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

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I. INTRODUCTION AND NATIONAL CIRCUMSTANCES

1. Austria ratified the Convention on the 28 February 1994 and submitted its first national communication (referred to as NC1) on 23 September 1994. It subsequently submitted its second national communication (referred to as NC2) on 31 July 1997. The in-depth review of the NC2 was conducted between February and July 1998, and included a country visit by a review team from 30 March 1998 to 3 April 1998. The team members were Mr Harun R Muturi (Kenya), Dr Jaan-Mati Punning (Estonia), Dr Wolf-Dieter Glatzel (Germany), Ms Amrita Narayan Achanta (UNFCCC secretariat, coordinator), and Dr Katia Simeonova (UNFCCC secretariat, coordinator).

2. Austria is situated in central Europe, bordering eight countries, four of which have economies in transition, with considerable implications for transit traffic, and for greenhouse gas (GHG) abatement policy in the transport sector. Austria, although a small country, is characterized by three types of climate, namely continental, alpine and transition type. The location of the Alps strongly influences the climate pattern, making national climate modelling and impact assessment a challenge.

3. Austria has a small and open economy with exports accounting for 38 per cent of gross domestic product (GDP). Industry accounted for a high share of GDP of 34 per cent in 1995, and showed an average growth of 2.9 per cent for the 1985-1995 period. The recession in the early 1990s led to a downward trend in GDP growth from 4.2 per cent in 1990 to 0.4 per cent in 1994. Since 1994, the Austrian economy has experienced growth, with GDP rising by 3.0 and 1.8 per cent in 1994 and 1995 respectively, which in turn, with a very short lag induced an increase in greenhouse gas (GHG) emissions. Overall, in the past two decades Austria has enjoyed higher economic growth and lower unemployment than other countries of the Organisation for Economic Co-operation and Development (OECD).

4. A distinctive feature of the Austrian energy sector is its diversified energy supply. In 1996 the total primary energy supply (TPES) included liquid fuels (38.3 per cent), natural gas (23.5 per cent), hydropower (13.4 per cent), other renewables (13.0 per cent) and coal (11.8 per cent). The renewables share in TPES increased from 15.7 per cent in 1973 to 26.4 per cent in 1996. This fact assumed significance both from the climate change standpoint and from the energy security standpoint, given that two thirds of the energy supply is imported. Between 1973 and 1995, the energy intensity of the economy declined by 28 per cent, which corresponded to the OECD average for the period. In recent years, however, between 1987 and 1996, the energy intensity of the Austrian economy has improved by about 2 per cent per year, approximately two times higher than the OECD average. The structure of the electricity sector is unique among the OECD countries, with a hydroelectric share of approximately 65 per cent, the highest in the European Community (EC), and a share of electricity from thermal sources of 35 per cent, of which coal accounts for approximately 10 per cent. After a period of extensive growth of hydropower from 1970 onwards, when the installed capacity almost doubled, the potential for economically feasible and environmentally sound development of this source is now

exhausted. Nuclear power is legally banned, following a referendum on the subject in 1978. The Austrian government and all political parties do not consider nuclear power as compatible with the concept of sustainable development and the reliance on nuclear power cannot be considered a viable option.

5. At the time of submission of the NC2, in July 1997, Austria had already been a member of the EC for approximately two and a half years. The discussion on the implications of the Maastricht criteria, which determined membership of the European Monetary Union, on the national budget, with specific reference to the climate change policy, indicated that it could be difficult to secure the necessary financing for the implementation of additional mitigation policies and measures or co-finance climate change research projects. Other implications arising from the EC membership relate to the implementation of the EC directives on electricity, agriculture, large combustion facilities, and the proposed tax on carbon dioxide (CO_2) and energy, harmonization of mineral oil taxes, technology programmes, the trans-European gas supply network and the outcome of negotiations on burden sharing under the Kyoto Protocol.

6. Austria's federal structure involves a high degree of decentralization with the executive and legislative functions shared between the Federation and the Länder (provinces). The Länder play a role in federal legislation, have independent regional legislation and also cooperate with the Federation in the execution of the federal legislation. In general, Austria's version of a federal state has ensured that the majority of competences lie with the Federation, with a limited influence of the Länder on federal legislation. In contrast, the role of the Länder in climate change policy formulation and implementation is significant. The municipality, at the lowest level, with no legislative functions, is responsible for administration and has had success in addressing climate change issues at the local level. While only a limited amount of information on the actions at the Länder and municipal level was given in the NC2, the country visit provided the team with a better understanding of the wide scope of activities relating to climate change at these levels.

7. The Austrian Federal Constitution, allows for agreements between the Federation and the Länder about matters in their respective spheres of competence. One such agreement, is the so called Toronto Agreement, currently being negotiated. Under the appropriate provisions of the Austrian Constitution, the agreement aims at reducing GHG emissions and achieving the Toronto target by implementing measures at the Federal and the Länder level. At the time of the review, general agreement had been reached on its scope, but financial aspects were yet to be resolved.

8. In a continuation of the past situation, the Austrian Council on Climate Change (ACCC), known earlier as the National Carbon Dioxide Commission, is responsible for analysis of various mitigation policies and measures, and considering the scientific and technical aspects. The Interministerial Committee to Coordinate Measures to Protect Global Climate (IMC Climate), recently expanded to include Länder representation, draws up implementation programmes and strategies on climate change. The team noted that environmental non-governmental

organizations were not represented in the IMC Climate and the representation of non-university research organizations was limited.

9. The Austrian national target, corresponding to the Toronto target, to reduce CO_2 emissions by 20 percent relative to 1988 by the year 2005 was the focus of discussion during the review meetings. Not only has the parliament passed two resolutions urging the federal government to implement policies and measures to reduce GHG emissions and meet the Toronto target, but the target also finds inclusion in the 1993 and 1996 Austrian energy reports. In addition to the Toronto target, Austria has adopted the United Nations Framework Convention on Climate Change (UNFCCC) target of stabilizing GHG emissions at 1990 levels, by the year 2000, and the NC2 states that this could be realized using the current measures scenario. Most recently, the agreement reached by the Conference of the Parties at its third session (COP3) in Kyoto, for the first commitment period (8 per cent reduction for the EC) has assumed significance.

10. The progress in the climate change policy between the submission of the NC1 and the NC2 and in the subsequent period, was discussed during the review under four heads: the preparation of the NC2, developments on the Toronto Agreement, shifts in both the national and the EC stance on gases in the reduction basket, and the level of burden-sharing at the national level. The preparation of the NC2 was initiated in January 1997. The NC2 was adopted by IMC Climate in May 1997 and later passed by the Ministerial Council in July 1997. The Toronto Agreement was first discussed between the Federation and the Länder in 1996 leading to the development of the Toronto technology program. In response to the international negotiations, Austria altered its initial focus from a single gas target to the current target of a basket of six gases. Austria has agreed to contribute a 13 per cent emission reduction to the overall EC commitment of an 8 per cent emission reduction under the Kyoto Protocol.

II. INVENTORIES OF ANTHROPOGENIC EMISSIONS AND REMOVALS

11. In the NC2, Austria provided inventory data for the three major and direct GHGs, carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) for the period 1990-1995 and subsequently submitted GHG emission estimates for 1996. The data for the years prior to 1990, i.e. 1980 onwards were also included in the NC2. The data set was based on an ongoing research project for provision of emission data since 1955 by sector and fuel type. Additionally, the country has provided data on per capita CO_2 emissions and CO_2 emissions per unit of GDP. The team observed that Austria has a system for collection of emissions and activity data, producing yearly estimates and updating the time series. The Federal Environment Agency has the overall responsibility for compilation of the national GHG inventory.

12. Data for the indirect GHGs: non-methane volatile organic compounds (NMVOCs), nitrogen oxides (NO_x) and carbon monoxide (CO), for the period 1990 to 1995, and estimates of potential emissions of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and (sulphur hexafluoride (SF_6) for 1994 were provided in the NC2, and data for 1995 and 1996 was

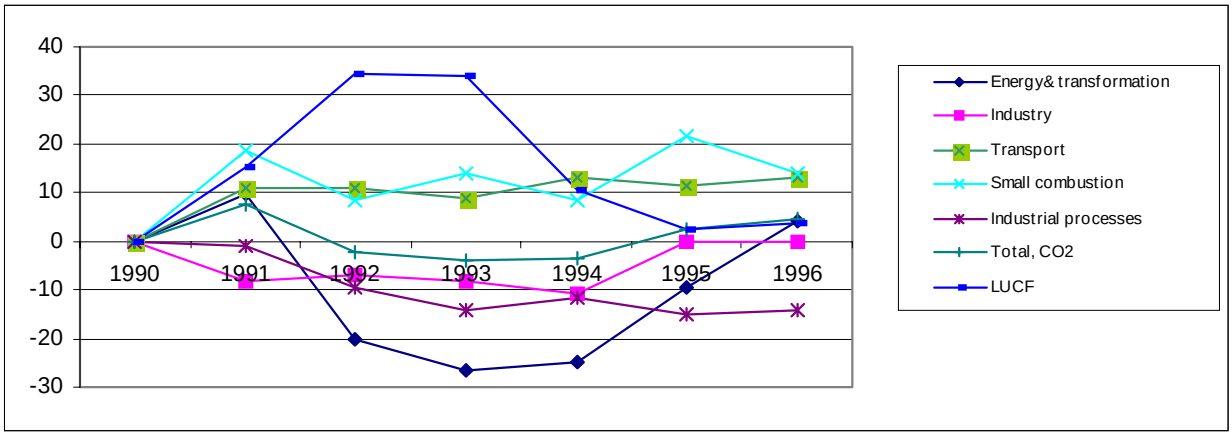
submitted to the secretariat after the visit. The 1996-1997 data on PFCs (perfluorobutane only) were submitted during the visit. Though the NC2 lacked the data on sulphur oxides (SO_x), these were provided during the visit.

13. In 1996, the total CO_2 emissions in Austria amounted to 65 000 Gg, with 82 per cent arising from all energy activities (29 per cent from transport, 27 per cent from the residential, institutional and commercial sector, 24 per cent from energy and transformation and 20 per cent from industry and other subsectors) followed by 17 per cent from industrial processes and 1 per cent from other sectors. The land-use change and forestry sector (LUCF) is a net sink, which was estimated at 13,800 Gg CO_2 in 1996. The emissions from transport increased by 1,900 Gg CO_2 over the 1990-1996 period, a 13 per cent rise, while the emissions from energy and transformation industries oscillated and those from industrial processes decreased, resulting in an overall increase of 5 per cent in CO_2 emissions for the same period (table 1 and figure 1).

Table 1. Carbon dioxide emissions by source, 1990-1996 (Gg)

	1990	1991	1992	1993	1994	1995	1996
Energy & transformation	12 500	13 700	10 000	9 200	9 400	11 300	13 000
Industry	7 400	6 800	6 900	6 800	6 600	7 400	7 400
Transport	13 900	15 400	15 400	15 100	15 700	15 500	15 700
Small combustion	12 900	15 300	14 000	14 700	14 000	15 700	14 700
Industrial processes	12 700	12 600	11 500	10 900	11 200	10 800	10 900
Others	2 600	2 800	2 900	2 800	2 900	2 900	3 200
Total	**62 000**	**66 600**	**60 700**	**59 500**	**59 800**	**63 600**	**64 900**
LUCF	-13 300	-15 300	-17 900	17 800	-14 700	-13 600	-13 800

Figure 1. Carbon dioxide emissions, percentage change from 1990, by source



The CO_2 emission data provided in the NC2 include both unadjusted and adjusted estimates. The adjustments were made to the CO_2 inventory data for both (a) temperature variations and fluctuations and (b) industrial production activity. The impact of production and temperature fluctuations on CO_2 emissions almost offset each other. International bunker fuels have been calculated but are not included in the national totals. The trend for such bunker fuels showed a growth of 55 per cent over the 1990 levels in 1996.

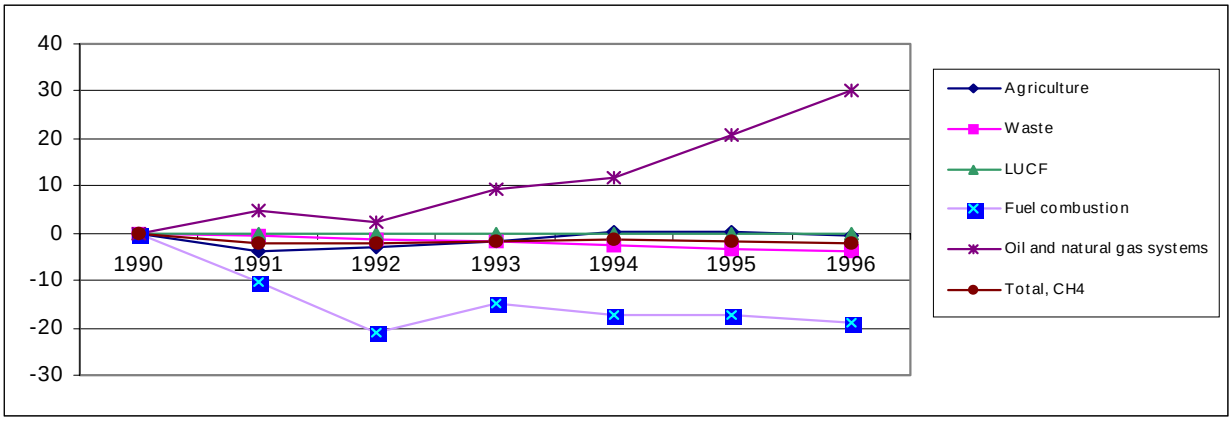
14. For the LUCF sector, it was observed that the land cover categories remained relatively constant during the period 1960-1990, but a slight increase in forest area and increment in biomass growth was observed during that period. With regard to the estimate of the sink capacity, concern was expressed by the team at the lack of transparency in the communication, although additional information was provided during the visit. The host country stated that the estimates were conservative and spelt out the associated uncertainties in the estimation. The latter included uncertainties concerning the forest area (5 per cent), annual growth rate (5 per cent) and commercial harvest as reported by the Austrian Central Statistical Office (3 per cent). The category of abandonment of managed lands was regarded as a sink in Austria. The NC2 included estimates of natural emissions from the LUCF sector, arising primarily from forest soils. These emissions are high relative to other estimates for Europe and are based on the United Nations Economic Commission for Europe (UNECE) classification of managed forests as anthropogenic.

15. In the case of CH_4 emissions the estimate for 1996 is 574 Gg. The major source of emissions was waste, estimated at 38 per cent, followed by agriculture at 36 per cent, and LUCF 22 per cent, with the remainder coming from the energy sector. There was a decrease of 2 per cent in CH_4 emissions from 1990 to 1996, attributed primarily to a decline in solid waste disposal (table 2 and figure 2). Potential methane emissions associated with organic farming were not available.

Table 2. Emissions of methane by source, 1990-1996 (Gg)

	1990	1991	1992	1993	1994	1995	1996
Agriculture	208.1	199.9	201.7	204.2	209.1	208.9	206.8
Waste	227.2	225.7	224.3	222.9	221.3	219.8	218.2
LUCF	126.8	126.8	126.8	126.8	126.8	126.8	126.8
Fuel combustion	20.2	18.1	16	17.2	16.7	16.7	16.4
Oil and natural gas systems	4.3	4.5	4.4	4.7	4.8	5.2	5.6
Industrial processes	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total	**586.7**	**575.1**	**573.3**	**575.9**	**578.8**	**577.5**	**573**

Figure 2. Methane emissions, percentage change from 1990, by source

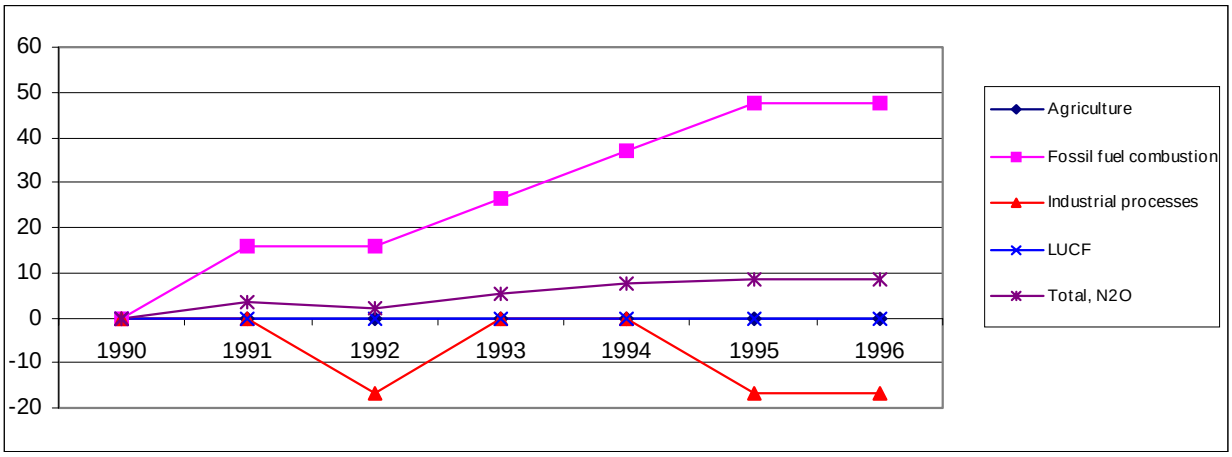


16. N_2O emissions in 1996 were estimated to be 10 Gg, originating from fossil fuel combustion (including transport) 31 per cent, agricultural activities 37 per cent, other LUCF activities 29 per cent, and others 3 per cent. An increase of 9 per cent in N_2O emissions occurred between 1990 and 1996, primarily owing to the transport sector (table 3 and figure 3).

Table 3. Emissions of nitrous oxide by source, 1990-1996 (Gg)

	1990	1991	1992	1993	1994	1995	1996
Agriculture	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Fossil fuel combustion	1.9	2.2	2.2	2.4	2.6	2.8	2.8
Industrial processes	0.6	0.6	0.5	0.6	0.6	0.5	0.5
LUCF	2.6	2.6	2.6	2.6	2.6	2.6	2.6
Solvents	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Total	**9.2**	**9.5**	**9.4**	**9.7**	**9.9**	**10**	**10**

Figure 3. Nitrous oxide emissions, percentage change from 1990, by source



17. With regard to the new gases, the potential emission estimates for 1995 and 1996 (within brackets) for SF_6 were 0.047 Gg (0.033 Gg), HFCs 0.695 Gg (0.712 Gg) and PFCs 0.01 Gg (0.01 Gg). Actual emission estimates were likely to be available by 1999. Of the new gases SF_6 was considered to be the most important. Additionally, emissions of HFCs had increased because of the growing number of air conditioned cars. The PFC data for 1996-1997 revealed a rapid increase of 10 per cent, but the increase was attributed by the host country to the absence of consistent national statistics. The team was informed that Austria would focus on increased accuracy in estimation of emission factors for these gases.

18. The Intergovernmental Panel on Climate Change (IPCC) standard data tables contained in the 1995 IPCC Guidelines were used to report emissions. In general, the country complied with the IPCC reporting requirements, except as concerns the submission of detailed worksheets for the sectors of fuel combustion, LUCF and agriculture. The activity data, disaggregated emission factors, the detailed IPCC worksheets and associated uncertainties for the LUCF sector were provided to the team during the visit. This estimate of GHG emissions was based on the CORINAIR methodology.

19. The methodological changes in inventory calculation between NC1 and NC2 include: (a) Use of the Austrian methodology, was replaced by the use of CORINAIR, for the construction of a homogeneous data set for the period 1980 to 1996; (b) The LUCF calculations, based on a project on system analysis of the Austrian carbon balance, at the Austrian Research Center, Seibersdorf, which had considered the last forest inventory in 1997; (c) The significant change in estimates of N_2O emissions for 1990, were attributed to an increased number of sources (5 to 12 sources) and revised emission factors. Further changes in the estimates of process emissions were likely due to the increased process monitoring within the industry. The team was informed that the N_2O emission factors estimated by industry were higher than those used in the NC2; (d) The review team was informed of a joint study by Austria, France, and Switzerland, focused on the emissions from the transport sector. In the NC2, N_2O emissions from the transport sector had been overestimated, which has been corrected in the last submission to the secretariat**.**

20. The team was informed that the estimate of CO_2 emissions from fuel combustion, based on a comparison between the Austrian methodology and the CORINAIR approach, showed a 2 per cent difference. It was stressed that such a comparative exercise had assumed importance in the view of the Government, owing to its implications for EC burden-sharing and its potential for revealing uncertainties associated with individual sources. The team was informed that independent validation studies for CO_2, CH_4 and N_2O emissions had been conducted within and outside the country, but the results were not communicated to the team.

21. While reviewing the emission factors, the team found it difficult to distinguish between the use of IPCC default and country-specific emission factors, and noted that peer review was often lacking. The emission factors and activity level data for calculation of CO_2 emissions for 1990-1996 were based on data from the Institute of Economic Research and the Austrian Central

Statistical Office. It was conveyed to the review team that selection of both activity level data and emission factors in other instances was done using less rigorous procedures.

22. Individual sectoral studies served as the bases for the selected emission factors. In the oil refinery sector, for example, monthly sampling and elemental analysis of liquid fuels was used. Industry had also financed the estimation of emission factors, one instance being within the steel industry, which had led to a modification of the emission factor reflecting a technological change in steel-making, related to increased use of direct insertion of coal into the coke ovens. Another instance of usage of a refined emission factor was that of CO_2 emissions from waste incineration, which led to a difference in emissions of the order of 100 Gg CO_2. The review team noted that the emission factor of 78 kg CO_2/GJ for all fuel oils, in the energy and transformation sector, considered high (compared with the default of 73.3 kg CO_2/GJ) during the first review visit, was still in use. Initially, the assumption made for CO_2 emissions from waste incineration was that the fossil fuel based content of waste was zero, which was subsequently revised to 10 per cent after an analysis of municipal waste in Vienna.

23. Future work will concentrate on estimating the quantitative uncertainties of individual emission estimates. The need to harmonize the Austrian forest felling and yield statistics in accordance with the national wood balance and energy statistics, and assess the treatment of feedstocks has emerged. A high priority has been set for using improved emission inventories to refine GHG emission projections for different economic sectors. The team was informed of the possible privatization of the Federal Environment Agency in the future.

III. POLICIES AND MEASURES

24. The focus of the NC2 and the ensuing discussions during the review was on the use of various policies and measures to address climate change with a view to achieving the Austrian national target and the UNFCCC stabilization target. The Toronto Agreement, which is under negotiation within the country, is the policy document which reaffirms the national target and includes the mitigation measures necessary to achieve it. The team acknowledged that there was a general awareness among stakeholders of the 14 per cent increase in CO_2 emissions that had taken place during the period 1988-1996, with actual emissions in 1996 being 65,000 Gg (57,200 Gg in 1988), instead of the 9.5 per cent decrease envisaged under the Toronto target. Simultaneously, though there had been success in decoupling energy demand and associated CO_2 emissions from economic growth, the actual increase in emissions would imply that a far more rapid reduction (than estimated earlier) would be necessitated in the intervening period till 2005.

25. As far as compliance with the reporting guidelines for policies and measures is concerned, the reporting tables were used, although the reduction potential of measures and the time-frame of reduction were not always presented. The team noted that overestimation of the effects of policies and measures had been avoided, as the reduction potential of measures was based on conservative estimates rather than on theoretical technical potentials. The difficulty in adhering to the reporting guidelines in this section, related to overlap of potential across

measures, estimation of the synergies across measures, identifying the exact mix of factors which would actually define their implementation and estimation of costs, was acknowledged by the host country officials. The importance of monitoring implementation of measures and identifying indicators of progress, and of accountability for the individual measures, was emphasized by the team.

26. The team was informed that approximately 10 per cent of the current emissions had been targeted using a broad range of policy instruments, with the exception of voluntary agreements, which had a marginal role. Since 1996, mitigation measures were funded under the Environmental Support Act at the federal level and Länder grants and subsidies at the local level. The extent of funding under the Environmental Support Act for energy measures amounted to ATS 440 million for 1994-1996 period. The extent of funding at the Federal level for energy measures in the agricultural sector amounted to ATS 230 million in 1997. A similar level of detail is not available for the Länder, but estimated subsidies were approximately ATS 1,000 million annually.

27. The achievement of the full potential of the mitigation measures would be influenced by the degree of coordination of the policies and actions at the federal and Länder levels, likely to be further enhanced by the Toronto Agreement. The provision of subsidies by the federal Government for the preparation of Länder energy plans, and the focus of education and public awareness efforts on decision makers at this level, were indicative of such coordination. Two additional factors likely to strengthen progress towards attaining the Toronto target were the progress on the Toronto Agreement negotiations, and the role of the Ministry of Environment, Youth and Family Affairs (referred to below as the Ministry of the Environment) vis-a-vis other ministries. The Ministry of the Environment was responsible for the preparation of the national communications, with a limited role in implementation, in contrast to some of the line ministries. The Toronto technology program, aimed to achieve the Toronto target contributes to the GHG abatement policy, and includes a wide range of mitigation measures directed at: (a) higher efficiency in energy use, including thermal efficiency of buildings, and the redesign of transport infrastructure; (b) enhanced efficiency in energy transformation, including co-generation in the industrial and residential sector; (c) increased opportunities for renewable energy options, including biomass, biogas, wind, solar-thermal and solar-photovoltaic.

A. Energy supply and transformation

28. Austrian energy policy, described in the 1993 and 1996 energy reports of the federal Government, is based on the broad principles of security and diversification of energy imports, cost-effectiveness, and environmentally benign energy supply. According to the Austrian authorities, the strategies to implement this policy include energy efficiency improvements, use of renewable sources of energy and improved performance of energy supply system. Different instruments used to promote these strategies in the energy and transformation sector include information policy at both federal and Länder levels, research mainly in the renewable sector and energy conservation, legislation and regulations (nine Building Codes by Länder, adopted

between 1991 and 1998, and Federal Electricity Law). A catalogue of 97 such measures aimed at improving energy efficiency and reducing CO_2 emissions included in the 1993 energy report, and updated in 1996, was the basis for the measures identified in the first and second communication.

29. Entry into the EC has involved bringing national legislation into line with the EC electricity and gas directives, adopted in 1996 and 1998 respectively. The Federal Electricity Law adopted by the parliament in 1998, and due to be enforced in 1999 by Länder laws, translates the EC directive on the electricity market into national law. Deliberations during the review gave a rather variable picture of the Law, its impact on CO_2 emissions and the prospects of implementation. The general view of the Austrian authorities was that there would be a decline in electricity prices because of intensified competition in the electricity markets as well as a faster penetration of renewables. The impact on the CO_2 emissions has not been analyzed so far by the Austrian authorities. The team noted that, in general, a decline in energy prices need not necessarily be beneficial to CO_2 emissions as it may limit incentives for energy conservation. As to the promotion of renewables, the Federal Electricity Law stipulates that electric utilities by 2005 would have to ensure that at least 3 per cent of the electricity sold is obtained from biomass, solar or wind energy sources. Additionally, priority access to the grid would be provided for electricity produced from co-generation and renewables, and a minimum support price guaranteed by Government to facilitate their penetration.

30. District heating (DH) is supplied by utilities operating combined heat and power plants (CHP), district heating companies owned by municipalities, oil companies and private entrepreneurs. Under the 1982 District Heating Promotion Act DH projects which have been started before the end of 1993 have been financially supported. The financial support was provided in the form of grants in cooperation with the Länder, focusing on special policy areas such as combined heat and power stations, biomass, geothermal energy and industrial waste heat. During the 1984-1998 period, DH projects with an investment of about 15 billion ATS have been supported by a 1.5 billion ATS grant. In the post 1996 period, financial support for the DH projects was partially generated from the levies on natural gas and electricity assigned to the Länder under the 1996 Natural Gas and Electricity Levies Act. With regard to the electricity produced from thermal sources, cogeneration attained a share of 75 per cent in 1996. This was partially achieved through utility involvement, and also autoproduction. In 1996 CHP producers generated 14.457 GWh of electricity, of which 6.125 GWh was by autoproducers. The estimated investment amount for CHP from 1997 to 2006 is approximately 4 billion ATS. Owing to the competition in the heat market among supplying companies and other regional factors such as limits for expansion of district heating due to settlement structure outside the cities, the federal Government abolished the price regulation of district heating or submitted it to the competence of the Länder.

31. In Austria about 65 per cent of the electricity production is already generated from renewable sources, primarily from hydro power. The current Austrian renewable energy policy promotes non traditional renewable sources such as biomass, small hydropower, wind power,

solar-thermal, solar-photovoltaic (PV), biomass and geothermal energy. These renewable sources receive subsidies mainly from the Eco Fund and the Eco Energy Fund, the latter jointly established by the Federal Ministry for the Environment, Youth and Family Affairs and the Federal Ministry for Agriculture and Forestry, with additional support from the Länder. These subsidies allow for switching to renewable energy sources, connections to district heating, installation of modern biomass boilers and the construction of combined heat and power systems. In 1997, the share of electricity produced from renewables excluding hydro power, such as autoproducers and combustion of spent liquor from pulp and paper industry was estimated at 0.32 per cent and 2 per cent respectively. The Federal Electricity Law seeks to increase this share of renewables from these sources, disregarding combustion of spent liquor, from 0.32 per cent (in 1997) to 3 per cent by 2005.

32. In 1992, a project called the "Broad-based Test for Small Grid Connected PV Sets" was launched, with a target of installing 200 kW of PV, which was reached in 1993. Additionally, premium buy-back rates for PV and biogas-generated electricity are being paid by the Länder of Vorarlberg. For wind energy, premium buy-back rates were set at ATS 1.75/kWh in 1993. This earlier promotion of renewable electricity supply into the public grid slowed towards the end of 1996. The Federal Electricity Law intends to extend the coverage to electricity generated from all renewable sources. The team noted that there was an interim period of uncertainty due to the non renewal of the formal three year framework agreement of 1994, between the federal Ministry of Economic Affairs and the Austrian Association of Electricity Utilities (VEO), to address the increased compensation for electricity from PV and wind power stations, biomass and landfills or sewage treatment plants. The host country assured the team that though the agreement had not been extended formally most utilities continued to pay an increased compensation for electricity from renewables.

33. Price and tariff policy has played an essential role in energy efficiency improvements. In the household and industrial sector, a model electricity tariff structure has been applied which reflects the specific Austrian supply and demand characteristics, seasonal and daily variations of the energy consumption and uninterruptible supply. Additionally, there exist EC directives on Community procedure to improve the transparency of gas and electricity prices charged to industrial end users. In 1995, an agreement on electricity price monitoring was signed between the Ministry of Economic Affairs and the Association of Austrian Electricity Utilities, governing price transparency and price monitoring. In 1996, new levies were applied on electricity (ATS 0.10/kWh) and natural gas (ATS 0.60/m^3), with the ceiling of the tax for the material goods producing industry set at 0.35 per cent of the net value added by the company. The concept of least cost planning and integrated resource planning have been considered at the level of utilities and are covered under the Federal Electricity Law; they are also incorporated in the Länder energy action plans. With regard to heat consumption in the household sector, a newly introduced law stipulates the change of the bases for estimation of heating costs from the size of the dwelling to actual consumption.

B. Transport

34. The team noted that Austria had one of the highest passenger kilometers per capita (13,545 in 1996) among the OECD countries, with approximately 70 per cent of this taken by road traffic. This fact is not reflected in a correspondingly high level of emissions for 1991-1995, because of the increased share of diesel cars (with lower GHG emissions) and tank tourism (emissions accounted for in source country). The transport sector receives the largest share of the national budget, with heavy investment in the construction of railways, highways and another infrastructure. The NC2 contained information on two programmes: the 1991 Austrian Overall Traffic Concept (Österreichisches Gesamtverkehrskonzept 1991) and the Austrian Federal Transport Infrastructure Plan (Österreichischer Bundes verkehrswegeplan). The 1991 Austrian Overall Traffic Concept included guidelines for the federal transport policy in Austria and recommended many transport measures simultaneously ensuring sustainability. The Concept targets a 20 per cent reduction in CO_2 emissions from the transport sector by the year 2005 compared to 1988. While many of the recommended measures for sustainable transport have been implemented, transport experts acknowledged on the basis of more recent studies that it is quite difficult to meet the Toronto target in the transport sector. An Austrian Federal Transport Infrastructure Plan, is being developed based on this Concept aimed at the implementation of recommendations for the rail, road and inland waterway infrastructure in Austria.

35. The NC2 reported many measures in the transport sector, but it was stressed that only a limited number of them were evaluated. A study commissioned by the Ministry of the Environment, conducted jointly by the Austrian Institute for Internal Combustion Engines and Thermodynamics, the Institute for Transport Studies and the Johannes Kepler University of Linz, evaluated 26 different measures in this sector (including those identified in NC2) from a cost-benefit standpoint, examining the technical potential, fiscal incentive, infrastructure, and organizational measures. The measures found to have the greatest CO_2 reduction potential were increased fuel prices and road user tolls, followed by technical measures for reducing specific fuel consumption in the private vehicle sector, logistical improvements and measures to change driving behaviour. Interestingly, if only the infrastructure and operating costs are considered, seven of the investigated measures lead to monetary savings.

36. The three areas of intervention in the transport sector mentioned in the NC2 were: shifting the modal mix, levying taxes and liberalizing the railway system. The measures aimed at shifting the modal mix included a new parking tax on private vehicles in the large cities meant to promote the public transport and the use of road pricing, which was under deliberation by the Government and other stakeholders at the time of the visit. Though road pricing appeared a promising measure, it was expected to be limited to the highway system which in turn could increase pressure on the local road system. An assessment by the Austrian Government of the impact of measures to encourage the modal shift to public transport had not indicated a significant degree of success so far.

37. Taxation in this sector includes (a) a fuel consumption levy, (b) an annual motor vehicle tax, (c) mineral oil taxation, (d) environment related taxation of aviation (under deliberation), and (e) user charges on motorway toll stickers ("vignette"). The fuel consumption levy was introduced in 1992 in addition to the 20 per cent value added tax levied on the selling price of the vehicles, and modified in 1996, when it reached a maximum level of 16 per cent, which resulted in a total tax level of 39.2 per cent, including value added tax (VAT). It applies to newly registered passenger cars, and depends on the standard fuel consumption of the vehicle and is meant to provide an incentive to purchase cars with lower fuel consumption. The fuel consumption levy was not sufficient to encourage the purchase and use of fuel-efficient cars. An increase in the maximum tax rate from 39.2 to 60 per cent (including VAT) would provide an adequate incentive to alter the purchasing pattern but was unlikely to occur in the near future. Motor vehicle taxation including fuel consumption levy and annual motor vehicle tax might be modified in the near future taking a greater account of environmental aspects.

38. The mineral oil tax was one of the major transport measures implemented, with an estimated reduction potential of 0.1 million tons CO_2 annually. There has been an increase in this tax in the 1990s, the most recent increases amounting to ATS 0.5 per litre of gasoline as of January 1994, and to approximately ATS 1.0 per litre of gasoline and ATS 0.6 per litre of diesel as of May 1995. Further increases in diesel oil taxation might be feasible in the distant future, which is likely to modify the current upward trend in emissions from diesel transport. So far, the effect of the mineral oil tax on emission trends has been limited in comparison to the fuel consumption levy. An aviation kerosene tax for domestic flights existed in Austria before the country became a member of the EC and it was abolished afterwards. An environmentally motivated taxation of aviation was being deliberated upon in the Ministries of Environment and Transport. The motorway vignette (with different prices for trucks, buses, passenger cars and motorcycles was introduced in 1997 and allows use of motorways for a specific time period.

C. Industry

39. The industrial sector in Austria has shown a steady trend towards the improvement of energy efficiency, which has influenced the GHG emission trend. For instance, between 1973 and 1995, a 65 per cent increase in industrial production was accompanied by a reduction in industrial energy consumption of approximately 5 per cent, and a drop in CO_2 emissions of 20 per cent. There was a simultaneous change in the structure of industry, in spite of the continuing high share of the basic material industry.

40. In addition, environmental standards in industry are very high in Austria, stricter than in many other EC States, which is one of the reasons for the high energy cost. For example, medium-capacity steam boilers are subject to lower SO_2 limit values than in other EC States, entailing the use of more expensive low-sulphur fuels. The business non-governmental organizations stressed that it would be difficult to further reduce CO_2 emissions from industry in order to achieve the Toronto target, because of implications of competitiveness, the already

high levels of energy efficiency and the strict national interpretation of the concept of "best available technology" under existing national legislation.

41. Measures taken in this sector included energy audits, and increased use of CHP and renewables. The energy audits for energy-consumers of at least 20 TJ per annum were funded by the Ministry of Economic Affairs and conducted by the Austrian Association of Energy Consumers, in many industrial subsectors. For 1996, the audits identified a total investment of 107 million ATS by industry in energy-saving measures, corresponding to an energy-saving potential of 58 million kWh, or 5.5 per cent of the total energy consumption of the companies reviewed.

42. The policy of promoting CHP in the Austrian industrial sector (including public utilities and autoproducers) is considered a success, with operational CHP units numbering 86 in 1996, with an installed electric capacity of 3,471 MW, of which autoproducers accounted for 1,081 MW. Currently approximately two thirds of the potential for new CHP has been exhausted, with an additional capacity of 560 MW planned or under construction till 2010. The main instrument used to promote the adoption of CHP was the subsidies provided under the Environmental Support Act and until 1996 the District Heating Promotion Act.

43. Due to the high contribution of renewables of 26.4 per cent in 1996 (comprised of almost equal shares of hydropower and other renewables especially biomass) to the TPES, it would be inevitable that enhanced efforts would be directed to increasing this energy source to industry. A slight increase in energy supply from biomass in the industrial sector was noted in recent years. In the near future, priority access of biomass-based electricity to the grid was to be promoted by the Federal Electricity Law. The team felt that this supply has to be done in the context of sustainable biomass utilization.

44. The reduction of nitrous oxide emissions from nitric acid production was identified as a promising measure in the NC2, as there was scope for a reduction from the current level of 550 tonnes annually (170.5 kilotonnes carbon equivalent) to 250 tonnes annually (77.5 kilotonnes carbon equivalent), but at the time of the review it was not economically viable and therefore politically acceptable. In regard to the new gases, the host country emphasized the efforts to persuade industry to be cautious in using these new gases as substitutes for ozone-depleting substances.

D. Residential sector

45. Efforts to improve energy efficiency and mitigate GHG emissions in the residential sector include the implementation of measures aimed at harmonizing the regulations of the Länder, the introduction of more stringent values for building efficiency (K-values), improved efficiency of small-scale heating systems, and the application of efficiency standards for household appliances, space heating and hot water supply. These measures are covered under various agreements, drafted in accordance with the appropriate articles of the Constitution.

46. The nine Länder are responsible for implementing their own distinct building codes, while the minimum standards are based on a treaty, negotiated under the appropriate article of the Constitution. The situation in the Länder reflects the trend towards higher standards of building efficiency and energy certification of buildings. Nevertheless a "rebound" effect has been observed, in the slight increase in energy consumption per dwelling.

47. In 1995, under the Housing Promotion Act, the Länder spent 33.9 billion ATS on subsidies, including energy-related subsidies, of which 78.9 per cent was for new construction and 21.1 per cent for renovation of old buildings. There has been an increase in energy-related subsidies and an associated reduction in heating demand of 30 to 40 per cent in new buildings. Of the amount spent on old buildings, ATS 1.2 billion went to energy-saving measures.

48. At the Länder level, the development of the renewable energy programme in the residential sector was exemplified by the biomass district heating projects of Styria. In 1994, there were only a limited number of biomass heating supply units, whereas in April 1998 the number of such units had risen to 100 with a 145 MW capacity. This development was attributed to the policy to promote biomass at the Länder level, by the energy commissioner, the regional energy agency, the energy consulting office, the Chamber of Agriculture, farming cooperatives, and local authorities. There were similar efforts in several other Länder. This was a positive development not only in terms of the number of supply units, but also in terms of exchange of know-how within the EC.

49. At the municipality level, the team was impressed with the ongoing efforts in the municipality of Mäder (Vorarlberg) to integrate climate change and other environmental concerns into the decision-making process and policy planning, which had resulted in a reduction in energy consumption of approximately 30 per cent. This included the construction of buildings equipped with state-of-the-art technology for energy efficiency improvement, use of renewable energy options, including biomass utilization for power generation, and the private construction of solar installations, and the construction and functioning of schools in an ecologically friendly manner.

E. Agriculture

50. Broadly organic and extensive farming (integrated husbandry and reduced fertilizer application) were implemented in the agricultural sector. Austria has approximately 20,000 organic farms; the extent of organic farming increased substantially in the early 1990s but since 1996 was followed by stagnation. The current acreage is estimated at 350,000 ha, of a total cultivated area of 3.4 million ha. The prevalence of relatively high subsidies to organic farming has promoted it to a great extent. Additional factors which favoured its extension were the topology of the Alps, which do not favour fertilizer application, and the willingness of consumers to pay higher prices for organic produce. This latter fact led to 70 per cent of the produce finding a market. Organic and extensive farming have in turn led to a decrease in the quantity of fertilizer

applied and a reduction in emissions. A life cycle analysis of organic farming shows a 50 per cent reduction in GHG emissions.

51. Increased use of biomass-based heating systems essentially wood-based was noted by the team. As of 1998, there are 22,500 such systems, with a total installed capacity of 2,200 MW, and 360 heat distribution systems. Outdoor biomass burning is banned by law. The measures to promote biogas included subsidies, education and advisory services. The barriers identified by the Government to wider adoption of this technology are the high investment cost, and the small size of farms. In 1988 there were about 80 farms using biogas technology. The substitution of fossil fuel by fuel derived from oilseed crops has a limited potential, due to lack of market and high costs. The production of biodiesel in Austria was approximately 20,000 tonnes in 1997.

F. Land use change and forestry

52. The increase in carbon accumulation by managed forests between 1985 and 1995 was approximately 60 per cent. This was attained primarily by the afforestation of regions previously used for agriculture, better forest management and innovative forest engineering practices. The 1997 forest inventory showed an increase of 7,000 ha per year, compared to the earlier inventory figure of 2,000 ha per year. The estimated amount of biomass available for energy purposes is 15 million m^3 per year but at present only one third of the biomass available is used for energy purposes.

G. Waste

53. The four measures to mitigate GHG emissions from waste stressed in the NC2, namely, the utilization of landfill gas, sewage gas, cooker waste (from the pulp and paper industry) and waste for energy purposes, are addressed by the Austrian Waste Management Plan. At present, larger landfills have the landfill gas utilization infrastructure for electricity production, although only a limited number are used, whereas in the smaller landfills gas is flared. The Austrian Waste Management Plan is an policy instrument for the development of the Austrian waste management system covering all sectors, ranging from production and distribution of goods to waste disposal. This plan is implemented using laws and ordinances, among which is the Landfill Ordinance, currently in place, which is limited to a single waste disposal sector, namely landfills and waste to be dumped in landfills. The host country informed the team that the implementation of the Ordinance would aim at the energy utilization of waste and landfill gas. This would require proper treatment of waste (mechanical or biological treatment), as well as the construction of 10 to 15 new waste incinerators by 2004, and burning of 90 per cent of the waste. The estimated potential for the reduction of CO_2 emissions by using landfill gas in CHP plants as a substitute for other energy sources is 100 Gg CO_2 by 2005, with a corresponding reduction of 2,000 tonnes of methane per year by 2005. Any further reduction of CO_2 would depend on the future ratio of thermal treatment to mechanical biological treatment. The estimate provided for leakages of methane emissions in 1995 is 1,000 tonnes of methane, which is likely to be an overestimate.

54. In the case of waste utilization for energy purposes, pretreatment of waste including mechanical and biological treatment (where the light weight section is incinerated) leads to abatement of methane emissions. As of 1998, three incinerators were in operation. A study entitled "Climate aspects of waste treatment" assessing the various GHG reduction potentials for various options has shown that incineration and gas collection have the maximum potential. Since 1995, Austria has had mandatory separate collection of organic waste which enables pretreatment of waste. The team was informed that the Ministry of the Environment was working on strategies to produce biogas in an energy efficient way. The Compost Ordinance, under preparation shall introduce utilization of organic waste by composting in combination with digestion. The market is yet to be established for the resultant compost and it is expected that it can be used in agriculture and in landscaping.

H. Cross sectoral issues

55. The efforts made by Austria to introduce an energy tax on electricity and natural gas in 1996 were noteworthy, in that their level was approximately 10 times higher than those being considered within the EC. The revenue from the tax amounts to 7 billion ATS per year, 12 per cent of which is transferred to the Länder for additional funding of environmental and energy-saving measures and 5 per cent to the municipalities for funding the public transport. The general opinion of the officials participating in the review was that an increase in energy taxation would be necessary to reach the Toronto target, but could only be realized by a common decision at the EC level. A shortcoming of the tax was that it made no distinction between electricity generated from different sources, thus providing no incentive for fuel switching.

56. One of the taxes discussed during the review was the excise tax on mineral oil, updated in 1996, which was harmonized within the EC. The present tax rate is higher for gasoline than for diesel and kerosene. The total revenue currently received from this tax was estimated at approximately 35 billion ATS of which 4.9 per cent is recycled to the Länder for investment in public transport.

IV. PROJECTIONS AND EFFECTS OF POLICIES AND MEASURES

57. The projections of the emissions based on implemented policies and measures, contained in the NC2, were prepared by the University of Graz and the Austrian Institute of Economic Research, discussed at the IMC Climate and formally noted by the Government. A business-as-usual and three mitigation scenarios were developed using the measures identified by the Toronto technology program for assessing the achievement of the national target for CO_2 reduction and the stabilization target. The unadjusted inventory figures for CO_2 emissions were used and the aggregated emissions for CO_2 under the four scenarios were reported. The team noted that the guideline requirement of reporting emission projections by gas and by sector using the tabular format was not adhered to. The amount of information presented in the NC2 was limited but was substantially augmented during the visit, as reflected in this section. As to the

reporting on the effects of policies and measures, the information was presented in a tabular format, with non-uniform coverage.

58. Broadly, three models were used for projections, including an econometric top-down model, a classical model for energy projections and a technology-oriented, bottom-up energy model. The econometric top-down model was used to extrapolate historical trends into the future, disregarding current policy decisions. The model for energy projections, which was used by the Austrian Institute of Economic Research for energy forecasts, had a sectoral disaggregation for 17 activities and 20 fuel types and allowed for fuel substitution. Further, it was linked to the macroeconomic model, which gives the value added by sectors and accounts for energy efficiency improvements, and structural changes. The technology-oriented, bottom-up energy model developed for the Austrian national environmental plan was used by the ACCC for policy-making relating to various energy services, useful energy demand, final energy demand and primary energy demand. The model is demand-driven and has links to the macroeconomic model.

59. The business-as-usual or "without measures" scenario was based on econometric extrapolation of the time series for CO_2 emissions, using the econometric model. The "current measures" scenario was developed using the model for energy projections. The "additional measures" and the "additional measures delayed" scenario, were runs based on the technology model, with the estimates of reduction potentials of individual measures taken from the Federal Environment Agency. The difference between the "additional measures" and the "additional measures delayed" scenario was that the latter, assumed delayed adoption of the Toronto technology program.

60. The broad assumptions in place in the "current measures" scenario are: (a) fuel substitution was modelled on the basis of past trends of fuel substitution without taking the impact of the change in energy prices into account; constant relative energy prices were assumed; (b) the model accounted indirectly for energy efficiency improvement, i.e. energy efficiency in buildings; (c) the hydro energy development was exogenously set in the model using the detailed plans available of the electricity sector. The assumptions in the "additional measures" scenario include: (a) the model allowed for the price elasticity of energy consumption of all sectors towards different fuels; for example, the elasticity of natural gas consumption in industry is double that of electricity consumption; (b) indigenous technical progress was also considered by using expert estimates. For all scenarios, the implications of liberalization of the energy market were not incorporated in the models, owing to the high level of uncertainty.

61. The emission reduction potential of the measures under the Toronto technology program, is based on economic potential (which is lower than the technical potential) and does not account for any synergies across measures. The incremental part of the potential for a specific measure, over its implementation level in the "current measures" scenario, formed the basis for the estimation. While discussing the approach used to estimate the effect of measures, it was stressed to the review team that, in the case of measures related to electricity saving, the underlying

assumption was that the electricity saved would have been produced from fossil fuels. The team considered this a valid approach, given the structure of the Austrian electricity sector.

62. The current trend of CO_2 emissions is an upward one, the estimate for 1995 being 62,000 Gg, based on the inventory calculation. The "without measures" scenario, assumes continuation of this steady upward trend in the future, with emissions reaching a level of 65,000 Gg CO_2 in 2005. The "current measures" scenario (including implemented measures) showed an initial decline from the 1995 value, followed by stabilization around 2000, at the level of 57,300 Gg CO_2. The "additional measures" scenario showed a similar, but steeper decline to a level of 55,100 Gg CO_2 in 2000 and further decreasing to meet the Toronto target at 45,600 Gg CO_2. The "delayed measures" scenario assumed adoption of the Toronto technology program in 2000, instead of 1997. The team noted that the projected figure of 65,000 Gg CO_2 under the "without measures" scenario had already been achieved in 1996, based on the 1996 inventory data.

63. Some of the measures from the Toronto technology program, modelled in the "additional" and the "delayed measures" scenarios, and discussed during the review, included further expansion of the combined heat and power plants, thermal insulation of residential buildings and measures for the transport sector. As for CHP, significant potential still exists in the non-industrial sector, and an overall doubling of the existing installed capacity of 900 MW is modelled by the year 2005. The high potential for energy efficiency improvements through thermal rehabilitation (retrofit) of buildings or new construction using the higher energy efficiency standards has been modelled. Emphasis was laid on the implementation potential at the Länder and municipality levels, using an illustrative example of the thermal structure of buildings of Vienna. Overall, the current energy prices create incentives to adopt the higher standards for new buildings and for improving the thermal structure of existing buildings.

64. In the transport sector the focus was on incorporating the effect of the measures for redesigning the transport sector, which constituted a part of the 1991 Master Transportation Concept (which was partly implemented in 1997), modelled under the "additional measures" scenario. This included an expansion of transport services, implying an increase in passenger-kilometres. Simultaneously, strong emphasis was laid on altering the modal mix, by providing incentives for public transport, encouraging the use of bicycles, physical planning, and incorporation of zoning regulations. A stronger role for physical planning, which had been underestimated in the past, was assumed in modelling, as a means of altering the modal mix in particular. The results show that the current structure of the transport sector does not suggest a dramatic reduction of future emissions and that there would be a difficulty in achieving the 20 per cent reduction in this sector.

65. The Toronto Technology Program is aimed at the implementation of cost-effective emission reduction activities that stimulate innovative structural reforms of the Austrian economy. A ranking of the investment opportunities reveals, that about 40 per cent of a carefully designed technology package have pay-back periods of four years or less (for example, the additional improvements of the thermal quality of new buildings for achieving low-energy

standards). About the same percentage of investments can be identified that have pay-back periods between four and ten years (for example the improvement of thermal rehabilitation of buildings in the context of a general refitting activity). An additional 15 per cent of investments which fall beyond microeconomic acceptable pay-back periods become viable from a macroeconomic perspective if multiplier effects and their impact on growth, employment and international competitiveness are taken into account. Thus, about 95 per cent of an adequately selected technology program can be regarded as "no regrets" measures, if it is accompanied by institutional reforms and information activities. The Austrian business and industry federations expressed their concern that the results of the Toronto Technology Program do not really reflect a scenario which can be implemented in an economically and socially feasible way. In the industry sector's view the CO_2 reduction potential stipulated in the Program is overestimated.

66. The investment under the Toronto technology program was estimated at 99 billion ATS over nine years (11 billion ATS per year), originating from the revenue earned by the federal and provincial governments. It is anticipated that the implementation of this programme would further leverage investment of more than 200 billion ATS within nine years. The macroeconomic implications for GDP and employment have also been estimated by feeding the estimated results of the measures back into the macroeconomic model. The increase in GDP resulting from the additional measures contained in the Toronto technology programme, with respect to the "current measures" scenario, was in the range of ATS 10 billion and ATS 24 billion for 1997 and 2005, respectively. The anticipated employment effect is approximately 12 thousand jobs.

67. Although the LUCF sector was not among those targeted in the Toronto technology programme, information was provided during the review on the current and future sink capacity. The likelihood of the forest sink capacity leveling out around the year 2030 was mentioned during the discussions. Some of the issues discussed were the linkage of forest policy to international environmental policy, the sustainable management of Austrian forests, factors influencing sink capacity (age structure, tree species composition, associated increment, air pollution and the host-parasite relationship), the forest inventory, and the afforestation rate per year and its impact on the future sequestration capacity of the sink.

68. Projections of CH_4 emissions were not given in the NC2, nor presented to the team, although some estimates of the emission trend from the waste sector for various technical options to be adopted in the next 20-30 years, were discussed during the visit. The team learned that, though the Landfill Ordinance had been implemented, the choice of different technical options would strongly influence the future trend of emissions. Approximately 10 incineration plants would be required under the Ordinance by the year 2000, though impact assessment considerations, public attitude to siting, and high costs could influence this choice. In the animal husbandry sector, no changes were expected in spite of the slight decline in livestock populations. In general, methane emissions are expected to decrease.

69. No projections of N_2O emissions were contained in the NC2, but estimates made at the time of the review showed that they are likely to grow, owing to the increasing share of cars with

catalytic convertors and the penetration of fluidized bed combustion of biomass and other fuels. Emission projections for the new GHGs are likely to be available in a year. Currently there is no national legislation to regulate HFCs, PFCs and SF_6, but an EC draft directive on control of HFCs and PFCs may influence future trends. Future national legislation is likely to be based on controlling the recovery of products using these substances, which will require the availability of actual emission estimates. No projections of emissions from international aviation bunker fuels were made, in spite of their high growth rate of 50 per cent for the period 1990-1996.

V. EXPECTED IMPACTS OF CLIMATE CHANGE AND ADAPTATION MEASURES

70. Austria used both international findings and more specific country research to assess the potential impacts of climate change. The NC2 mentioned that no follow-up report to NC1 on expected impacts of climate change had been produced, but the Ministry of Science and Transport had conducted a feasibility study on setting up a Coordination and Information Centre for Climate and Climate Impact Research. In contrast to the NC1, this section in the NC2 was more comprehensive, and was supplemented by new findings, for instance on the regional impact characteristics of mountain systems, an important issue for Austria because of the altitude distribution of land (70 per cent of the land area being over 500 m above sea level of which 40 per cent is above 1000 m). The number of impact assessments conducted so far have been small because of the limited climatological information available at high spatial and temporal resolution. Work is being done on the impact of climate change on the mountain cryosphere, geomorphological processes, vegetation migration, mountain agriculture, tourism, and hydropower, among other aspects.

71. No detailed assessment of hydrology and water resources has been done for the whole of Austria, as individual catchment areas would respond variably to climate change. However, a dramatic lack of water was not anticipated. The University of Innsbruck has been monitoring the impact of temperature and precipitation changes on glaciers and also modelling the potential reaction of 20 Austrian river systems. Climate change could impact the hydrological cycle, further influencing hydropower generation. Tourism-related activities, currently accounting for 4 per cent of GNP, were also likely to be affected.

72. A presentation was made to the team on the research carried out into the vulnerability of forest ecosystems. The resolution of the 1993 Helsinki Ministerial Conference on strategies for a process of long-term adaptation of forests in Europe to climate change commits signatory states to intensify research, international cooperation, development and coordination of existing monitoring schemes to assess patterns and dynamics of alterations caused by climate change and promote sustainable utilization of wood. The work done at the Federal Forest Research Institute showed that a 2-3^{0}C rise in ambient temperature would lead to a new equilibrium, with the species composition being predominantly hardwood. Scenarios of vegetation migration for the southern foothills of the Alps predicted an impact on secondary pine and spruce, with implications on wood production. There was ongoing work on forest succession models. The air pollutant concentrations in the Alps were likely to aggravate any potential impacts of climate

change. The pollutant concentrations in the Alps are under constant monitoring. The direct negative effects of climate change on crop yields may not be too great, thanks to the diversity of crop cultivation in diverse microclimates.

73. Although the Austrian Government attaches a higher priority to mitigation than to adaptation, a fact worth highlighting is that some methods identified for torrent control could provide useful lessons for other countries as well.

VI. FINANCIAL ASSISTANCE AND TECHNOLOGY TRANSFER

74. Austria's Official Development Assistance (ODA) was of the order of 0.33 per cent of GDP, the OECD average, though it fell short of the 0.7 per cent target set for the developed world. It took the form of grants, or infrastructural support. As to "additionality" of funding, the team was informed that the Austrian Government considered all climate change related projects as being additional. During the session on financial assistance, discussion focused on how the volume of aid had been influenced by EC membership, as a clear picture did not emerge as to how ODA was handled subsequent to Austria joining the EC.

75. Bilateral funding has been directed at the transport and forestry sectors, and appears to be concentrated on capacity building. The team noted that Austria was active in providing assistance to the Czech Republic, Hungary, Slovakia and Slovenia. The establishment of the East Eco Fund estimated to be US$ 5 to 10 million had facilitated the process of capacity building. Prioritization of the projects to be supported was done by discussions with the ministries of the environment of host countries, biomass being the priority for the Czech Republic, Hungary and Slovenia, and CHP for Slovakia. In 1991-1997 the projects financed were limited to feasibility and non-investment studies, with the shift to investment projects occurring in 1997, which however did not exclude feasibility studies. Up to 10 to 15 per cent of the investment costs were funded by the East Eco Fund, with additional finance being leveraged by other multilateral agencies. The host country stated that one of the main barriers was the proper identification of really effective projects. Contributions to multilateral organizations included those made to the Global Environment Facility during the pilot phase and the first replenishment, the UNFCCC Trust Fund, United Nations Development Programme and the Multilateral Technology Program of United Nations Industrial Development Organization (UNIDO).

76. As to the difficulties encountered by Austria in adhering to the reporting guidelines on technology transfer, they primarily related to the data being available in a more aggregated form than what was required. Clearly, a definite element of technical assistance under bilateral funding through the East Eco Fund exists, apart from funding of multilateral technology programmes such as the UNIDO cleaner production centres and workshops. Establishment of these cleaner production centres in countries with economies in transition and in Latin America have involved both know-how transfer and capacity building. The team noted that it was difficult to obtain information on technology transfer involving the private sector.

77. Austria possesses a competitive position in manufacturing and trade of environmentally sound technologies, including climate technologies, with about 50 per cent of production earmarked for export, an example being the highly competitive CHP technology, 95 per cent of which is exported. It was stressed to the team that it was difficult to make a clear distinction between the export of technologies in general and those relating to climate change in particular, though the latter have usually related to water, energy and waste treatment. One important activity, aimed at facilitating the transfer of climate technologies within and outside the country, was to set up a comprehensive database on state-of-the-art environmental technologies. The database has subsequently been integrated with international databases, with further links being foreseen, with the Regional Environmental Centre in Budapest among other institutions.

78. Currently, there are no Austrian projects on activities implemented jointly. The host country stated that it would rather initiate new joint implementation projects than change originally bilateral projects into joint ones. Potential options for joint implementation activities in the future include development of hydropower in developing countries and the use of energy efficient methods for steel production.

VII. RESEARCH AND SYSTEMATIC OBSERVATION

79. The discussions on research and systematic observation focussed on data collection, monitoring and system observation, including data banks, research on climate modelling and prediction using general circulation models, impact assessment and technology research and development. Austria has a long tradition of climate observation. A working group in the Austrian Central Institute for Meteorology and Geodynamics is conducting a time series analysis of Austria's climate stations. The data has been digitized, and tested for homogeneity. The country has also been active in the World Weather Watch and Global Atmosphere Watch programmes of the World Meteorological Organization. Further, due to the limited representation of the complex topography of the Alps in current general circulation models, regionalisation using downscaling has been a research priority.

80. The research activities of the Ministry of Agriculture include the study of emissions in agriculture and forestry. The Federal Forest Research Institute has worked on projects on forest development and succession and reconstruction of past climatic conditions in the Carinthian basin (project of the University of Agricultural Sciences, Vienna). The team was briefed on the Austrian network for environmental research initiated by the Ministry of Science and Transport, also involving international cooperation in the EC. One of the nine nodes of this network is the Coordination and Information Centre for Climate and Climate Impact Research at the University of Agricultural Sciences, Vienna. The team took note of research projects on: an evaluation of Austria's CO_2 emissions, a model for national emission projections, systems analysis of Austria's carbon balance, an analysis of the cost-effectiveness of measures for reduction of CO_2 emissions from the transport sector, the database on Austrian climate change technologies, and the work of the UNECE inventories.

VIII. EDUCATION, TRAINING AND PUBLIC AWARENESS

81. The 1997 climate information campaign of the Ministry of the Environment, which was based on comprehensive empirical surveys, extended information coverage to means of reducing energy losses, resource conservation and consumer behaviour, and targeted local decision makers. Decisions at the local level relating to transport, traffic planning and agriculture, were influenced by the "guidelines for climate protection at the local level", developed by the Institute of Ecology and others. The Chamber of Commerce had initiated intensive training on consultation on energy issues, focused on climate change. In addition, the Länder have established training programs for consultants in energy efficiency.

82. The Klimabundnis or Climate Alliance, an initiative by non governmental organizations, was active in enhancing general awareness of climate change. By joining this alliance a community committed itself to lowering CO_2 emissions by 50 per cent, by 2010. By June 1998, all nine Länder had joined this initiative. One of the Climate Alliance activities involved a partnership with the residents of the tropical forests; another was a climate hotline targeting the 1997 climate information campaign, with the issues ranging from biomass heating, transport and traffic to the sustainable use of wood. Media attention at COP 3, had also contributed to increased general awareness of climate change.

83. The Ministry of Education and Cultural Affairs has launched a special programme on "Building ecological awareness in schools", with the participation of 6,000 schools. The programme focuses on including children in decisions on the school budget, the energy budget and energy conservation. The team remarked on its innovative nature.

IX. CONCLUSIONS

84. In general, Austria complied with the IPCC reporting requirements for the national inventory except for the non-submission of detailed worksheets for the sectors of fuel combustion, land-use change and forestry (provided during visit) and agriculture. On the other hand the team acknowledged the continuous efforts to improve the quality of the GHG emission inventory and subsequently construct a homogeneous data set. Other positive aspects included validation of inventory work and sectoral studies being used for the development of emission factors.

85. In terms of compliance with the reporting guidelines for policies and measures, the reporting tables were used, although the reduction potential of measures and the time-frame of reduction were not always presented. The host country officials acknowledged some difficulty in reporting on the overlap of potential across measures, estimation of the synergies across measures, the identification of the exact mix of factors affecting the implementation of measures and the estimation of costs. From the perspective of an integrated climate policy the Toronto Technology Program will undoubtedly have an important role. This program outlines investment activities which could stimulate both the required technological innovations in various sectors of

the Austrian economy and make it possible to achieve the Toronto target, a view which is however not shared by all stakeholders. Although the analysis indicates that up to 95 per cent of the required investments could be identified as "no regrets" opportunities, such a program would have to be accompanied by major institutional reforms in the energy sector, in the financial sector and the transportation sector. Examples include the shift of financial support for new buildings to retrofitting of existent buildings and a comprehensive reform of the transport sector. The Toronto Technology Program envisages the reduction of GHG emissions providing an opportunity to stimulate economic growth, employment and international competitiveness by technological innovation.

86. The achievement of the Toronto and stabilization targets would require a further strengthening of the existing policy and institutional framework and a convergence of the views of various stakeholders on the usefulness of the Toronto Agreement for further action. It was anticipated that this agreement would constitute an important component of future progress made by Austria in addressing climate change. Further, an improvement in the coordination of policy formulation and implementation at the federal and Länder levels would contribute to the effective implementation of this agreement.

87. A substantial amount of information on the projections was shared with the team during the visit, although the requirement to report emission projections by gas and by sector using the tabular format was not adhered to, and only a part of the information discussed was included in the NC2. The team felt that the results obtained under different projection scenarios indicated the feasibility of (a) achieving the UNFCCC stabilization target (1990 levels by 2000) with the current policies in place and (b) achieving the Toronto target (20 per cent reduction of CO_2 emissions relative to 1988 by 2005) with the adoption of additional measures, unless economic growth and energy prices were different from the expected range, or the anticipated effect of implemented measures was lower than currently estimated. The team noted that the figure of 65,000 Gg CO_2 projected under the "without measures" scenario had in fact already been attained in 1996, based on the 1996 inventory data.

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