fired plant, completing the start-up of the Temelín nuclear power plant and decommissioning of old coal-fired plants should result in reductions of SO_2 emissions by 93 per cent, NO_x by 58 per cent and CO_2 by 27 per cent in 2005, compared to 1993.

73. In part, CH_4 and N_2O emissions relate to the combustion process, so the projections in the NC2 for these gases take into account future values of energy sector activities. Fugitive emissions of CH_4 are expected to be proportional to the assumed future volume of domestically mined coal. The second largest source of CH_4 is agriculture and, after a decline in agricultural production in the early 1990s, from 1995 onward emissions are assumed to remain stable. CH_4 emissions from waste are assumed to increase in line with the growth in GDP and the estimates do not take into account recent policy or the development of gas collection and flaring. By 2000, emissions of CH_4 and N_2O are projected to be 16 per cent and 12 per cent lower than in 1990, respectively. Emissions of both these gases trend upward thereafter such that CH_4 is projected to be 7 per cent higher and N_2O 4 per cent higher than the 1990 level in 2010.

V. RESEARCH AND SYSTEMATIC OBSERVATION

74. The review team was impressed by research and systematic observation efforts related to climate change and associated impacts. There are 39 ‘professional’ observatory stations, taking measurements in line with World Meteorological Organization (WMO) recommended practice, complemented by several hundred ‘voluntary’ stations collecting data on climate and precipitation. Several stations have time-series data going back over 140 years. A National Climate Programme (NCP) was established in 1990 to carry out activities along the lines recommended by the World Climate Programme, coordinated by the WMO. Most data gathering and joint research on climate change is conducted through the NCP, which is structured around the Czech Hydrometeorological Institute, along with a number of other institutions, primarily academic. Funding for collaborative tasks and related publications is generally provided by the Ministry of the Environment and Czech Grant Agency. Officials noted that during the current recession, there would be competing demands for state funds and research may be given less priority.

75. From 1993 onward, the NCP was involved in a United States Country Studies Program and then benefited from support from the United States for a national action plan, resulting in a number of English language publications covering climate change projections and assessments of possible impacts on agriculture, forestry, hydrology and water resources. At the time of the review, these projects were in their final stages. Much of the research has been aimed at an improved understanding of possible changes in variability and frequency of extreme events, resulting from increasing CO_2 concentrations at a regional level. This work involves, *inter alia*, the output of global circulation models and validation studies using historic data. By refining

future climate change scenarios, a better understanding of resultant impacts should be possible. To complement national and regional research as well as the United States Country Studies Program, an international workshop was held in Prague in 1995 on 'Climate Variability, Climate Change Vulnerability and Adaptation' and its proceedings were published.

76. Additional research activities encompass historic climate and paleoenvironmental changes in the Czech Republic, energy-saving studies and use of biomass as a renewable source of energy. Part financing for the energy-related studies has been provided by ČEZ. The Ministry of the Environment funded a project to develop energy models for use in projections and also in the evaluation of new technologies and energy efficiency potential. The NCP has proposed new research projects to improve climate change scenarios and understanding of climate change impacts on managed agricultural and forest ecosystems and on deep stratified reservoirs. This work could contribute toward the IPCC third assessment report.

VI. EXPECTED IMPACTS OF CLIMATE CHANGE AND ADAPTATION

77. Projections of climate change in the Czech Republic, in general, indicate greater warming effects in the winter than summer and an increase in annual precipitation. However, of particular concern is the possibility of higher summer temperatures along with lower precipitation. Studies of climate change impacts have focused on the agricultural and forestry sectors, as well as water resources. Work related to health impacts showed no significant effect.

78. Agriculture is highly dependent on climate and it has been found that agricultural yields could increase as a result of warming. However, study results are complicated by possible changes in precipitation and increased risk of frost damage as the vegetative period extends to encompass March; and some areas could even be affected by drought. Changing climate could also affect the type of pests and diseases that attack crops. A high proportion of monocultures adversely affects the stability of the forest ecosystem, especially given that forests have been badly affected by SO_2 and NO_x emissions, which reduce trees' resistance to wind, snow, parasites and fungi. Changes in temperature, humidity, precipitation and CO_2 concentration could have differing effects, both positive and negative, on the various tree species, which may also vary by region. Increased extreme weather events could have the greatest impacts on the forests. Different scenarios of climate change along with economic development affecting water demand showed, in general, decreased run-off with significant regional variability, such that even mild climate change could cause severe water management problems in catchments where the available water resources become insufficient or excessively polluted. In some areas, significant increases in the storage capacity of reservoirs would be required.

79. Following on from studies to assess possible impacts of climate change, in 1996, an adaptation plan was developed. For water this includes measures to decrease domestic water consumption, improve the efficiency of water supply systems and preserve water accumulating in groundwater aquifers. Agriculture will adapt over time with changes to the selection of crops, soil management and fertilization. Measures in the forestry sector are similar to those that would be required in the absence of climate change to ensure stability and include the maintenance of

good silviculture practices, changing the composition of species, maintenance of gene pools, monitoring and research.

80. The potential effect of more extreme weather events was felt in July 1997 when the country, in particular the Moravia region, experienced an episode of disastrous floods, unprecedented in the previous 100 years.

VII. EDUCATION AND PUBLIC AWARENESS

81. Whilst the quality and quantity of public information has improved in the 1990s, the Czech Republic has limited capacity to provide education and public awareness about climate change, although there are numerous activities related to environmental awareness, in general. The Ministry of the Environment, in 1997, focused its activities on the preparation of a new Act on access to environmental information. As part of the Czech constitution, the general public now has the right to information about the environment and the Ministry began a policy of releasing all unclassified information as of March 1998. It takes part in the support of training and publications targeted at officials in central and regional government. The Czech Environment Institute played an even more significant role in the provision of consultation and information services to civil servants, which encompassed local Agenda 21 activities. By 1997, most district offices had a full-time employee charged with education and public awareness and the Ministry of the Environment held a seminar for these officials. They have been further encouraged to take part in training courses related to Agenda 21. Activities at the city and municipal level vary widely. Various non-governmental organisations are active in publishing environmental concerns, including climate change. The Ministry of Industry and Trade supports a network of information centres and publishes information to raise public awareness about the efficient use of energy. The Ministry of the Environment also publishes periodicals covering energy saving, renewable energy and climate change.

82. Ecology is taught as part of the primary school curriculum, and some courses at a higher level are oriented toward the environment, but there is no specific programme to raise awareness about climate change. The main projects in eco-education focus on the monitoring of the local environment and taking practical steps for energy saving and waste management. A national children's parliament has been established to meet and discuss problems related to environmental protection, backed up by regional meetings. There are dozens of environmental instruction centres run on a private, non-profit basis providing services to schools in the field of environmental education with a focus on nature protection.

VIII. FINANCIAL ASSISTANCE

83. The Czech Republic recently decided to provide assistance to developing countries. The amount is expected to be 0.1 per cent of GDP, of which a part will be specifically for environmental assistance.

IX. ACTIVITIES IMPLEMENTED JOINTLY

84. The review team were presented with details of three projects under the pilot phase of activities implemented jointly (AIJ). Afforestation and modernization of a cement plant have been carried out in partnership with the Governments of the Netherlands and France, respectively. The Government of Denmark, along with United States private entities have been involved in a coal-to-gas fuel switching project at a co-generation district heating plant. Consideration is being given to the issue of additionality, taking into account how existing air quality legislation may result in fuel switching and energy efficiency improvements and also budgetary limitations to domestic funding of afforestation etc. The team noted that some activities in the Czech Republic involving arrangements between private sector entities and municipalities have not qualified under the Government's AIJ criteria.

85. The Czech Republic has taken part in the Swiss-World Bank programme to provide support for potential AIJ, joint implementation, clean development mechanism host countries. In all of the studies considered, CO_2 emissions grow such that the likely difference between actual emissions and the emissions budget under the Kyoto Protocol, during the period 2008 to 2012, only provides a temporary advantage, in the absence of additional policies and measures.

X. CONCLUSIONS

86. After the major political changes of 1989 and subsequent creation of the Czech Republic there was a major recession, which caused a substantial fall in output and energy use that consequently led to considerable reductions in GHG emissions. The economy has steadily recovered in recent years and upward GHG emission trends can be observed in the industrial and transport sectors as a result. The Czech Republic's priority remains continued market reform and economic growth. It has become a member of OECD and aims to accede to the EC. Climate change has a low priority in policy making. Nevertheless, concerns about air quality and environmental damage owing to a legacy of inefficient, heavy industry along with efforts to bring legislation in line with that in the EC has resulted in many measures which, in effect, do mitigate GHGs. However, some reforms which may have beneficial impacts in reducing emissions such as energy price increases are proceeding more slowly than originally anticipated, due to social and other concerns, and other goals related to economic growth, such as road building, may increase GHG emissions.

87. The team were impressed with the significant efforts made during the 1990s to establish an emissions inventory. Difficulties in data comparison over time have been a particular problem and continued improvement in statistics for activity data is ongoing to bring definitions and methods into line with international practices. There has also been extensive work in some sectors to establish national emission factors, in particular for CH_4. Following the adoption of the revised IPCC Guidelines, work is under way to update the time-series for each gas. Small modifications to inventory reporting were made in 1996. The team recommended that the Czech Republic update the time-series for all gases reported under the UNFCCC guidelines to achieve greater consistency.

88. Most environmental policy has focused on the improvement of air quality, given the historic reliance on fossil fuels. Considerable success has been achieved in lowering emissions of SO_2, in particular. Measures under the air quality legislation will have also resulted in a lowering of GHG emissions although this is not typically the case with investment in end-of-pipe technologies. The state electricity producer, ČEZ, has closed several of the oldest, least efficient coal plants, but is likely to retain the remainder until the end of their working lives, given large investments in flue gas desulphurization equipment. At the time of the review there was still uncertainty about when the Temelín nuclear power plant might be given approval to begin operation, which could displace coal-fired electricity production although in May 1999 the Government decided to finalise its construction. There is significant potential for biomass energy in the Czech Republic and measures exist to increase renewables' market penetration, but there are concerns about VOC emissions from biomass. Despite support for public transport, the growth in private car transportation has been significant and is expected to continue trending upward, unless there are major initiatives in this sector. Major changes in the waste sector are taking place which should lead to fewer, larger landfills and hence higher CH_4 emissions, yet the application of EC legislation should result in gas collection and flaring or its use for energy production. The Czech Republic has a high degree of forest cover and has continued to maintain this through good forestry practices. In the agricultural sector, livestock numbers have fallen and less arable land is used for agricultural production, resulting in lower GHG emissions.

89. The team recognized many of the difficulties faced by countries with economies in transition in producing projections. It is clear that in 2000 all GHG emissions will remain significantly below their 1990 level. CO_2, CH_4 and N_2O were forecast to be 17 per cent, 16 per cent and 12 per cent lower than the 1990 level in 2000, respectively. Thereafter, emissions of these three gases are expected to trend upward. By 2010, CO_2 may be 1 per cent lower than in 1990 although it should be noted that beyond 2005 the projections are highly uncertain.

90. The review team were impressed by the extensive research efforts conducted in the Czech Republic on a wide range of topics related to climate change prediction, impacts and adaptation in particular, but noted concerns about continued funding during the recession prevailing at the time of the review.

91. In the past, the climate change issue has not been widely publicized in the Czech Republic mainly because of the necessary focus of the Government's environmental activities on the improvement of very poor local air quality at the end of the 1980s and beginning of the 1990s. In recent years the situation has significantly improved and recent reforms related to freedom of information and training of officials in environmental matters form a good basis for further efforts. Several activities are under way at school level to improve environmental awareness, including that of climate change.

- - - - -