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## AUSTRIA

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

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Under Articles 4 and 12 of the Convention, Parties are required to prepare national communications on their implementation of the Convention. Guidelines for the preparation of national communications and the process for their review were agreed on by the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change, by its decisions 9/2 and 10/1, and by the Conference of the Parties, at its first session, by its decisions 2/CP.1 and 3/CP.1 (see FCCC/CP/1995/7/Add.1). In accordance with these decisions, a compilation and synthesis of the first 33 national communications from Annex I Parties was prepared (FCCC/CP/1996/12 and Add.1 and 2).

When reviewing the implementation of the Convention by Parties, the subsidiary bodies and the Conference of the Parties will have this report available to them in English as well as the summary of the report in the six official languages of the United Nations. (These bodies will also have before them the executive summary of the first national communication of Austria and country-specific information drawn from a compilation and synthesis report covering all countries that have submitted national communications.)

## Summary<sup>1</sup>

1. The in-depth review was carried out during the period November 1995 to November 1996, and included a country visit by the team from 3 to 7 December 1995. The team included experts from Ghana (paper review), the Netherlands and the International Energy Agency. Austria submitted its communication on 23 September 1994, and some supplementary information before the due date of 28 November 1994. Additional background material was made available to the team.

2. Austria is a federal state, and considerable responsibility for implementing policies and measures rests with the provinces (Länder), as well as the municipalities. Austria is bordered by eight countries, four of which have economies in transition, and this has some influence on national policies. The country has considerable transit traffic, and gasoline prices are higher than in its eastern neighbours and more or less equal to those in its western neighbours. Because of its climatic conditions, it has a considerable need for heating. In 1994 it utilized 26.4 per cent of renewables in the energy balance, evenly distributed between biomass and hydro. The level of carbon dioxide (CO<sub>2</sub>) emissions per capita is low, averaging about 7.5 tonnes in 1990 compared to an average of 12 tonnes in countries of the Organisation for Economic Cooperation and Development (OECD). This is due to the high share of renewables as well as the relatively low energy consumption. The electricity sector is largely characterized by monopolies, with significant overcapacity and little recent use of existing coal-powered plants. Some liberalization of that sector is foreseen, which could change conditions for the introduction of policies and measures. Use of natural gas is expanding, and competes in some areas with biomass and in others with coal.

3. CO<sub>2</sub> accounted for 78 per cent of greenhouse gas (GHG) emissions in 1990 using the Intergovernmental Panel on Climate Change (IPCC) 1994 values for global warming potential (GWP), and the CO<sub>2</sub> emission level has been fluctuating within a range of 55 to 64 megatonnes since 1971, mainly due to weather conditions as well as changes in electricity production and in the transport sector. The main source sectors were energy and transformation (27.8 per cent), transport (27.3 per cent) and industry (24.3 per cent). Methane emissions represented around 20 and nitrous oxide only 2 per cent of the inventory, the latter being relatively low due to the limited use of fertilizers. Forest covers 46 per cent of the land, and figures provided to the team revealed a net annual sequestration equivalent to 15 megatonnes CO<sub>2</sub>. Figures according to both IPCC and CORINAIR<sup>2</sup> were provided, and the team based its review primarily on documentation of the latter. Austria has two sets of energy statistics that give considerably different figures for emissions, and the team

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<sup>1</sup> In accordance with decision 2/CP.1 of the Conference of the Parties, the full draft of this report was communicated to the Austrian Government, which had no further comments.

<sup>2</sup> CORINAIR is the component of the European Community's CORINE (Coordinated Information System on the State of Natural Resources and the Environment) dealing with air emissions inventories.

considered the work being done to make these compatible as important. For the years 1994 and 1995 Austria succeeded in harmonizing these two statistical sets. The team noted that Austria has used a high emission factor for all oils, and that the inventory for CO<sub>2</sub> could be revised downwards. Revised emission factors have been laid down in the *Energy Report 1996* of the Austrian federal Government.

4. Austria has implemented, but to a varying degree, policies and measures to mitigate CO<sub>2</sub> emissions in all sectors. It also has some policies and measures that reduce emissions of other major GHGs and enhance sinks, although that is generally not their main motivation. The team noted in particular the taxation system for cars introduced in 1992 which encourages the purchase of energy efficient cars, although it is still uncertain whether this has been sufficient to establish a trend towards cars with less fuel consumption. Austria increased the relevant tax rate in May 1996. The team also noted that a considerable number of the measures described in the communication are either planned or are merely at the conceptual stage. In particular it noted that a combined carbon/energy tax has been discussed and was seen as potentially effective. Energy elements have been introduced into taxation; as a first step, an 18 to 150 per cent increase in mineral oil taxes depending on the fuel type was implemented in May 1995 and, as a second, natural gas and electricity became subject to taxes from 1 June 1996; for energy-intensive industries an upper limit regarding the tax burden (0.35 per cent of the net value added) has been introduced. Future development of policies and measures will also depend on the policies of the European Union, of which Austria became a member on 1 January 1995.

5. The team saw several scenarios showing possible development paths that could lead to achievement of the Toronto target of a reduction in CO<sub>2</sub> emissions of 20 per cent in 2005 from the 1988 level, as well as a stabilization of CO<sub>2</sub> emissions at 1990 level. A challenge would be to find policy instruments that would allow the technical and economical potentials identified in these studies to be realized. Even returning the CO<sub>2</sub> emissions to 1990 levels by the year 2000 would need a very high improvement rate in energy intensity (2.1 per cent annually with 2.5 to 3 per cent economic growth). This, however, was not seen as out of reach as long as the proposed measures are implemented sufficiently quickly. There are no estimates of whether and how long the present rate of net CO<sub>2</sub> removals could be maintained. Emissions of methane could be slightly reduced, while those of nitrous oxide could increase. The team assumed that emissions of hydrofluorocarbons (HFCs) would increase while those of perfluorocarbons (PFCs) would decrease, but none of them were mentioned in the communication.

6. Impact scenarios for Austria are carried out on the basis of information derived from the IPCC. The water system, is seen as vulnerable. The need to examine social and economic impacts further was recognized, a case in point being, the conditions for the important tourist industry, which could change significantly with a change in snow cover. No specific adaptation measures have been implemented but some projects are under way to investigate such measures. Austria provides important locations for monitoring climate-related variables as well as atmospheric chemistry. Research and development have been concentrated on the process of climate change itself, although applied research has also been done. Austria has a

relatively small expenditure on research and development on energy technologies, focusing on renewables and energy efficiency.

7. Austria provided one of the highest contributions on a per capita basis to the Global Environment Facility (GEF) in its pilot phase, and it is contributing its share to the replenishment. Official development assistance has been fluctuating between 0.30 and 0.34 per cent of GNP since 1991. Some efforts have been made to increase public awareness of climate change, but a major planned campaign reported in the communication had still not been implemented at the time of the team's visit. The involvement of social partners in policy formation enhances the understanding of issues related to climate change in important target groups.

## I. INTRODUCTION AND NATIONAL CIRCUMSTANCES

8. Austria ratified the Convention on 28 February 1994 and submitted its communication on 23 September 1994. Some supplementary information was supplied before the due date of 28 November 1994. Additional background material was made available to the team. The in-depth review was carried out during the period November 1995 to November 1996, and included a country visit by the team from 3 to 7 December 1995. The members of the review team were Mr. George Manful (Ghana; paper review), Mr André van Amstel (Netherlands), Mr Jan Keppler (International Energy Agency (IEA) secretariat) and Mr Peer Stiansen (UNFCCC secretariat, Coordinator). The team met with governmental officials, representatives from the academic community as well as representatives from business organizations and chambers and one environmental non-governmental organization.

9. Geographically, Austria is situated in central Europe, bordering eight countries, four of which have economies in transition. The situation implies that considerable transit traffic finds its way through the country both between eastern and western and between northern and southern Europe. The open borders also mean that due consideration must be paid to what goes on in neighbouring countries when policies and practices are developed, in particular when these could have trade implications.

10. Around 46 per cent of the land area of Austria is covered by forest, which constitutes a considerable carbon reservoir and is believed to effect a significant net removal of CO<sub>2</sub>, as well as being economically important and providing a source of renewable energy. Biomass use, often through district heating, has increased rapidly over the last two decades and represented 12.1 per cent of the total energy balance in 1995, which is very high in an international context. Austria also has a similar amount of hydropower, which normally accounts for 65-70 per cent of the electricity production, bringing the energy supply from renewables to 26.4 per cent of the total in 1994. After a doubling of the hydropower capacity since 1970, the potential for further environmentally and economically viable development of this source is limited because of environmental, hydrological and nature conservation restrictions as well as the liberalized EU electricity market. The bulk of the remaining energy supply is covered by fossil fuels; while the usage of coal is on the decrease, the supply of

natural gas has been increasing and in some markets competes with district heating and biomass use. Nuclear power is banned by law. Austria is phasing out subsidies to domestic coal production which is mainly of brown coal. This production has declined rapidly and only a small part is expected to remain on a competitive basis. Import of coal is still possible on relatively favourable terms from eastern neighbours. Prices of transport fuels are higher than in its eastern neighbours, and more or less equal to those in the others. This leads to some trade over the borders. The agricultural sector is relatively small in economic terms and there is relatively little use of fertilizers, partly as biological farms represent a high share of the overall sector, owing to favourable regulations.

11. The climate type entails a substantial amount of heating, around 30 per cent of which is supplied from biomass. Approximately 10 per cent of the housing stock is connected to district heating systems. The availability of hydropower and the temperature fluctuations create considerable variations in CO<sub>2</sub> emissions from year to year, especially since the short-term alternative to hydropower is a significant coal-based capacity that has not been in regular use in recent years, reflecting an overcapacity of electricity in the region; this is mainly a sign of a grid based on hydro and thermal production and should also be regarded in connection with the ban on nuclear power, as mentioned above. Austria also has considerable electricity imports and exports (equivalent to 15-20 per cent of the production), including long-term import contracts with Poland and Hungary; the imports and exports are balanced however. CO<sub>2</sub> emissions per capita are relatively low (7.5 tonnes in 1990 ) compared to the OECD average, partly due to the availability of renewable energy sources, and partly to an energy consumption that is lower than both OECD and European Union (EU) averages. These emissions have been broadly stable for the last 20 years, but annual fluctuations are high, with 1988, which is the base year for the domestic target, at the low end and 1990 near the median of the interval. Structural change has made the Austrian economy much less energy-intensive over the last two decades, in line with the average development in the IEA countries. Population growth (0.3 to 0.4 per cent annually) is low compared to the OECD average (0.7 per cent).

12. Austria acquired a new government shortly after the team's visit. It joined the European Union on 1 January 1995, and this is expected to influence Austria's response to climate change. Austria - like most of the EU member states - has a large public debt which the Government will reduce to meet the Maastricht criteria for a single European Union currency, through cutting expenditure and increasing taxes. Cuts of 10 per cent in government staff over time are envisaged. These could cause important obstacles in implementing policies and measures to respond to climate change. Still, Austria has enjoyed a stronger economic growth and less unemployment than OECD averages over the last decade. As in several other countries, some reforms allowing for more deregulation and competition in the energy sector, which is largely characterized by monopolies, have been envisaged. At the time of the team's visit, these were put on hold because of uncertainties related to the developments in the European Union on the issue; meanwhile the EU Council has accepted the draft of a deregulation directive on the electricity market, which will guide the development towards deregulation and competition in the Austrian electricity market.

13. Austria started drawing up policies relative to climate change in the late 1980 and adopted a Toronto target for CO<sub>2</sub>, which is a 20 per cent reduction between 1988 and 2005. At the United Nations Conference on Environment and Development, it initiated and signed a statement from like-minded countries committing itself to a stabilization of CO<sub>2</sub> emissions in 2000 at 1990 levels. Austria so far has no targets for emissions of methane, nitrous oxide, and other greenhouse gases or their removals by sinks.

14. Austria is a federal state, and considerable authority over matters related to policies and measures rests with the nine provinces (Länder) and the municipalities. There is no comprehensive environmental law covering emissions of GHGs. In principle, all that is not explicitly written into the Constitution is a responsibility for the provincial level. This applies for example to physical planning, air pollution from the domestic sector and building regulations. Generally there are "state treaties" between the federal and provincial governments, which specify minimum levels of performance in those fields but where the provinces may have stricter legislation. Climate change is covered by these treaties, and there is a special treaty in preparation on how to meet the Toronto target. The Länder administer federal legislation on, *inter alia*, agriculture and forestry, and some further tasks may be transferred to them. A considerable number (136 by October 1996) of Austria's cities and municipalities and eight of the nine provinces are members of the "Climate Alliance", which aims at reducing CO<sub>2</sub> emissions by half by 2010.

15. The Austrian response to climate change has been organized since 1991 through an interministerial group (the IMC Climate) involving the most affected ministries and the so-called social partners (industry, trade unions, chambers and labour organizations) and coordinated by the Ministry of the Environment. The group reports annually to the Government. A statement on integration of climate change concerns in the various sectors was part of the political basis for the previous Government, while the present Government has said that it intends to increase the efforts to protect the global climate. The ministries carry out the policy side of the response strategies, supported by the Federal Environmental Agency (Umweltbundesamt, UBA) doing technical work, for example related to inventories. In addition there has been a CO<sub>2</sub> commission since 1990, which is an expert panel on climate change consisting of representatives from academia and the so-called social partners, and to some extent environmental non-governmental organizations. This commission was set up by the Ministry of the Environment but is independent in functions. In 1996 the advisory functions of the CO<sub>2</sub> commission were taken over by the Austrian Council on Climate Change (ACCC), which is essentially an expert body currently concentrating on assessing implementation issues.

16. Austria's response to climate change will also be carried out within the comprehensive framework of the National Environmental Plan, that was published for the first time in 1995. This stated that "the National Environmental Plan provides Austria with a long-range concept that operationalizes the political commitment to integrate environmental concerns into all political levels; this includes industrial policy, traffic and energy policy, agricultural policy, health policy, research and technology policy, as well as education policy." Other references to Austrian climate change policy are the recent *Energy Reports 1993* and *1996* and the

Master Transportation Concept 1991 of the Austrian government. In the *Energy Reports* the situation of Austrian energy supply as well as the guidelines of the Austrian energy policy are described. The *1993 Energy Report* includes the Energy Action Programme, a set of energy policy measures primarily related to energy efficiency and and reduction of CO<sub>2</sub> emissions.

## II. INVENTORIES OF ANTHROPOGENIC EMISSIONS AND REMOVALS

17. CO<sub>2</sub> emissions in 1990 were estimated at 59.2 megatonnes (Mt) and accounted for 78 per cent of the GHG emissions in 1990 using IPCC 1994 GWP values. The main source sectors were energy and transformation (27.8 per cent), transport (27.3 per cent) and industry (24.3 per cent). Process emissions from cement production accounted for 2.1 Mt CO<sub>2</sub>, while process emissions from some non-energy use of coal and coke were included in the energy-related emissions. In the communication the emissions were given both according to the IPCC guidelines and to CORINAIR, but without enough information to provide transparency. Underlying emission factors for the CORINAIR inventory were provided during the review. The review team noted that the overall emission factor of 78 kg CO<sub>2</sub>/GJ for all oil-type fuels, used in both inventories, is high compared to the IPCC default of 73.3 kg/GJ, but also that a closer assessment has been made and emission factors used for liquid fuels are now within the range of 74 to 81 kg CO<sub>2</sub>/GJ (based on field experiments).

18. CO<sub>2</sub> emissions calculated according to the CORINAIR methodology still differed significantly (by 11 per cent based on revised CORINAIR data), from the emissions calculated according to the IPCC method. The explanation given for this was differences in aggregation where some sectors may not be included in both inventories, and possibly different treatment of feedstocks. In addition, two incompatible sets of energy statistics, provided by the Austrian Institute for Economic Research (WIFO) and Statistics Austria (Östat) are the source of activity data. Austria has since succeeded in developing a key to translate the CORINAIR inventory to the IPCC format (first applied for the years 1994 and 1995) and the energy statistics have been made compatible, both developments recognized by the team as necessary for consistency and transparency. The team envisaged that the CO<sub>2</sub> inventory could be subject to revisions, and that this would most likely be downwards due to the high emission factor used.

19. CO<sub>2</sub> emissions from bunker fuels were not reported separately. According to IEA data, these amounted to about 0.4 Mt CO<sub>2</sub> in 1990, which would be relatively small in an international context and explained by Austria's inland location. Attention was drawn to the situation in which an estimated 2 per cent of transport fuel used in Austria is tanked over the border with the eastern European countries due to price differences. According to IPCC methodology this does not show up in the Austrian inventory. During the review, figures in the communication's CORINAIR table 3.14 for total CO<sub>2</sub> were corrected from 50.2 to 52.8 Mt.

20. According to figures taken from a research project cited in the communication, Austrian forests act as a reservoir for 300 Mt of carbon, while another 475 Mt were estimated



to be bound up in the soils. The communication did not give estimates of emissions from the *land-use change and forestry sector* for 1990. During the review, an estimate of average net removals of 15 Mt CO<sub>2</sub> per year for the last ten years was given. This estimate was based on the net timber volume increment, which accounts for fellings and natural decay. The team noted that the statistical coverage of the forest situation appeared to be relatively comprehensive. Forest fires are very rare in Austria, and do not lead to major carbon losses from vegetation. Carbon storage in soils and its related fluxes are the subject of further study.

21. The communication provided time series of CO<sub>2</sub> emissions from 1955 to 1992. The energy-related emissions have fluctuated within a range of 55 to 64 Mt since 1971, peaking in 1991. The peak was attributed to a combination of a dry preceding year, causing less hydropower availability, and a cold winter. Preliminary estimates of CO<sub>2</sub> emissions for 1993 and 1994 provided during the review remained within the range of variations. The team was shown preliminary results from a research project, where data were adjusted for variations in temperature, availability of hydropower and fluctuations in the business cycle. Then a slight increasing trend in CO<sub>2</sub> emissions could be seen. Such adjustment was considered useful when assessing the underlying trends in emissions as well as effects of measures, but was only done for internal use and not included in the communication.

22. The communication provided inventories for methane emissions according to both IPCC and CORINAIR methodology. Agriculture, waste and natural gas distribution were the main anthropogenic sources, and the emissions in 1990 were estimated to 602.8 Gg according to the IPCC method (as opposed to 825 Gg according to the CORINAIR figures). Methane emissions represented around 20 per cent of the inventory, based on IPCC 1994 GWPs. The main difference was the natural emissions category (208 Gg), which is not included in the IPCC guidelines. Other minor differences could possibly be explained by different emission factors. CORINAIR activity data and emission factors were provided during the review, but these were not complete. Although similar data or emission factors were not provided for the IPCC figures, the information from CORINAIR made the inventories relatively transparent.

23. The most recent estimate of nitrous oxide emissions in 1990 provided to the team was 4.1 kt when calculated with the IPCC methodology. This represented around 2 per cent of the total GHG emissions using IPCC 1994 GWPs; the low figure compared to other countries is a result of the relatively sparse use of fertilizers. The major sources are agriculture, transport and industry. The communication also gives a figure of 4.8 kt referring to IPCC methods and 9.3 kt referring to CORINAIR. Revised CORINAIR estimates for 1990 were 8.02 kt, down from 9.3 kt. The main difference stems from the agriculture sector, although other differences were also significant, possibly due to the sector categorization. Emissions from nitric acid production are relatively low in Austria, because the processes take place under low pressure, and the estimate for this source was revised downwards compared to the communication (from 0.616 to 0.52 kt). Activity data or emission factors were not provided in the communication, but such information was provided for the CORINAIR inventory during the review, although not complete. Better knowledge of the agriculture sector could be expected to lead to revised estimates later on.

24. The communication did not mention the other GHGs, namely, HFCs, PFCs and sulphur hexafluoride (SF<sub>6</sub>). The team was told that there are no production processes generating emissions of HFCs in Austria. Emissions of HFCs arising from replacement of substances controlled by the Montreal Protocol only occurred after 1990. Monitoring of the use of these gases was seen by the Austrian authorities as complicated by the open borders in the European Union. As there was aluminium production in Austria in 1990, the team assumes that there were also emissions of tetrafluoromethane (CF<sub>4</sub>) and hexafluoroethane (C<sub>2</sub>F<sub>6</sub>) in 1990, although the two Söderberg plants that are now closed down were old, albeit refurbished in the 1980, and the emissions not necessarily comparable to those from newer plants. No assessment could be given of possible SF<sub>6</sub> emissions.

25. The communication gave time series from 1980 to 1992 for the precursor gases. A 23 per cent reduction in nitrogen oxide (NO<sub>x</sub>) emissions was accomplished during that period, mainly after 1985. Carbon monoxide emissions showed a 15 per cent decrease over the same period. Non-methane volatile organic compound (NMVOC) emissions have shown a slight decline in recent years. It is believed that biomass burning is contributing to the high per capita level of NMVOC emissions. The team noted that a major study was to be undertaken in the winter seasons of 1995/1996 and 1996/1997 to establish better emission factors for NMVOC generated by the burning of coal, oil, gas and biomass.

### III. POLICIES AND MEASURES

26. Austria has implemented policies and measures aimed directly at reducing CO<sub>2</sub> emissions from all sectors, although to varying degrees. The team found that there are also activities under way that could limit or reduce emissions of methane and nitrous oxide, as well as enhancing sinks, but that were primarily introduced for other reasons. The communication mentions a number of policies and measures that were at different stages of implementation, instructively specifying the competent authority and the then current situation. The team noted that a great number of these measures were still at the conceptual stage when it made its review. Specific mitigation measures aiming at enhancing sinks for CO<sub>2</sub> and other gases are only listed in the "planned implementation" or "concept" categories in the communication.

27. The communication describes most, but not all of the policies and measures discussed below. This is partly due to the fact that time has gone by since its completion, but it may also be that the reporting guidelines did not contain explicit guidance on what could be seen as relevant information. Thus, the team has given particular attention to the integration of climate change concerns in sectoral policies, and assessment of the effects of other policies on emissions, in accordance with Article 4.2.(e).(ii) of the Convention. Since the communication was submitted, Austria has published the National Environmental Plan which provides a broad framework for environmental policies in the sectors important for GHG emissions. The IMC climate and advisory boards have worked on developing and assessing measures for a number of years, and an updated catalogue of policies and measures was sent to parliament shortly after the team's visit. A major study on the costs and benefits of

policies and measures for the transport sector is under way and will be concluded by the end of 1996.

28. Measures in the residential sector are considered to have the greatest potential for emission reductions, partly indirectly through electricity and heat savings. Industry is seen as being quite efficient, with limited scope for reductions; the industrial sector was able to reduce its total energy consumption by 14 per cent between 1979 and 1994 in spite of a 43 per cent increase in production. The consistent promotion of biomass as a fuel has been very successful over the last two decades and is regarded as having considerable additional potential, although there are still economic difficulties because of rather high prices for the technology.

29. Changes in taxation, including the introduction of a carbon/energy tax, are expected to influence emissions from all sectors. An increase in the mineral oil tax of 18 to 150 per cent in May 1995 (depending on the fuel type) was a first step in this direction, with a second being the introduction on 1 June 1996 of an additional energy tax on natural gas (S 0.60/m<sup>3</sup>) and electricity (S 0.10/kWh). Possible costs, benefits and distributional effects of different tax structures have been examined. The team noted that, as the various energy sources are not evenly distributed between Austria's regions, a pure CO<sub>2</sub> tax would be less politically feasible, despite being more cost-effective in abating CO<sub>2</sub> emissions.

#### A. Energy-related emissions

30. Austrian efforts to mitigate energy-related emissions concentrate on the end-use sectors. Two main measures are the new State Treaty on efficient use of energy (focusing on the domestic sector) and the electricity tariff reform which is supposed to better reflect the real costs of production and to reduce cross-subsidization. The environmental improvement law mentions biomass boilers, photovoltaic panels, solar collectors, wind converters, biogas, heat pumps, combined heat and power and district heating as priority areas. The federal agencies and the provinces combined disburse about S 3.5 billion, of which roughly two thirds go towards the efficiency improvement of private residences. The level and distribution of financial responsibilities for subsidies to promote energy efficiency and renewables is subject to negotiations between the federal government and the Länder. The improvement of up to 50 per cent in the energy efficiency of new dwellings compared to present average is expected to play a major role in achieving Austria's CO<sub>2</sub> target.

31. Another feature of Austrian energy policy is the consistent promotion of biomass in the final energy mix. This policy has been remarkably successful, with biomass contributing 11-13 per cent of total primary energy supply, predominantly in the form of firewood (wood chips), but also with considerable use in industry. The team notes, however, that biomass is competing with the growing supply of natural gas in some areas, and that given the cost structure of the gas supply, it will normally be preferred once the pipelines are in place.

32. Until there is a better balance in the electricity market, promotion of least-cost planning could have less of an impact on the supply side. However, if there is growth in

demand, these efforts could be an investment in the acquisition of experience as the surplus power generation capacity is eliminated. The Austrian Energy Action Programme 1993 contains a comprehensive set of measures for further improvement in efficiency, production, transport and use of electricity.

33. A potentially effective measure in this sector could also be a CO<sub>2</sub>/energy tax. A first step in such tax implementation, an increase in the tax on mineral oils, was introduced in May 1995, and a second, an energy tax on electricity and natural gas as such, on 1 June 1996. Proposals for a CO<sub>2</sub>/energy tax have been developed from the concept discussed within the European Union, and implementation could be the subject of a Union-wide agreement. The objective of the energy tax would be to reduce emissions as well as to improve general energy efficiency. The new tax is projected to generate revenues of around S 3 billion in 1996 and S 7 billion in 1997, and could thus reduce the budget deficit. S 830 million is earmarked for environmentally friendly measures and energy savings measures. Coal, which is the source of 20-25 per cent of the total CO<sub>2</sub> emissions, stemming mainly from electricity and heat production but also from industrial processes such as steel production, is only taxed indirectly through the taxes on electricity. The team noted that such indirect taxation and possible exemptions, although they can be easily justified when a country imposes such taxes unilaterally, would make the tax less cost-effective and, for example, give less incentive for fuel switching. There would also be an exemption for renewable energy such as biomass.

34. The team noted that policies to deregulate the electricity market, where the supply and distribution are still largely characterized by monopolies, could have implications for emissions, including the feasibility and effectiveness of specific policies and measures. Through price effects, they could change the economic attractiveness of, *inter alia*, CHPs and further development of renewables, and influence the propositions of primary energy sources utilized. More competition in supply would give incentives to produce more effectively, which could mean better utilization of the primary energy sources and hence fewer emissions. However, it would also affect the utilities' incentives to carry out integrated resource planning and demand-side management programmes. The total effects on emissions of such a reform in Austria remain uncertain, and would depend on the regulatory framework applied in the sector, including the relating to access of independent power producers, as well as the overall situation in the electricity market in central Europe.

35. In recent years, the growth in heat supply has mainly come from CHP plants. CHPs have been promoted together with district heating, which covers around 10 per cent of the households, by a subsidy scheme in place up to 1993. There has also been continued implementation in industry, where about 1000 MW are now installed. The Government sees major additional potential for both technologies in the longer term, but the team notes that the short- and medium-term development will depend crucially on the developments in the electricity and heat markets, including the tariff structures.

## B. Transport

36. The transport sector is expected to grow substantially, particularly freight transport by heavy lorry. The growth in transit traffic has accelerated, particularly since Switzerland tightened its regulatory regime for heavy traffic. There are quite a number of proposed measures in the traffic sector, some of which have to be seen in the context of the EU, but it is considered that some of them would have only limited individual impact. It remains to be seen to what extent these can influence the increasing trend.

37. Due to the differentials in taxation on fuels and vehicles, diesel cars, which emit relatively less carbon dioxide than gasoline-powered cars, are gaining market share in Austria. Forty per cent of all new cars now have diesel engines, which gives them 20 per cent of the total fleet. However, this entails increased emissions of soot.

38. The team noted that in 1992 Austria introduced a new car registration tax system based on fuel consumption. To illustrate, a car with a fuel consumption of 3 litres per 100 km would be taxed at the minimum rate of 20 per cent (the value added tax rate) of the net price of a new car, while a car that uses 11 litres would be taxed at 39.2 per cent, which from 1 June 1996 is the maximum tax rate including VAT. Before then, the maximum rate was 36.8 per cent and the average 33.2 per cent, which in fact is more than one percentage point up from the previous system. The tightening is likely to increase the average tax. Also the annual motor vehicle tax, which is proportional to the power of the engine, favours more efficient cars as there is a strong correlation between fuel consumption and power. Despite the considerable incentives provided by these taxes, it is still uncertain if they, together with those on fuels, have had sufficient effect to establish a trend toward more energy-efficient cars.

39. Austria's gasoline and diesel prices were raised by more than 10 per cent in May 1995 as a result of an increase in the mineral oils tax, which was a first step towards a CO<sub>2</sub>/energy tax. There are limits, however, to this form of taxation owing to the fact that Austria is a small country with a large amount of transit traffic and that cheaper gasoline can be bought in neighbouring states, particularly those in the east. This situation has also led to the development of measures to increase transit transport by rail as well as regulate the total heavy vehicle traffic and improve the environmental performance of such foreign vehicles on Austrian roads, partly through bilateral agreements with neighbouring states. Part of the revenue from the mineral oil tax and the tax on natural gas and electricity is earmarked for additional financing of local public passenger systems. In 1997 up to S 1.92 billion are budgeted in the preliminary figures.

40. Some concepts and projects related to full cost accounting and road pricing are being implemented, but these have not been in place long enough to make qualified assessments of the effects. Austria applies a road price duty which is higher than the maximum rate specified in the EU directive regulating such levies. This duty will have to be aligned with the directive within a few years, and Austria has therefore increased the motor vehicle tax on lorries. Austria introduced within the EU the eco-point system, which will be administered

and controlled by electronic means as from 1997. The objective of this system is to reduce the NO<sub>x</sub> emissions caused by the transit of lorries of more than 7.5 tonnes by 60 per cent, compared to the level of 1991. This system provides an incentive for the modernization of vehicle fleets and the shift of goods transport to more environmentally friendly transport modes, because vehicles with high emission levels require more eco-points for each transit than low-emission vehicles.

### C. Agriculture and forestry

41. The promotion of energy based on biomass, mainly wood and wood waste, has been a constant feature of Austrian policy. This is supplemented by some promotion of biodiesel based on rapeseed. Overall, a total of S 300 million was spent on agricultural subsidies by the federal and provincial administration for wood combustion, biogas, straw and biodiesel facilities in 1994. In comparison, total agricultural subsidies amounted to S 25 billion in 1994.

42. As part of the common European agricultural policy there are now moves towards extensive agriculture, with a funding of S 7.3 billion in 1995 and S 8.4 billion in 1996. Austria had 19,000 organic farmers in 1995, more than in the rest of the European Union put together. Through subsidies, some land is being left fallow. This move towards extensive agriculture implies reduced methane emissions from gastric fermentation as the numbers and nutrition of cattle change. Also emissions of nitrous oxide are reduced from an already relatively low level, as less fertilizer is used.

### D. Removals by sinks

43. Forest management practices, including afforestation over the last decades, has led to the present situation in which net sequestration is equivalent to around 15 Mt CO<sub>2</sub> annually. The annual increment has been rising last over the two decades, and fellings have declined considerably. Measures directly aimed at enhancing the sinks were, however, only reported in the "planned implementation" and "concepts/projects" categories. The growth in newly forested land slowed from an annual 10,000 hectares in the 1970 to 2,000 in the 1990, and as around 46 per cent of the country is now covered with forest, major additional afforestation is not expected. Especially in the mountainous areas, the potential for new plantations is low. Where pine and spruce are used at the margins of or outside their natural habitat, only a slow shift towards broadleaved species is foreseen; mixed forest (coniferous and broadleaved species) is expected to dominate for natural reasons. The tendency towards mixed forests is promoted by subsidies.

44. Almost 20 per cent of the forested area is protection forest. The forests are under stress from pollution and pests, including browsing animals, and the team notes that efforts to mitigate these problems are also contributing to maintaining the carbon reservoirs. With present management practices, Austrian forest will still constitute a net removal. This is particularly due to previous and, to some extent, ongoing afforestation. However, there are no estimates as to whether and for how long the present rate of sequestration of approximately

15 Mt of CO<sub>2</sub> annually could be maintained. The team noted that a main longer-term challenge will be to maintain the carbon reservoir in the forest and soils.

#### E. Non-CO<sub>2</sub> gases

45. Two measures concerning methane emissions in the category "planned implementation" were referred to in the communication, namely energy utilization of landfill gas and of sewage sludge. The team noted that Austria has implemented policies to reduce, reuse and recycle waste, and to increase the incineration capacity of waste. Up till now, three municipal incinerators have been installed. Because of the long time taken by planning procedures it has proved difficult to increase this number. Methane is recovered from the bigger landfills, which capture 40-50 per cent of these emissions, and there is a trend towards larger, better managed units which could make additional capture easier and more economical. A new landfill ordinance, which will enter into force by 1 January 1997, allows the dumping of waste with a total organic carbon content of less than 5 per cent (for new landfills). In a stepwise approach, existing landfills have finally to fulfil the same requirements by the end of 2004 (amendment to the Water Act). Organic waste is collected separately and composted. As in other countries, these measures are only partly motivated by emission reduction objectives; groundwater protection, odour and safety are important motivations. Regarding other methane sources, only concepts or projects were included in the communication.

46. No explicit mitigation policies and measures motivated by climate change were reported as implemented for N<sub>2</sub>O, but the effects of some policies affecting emissions of this gas are discussed below in chapter IV of this report. The team noted that a tax on fertilizers had to be abandoned as a consequence of Austria's membership of the European Union. The communication did not give information on HFCs, PFCs or SF<sub>6</sub>.

47. On the precursors NO<sub>x</sub> and NMVOC, Austria has accepted the commitments under the United Nations Economic Commission for Europe Convention on Long-range Transboundary Air Pollution. NMVOCs from domestic installations will be more strictly controlled. Concerning evaporative NMVOC emissions, a vapour control programme for the transport and distribution of gasoline (the so-called Stage 1 and Stage 2) is in force. Smaller gasoline stations will have to be refurbished in 1996. A reduction of 50 per cent of NMVOC emissions from these sources is expected from these regulations.

#### F. Subsidies as a cross-cutting issue

48. In the context of Article 4.2(e)(ii) of the Convention, which states that each Party *shall identify and periodically review its own activities that lead to greater levels of anthropogenic emissions of greenhouse gases not controlled by the Montreal Protocol than would otherwise occur*, the team found a number of issues meriting an assessment. Government involvement in economic activities is an important feature of the Austrian economy and reflects the historic experience with a strong institutional and consensus-based tradition. The team felt that there are several instances where the effects of policies, in particular subsidies, on GHG emissions would warrant an examination, as they could potentially counteract the measures

mentioned in the communication. Given that the present economic situation already puts pressure on public expenditure and that reforms may be required, a knowledge of environmental effects could be useful in taking decisions. The most important issues in this connection were seen as:

(a) Allocating the sum of S 30 billion for the construction of lower-income housing could increase the demand for living space. On the other hand, high standards, of thermal insulation for example, reduce the energy demand of new buildings. The net effect of the subsidy on energy demand could not be assessed;

(b) Subsidies for coal exploration are being continued and imported and domestic coal are exempted from the initial stages of the proposed energy tax. Although being phased out, subsidies for coal production are still higher than those for non-hydro renewables;

(c) The subsidization of agricultural production in the European Union through price caps on most agricultural products amounts to roughly S 25 billion in Austria alone (federal subsidies only);

(d) The maintenance of single providers without any obligation to provide access to third parties in gas and electricity distribution still allows for cross-subsidization despite the tariff reform and has contributed to the present overcapacity which could delay the implementation of new technologies;

(e) The structure of the commuter subsidy for employees travelling to and from their workplace (up to S 28,800 per person per year) reduces incentives to look for geographical proximity of residence and workplace.

49. The team noted that these interventions have their justification in the wider setting of the Austrian political framework, but it felt that a coherent climate-change response will have to take their effects into account.

#### **IV. PROJECTIONS AND EFFECTS OF POLICIES AND MEASURES**

50. The team noted that Austria historically does not have a strong tradition of central government involvement in carrying out and using projections such as those presented in the communication when developing climate change mitigation strategies. Those and other projections presented to the team were carried out by groups of researchers acting relatively independently. These studies, although differing in approach, rely to some extent on bottom-up methodologies with detailed descriptions of the demand for energy services and features and penetration rates of the technologies that could provide them. The team found such approaches useful in describing possible development paths towards achievement of the Toronto target or other emission levels. It was noted, however, that relations between technical/economical reduction potentials and the policies needed to realize such potentials in the market have been developed only to a limited extent in the models.



51. To the team, the groups working on projections appeared to have different strengths, e.g. one in modelling the Austrian energy market and another in modelling emission reduction measures. The groups' complementary strengths could improve the relevance of the next generation of emission scenarios, and the team noted that enhanced collaboration is now taking place. A future generation of projection tools would hopefully also make it possible to develop a clear distinction between "with measures" and "without measures" scenarios which, in addition to being required by the guidelines for communications under the Convention, could also contribute useful information for policy decisions. Recently an approach to distinguish between the scenarios has been developed.

52. The team also noted that various technical options for providing energy services with lower primary energy input and CO<sub>2</sub> emissions have been analysed in the framework of the National Environmental Plan, and that these showed considerable technological/economical potential for lower emissions combined with growth in services, including the technical possibility of staying within the limits of the Toronto target. The team saw a challenge in finding policy instruments that will realize those potentials. It also noted that if relations between policies and technical options are not well established in the models, especially bottom-up models focusing on potentials rather than behavioural relations estimated from historical data, these could tend to give optimistic pictures. Still, the team concluded that the objective of stabilizing CO<sub>2</sub> emissions at 1990 levels by the year 2000 does not seem out of reach for Austria as long as proposed measures are implemented sufficiently quickly. Reaching the Toronto target is much more ambitious, bearing in mind also that CO<sub>2</sub> emissions were almost 8 per cent higher in 1990 than in 1988.

53. The communication drew largely on a study by the Austrian Institute for Economic Research (WIFO) commissioned by the Energy Department of the Austrian Ministry of Economics, which develops three basic scenarios on the basis of a model of the Austrian energy sector. For a "reference" scenario, a "reduction" scenario (Toronto target, reduction of 20 per cent from 1988 levels by 2005) and a "stabilization" scenario (stabilization at 1990 levels by 2005), shares of pyrogenic emissions for different sectors, fuels and consumer groups are given. The reference scenario, in which emissions would rise from 1990 levels by 9 per cent by 2000 and by 14 per cent in 2005, integrates some measures to reduce carbon dioxide emissions, but fewer than what the Government considered would reflect the actual situation. The rate of reduction in energy intensity is assumed to be 1.5 per cent per year, which is already very high by international (and historical) standards. The assumed economic growth rate of between 2.5 and 3 per cent might, however, turn out to be lower than projected. The reduction scenario assumes a 3.8 per cent annual improvement in the energy intensity ratio, while in the stabilization scenario it is 2.1 per cent.

54. In all three scenarios the main individual results for 2005 are that the share of traffic in total energy consumption would rise substantially, whereas the share of the domestic sector would fall. The share of gas and biomass in total energy supply would grow, and that of coal and oil would diminish.

55. The team noted a number of uncertainties relating to all projections. In the short and medium term, the utilization of existing generation capacity could give very different outcomes. A considerable portion of the installed capacity consists of modern, coal-fired plants that have been little used in recent years. If market conditions require a shift in this situation, emissions may rise considerably. Part of the CO<sub>2</sub> emissions in the electricity sector could be reduced by measures on the supply side (e.g. biomass use, hydropower, and CHPs). Without a more balanced market, the economic incentives for such measures could be limited. A more liberalized electricity market could also accentuate these points, in addition to changing the actors as well as the behaviour of the market. Further, an expansion in the use of natural gas could reduce emissions if the alternative fuel is coal, but increase them if it competes with biomass.

56. The team was also informed of projections developed by the University of Graz, which were utilized in the National Environmental Plan. The model attempts to build scenarios around distinct policy tools, in particular an energy tax. One key feature of it is the concentration on the consumption of energy services as opposed to fuel consumption. On the basis of expert opinions and case studies, estimates are made for the technical change that a policy tool such as an energy tax would induce.

57. Another important feature highlighted in this work is the existence of barriers to entry, for instance of independent power producers using gas; the removal of such barriers in line with the EU deregulation directive on the electricity market might lead to environmental as well as economic gains ("double dividend"). Yet, for renewables this could lead to some difficulties in competing with other energy sources, especially gas. However, the only instrument discussed in detail remains the energy tax which, in the modelling exercise presented, had a broader base (all energy and electricity sources based on fossil fuels) than the taxes actually implemented. The taxes discussed in the studies were in the order of magnitude of the carbon/energy tax proposal of the European Commission. They were also assumed to be phased in over a five-year period. The three scenarios presented diverged widely according to the recycling scheme chosen for the expected revenues of S 49 billion (about US\$ 5 billion) in the fifth year.

58. The communication did not contain projections for removal of CO<sub>2</sub> by sinks. The team noted that Austrian forests will still represent a net removal thanks to previous and, to some extent, ongoing afforestation, but it is expected that in a few decades the forests could be in equilibrium with regard to carbon. However, there are no estimates of whether and for how long the present rate of sequestration of approximately 15 million tonnes of CO<sub>2</sub> per year could be maintained. As 46 per cent of the country is already covered with forest, it is not expected that additional afforestation will lead to much further carbon sequestration. Especially in the mountainous areas, the potential for new plantations is low, and only a very slow shift in species towards more mixed stands that could potentially store more carbon is foreseen. The team concluded that the results from the relatively close monitoring of the forests could provide a good basis for making projections.

59. The communication states that Austria expected methane emissions to be relatively stable over the decade. Increased recycling seems to have put a halt to the growth in waste volumes. Methane recovery from landfills is envisaged to rise from 40-50 per cent today to 90 per cent by 2010 as the trend towards larger, better managed units produces effects. Waste incineration is growing, but from such a small base that its impact on total emissions is likely to remain small for several years to come. There may be a small reduction in emissions from agriculture, although the common agricultural policy of the European Union will probably not have a substantial impact on emissions from manure before the turn of the century. In total, the team concluded that methane emissions could go slightly down by 2000.

60. Austria also expected nitrous oxide emissions to stabilize. During the review, however, it was indicated they could grow by 15 per cent overall during the 1990s. The main factor would be a 50 per cent increase in energy-related emissions, primarily from transport, firstly because of the increase in vehicle-kilometres, and secondly because of the increase in the number of cars with catalytic converters. The emissions from agriculture are already relatively low because of the low fertilizer use and the success of organic farming (19,000 low-input farms), and projections depend on the effects of Austria joining the European Union. An environmental programme in which low-input (mostly organic) agriculture is subsidized started in 1995 and will last till 2000. A levy on artificial fertilizer has to be dropped as a consequence of joining the European Union, and this will reduce the incentives to limit N<sub>2</sub>O emissions. At the moment N<sub>2</sub>O emissions from sewage treatment are low, but they are expected to increase with increasing use of denitrification plants.

61. There is no production of HFCs in Austria, and no industries have been identified as generating HFCs as a byproduct. These gases were not mentioned in the communication, but the team assumed that emissions will increase or have increased as these gases are used to replace substances controlled under by the Montreal Protocol on Substances that Deplete the Ozone Layer. In the National Environmental Plan, it is stated that Austria totally discontinued the use of chlorofluorocarbons (CFCs) in late 1994. As there was aluminium production in Austria in 1990, the team assumed that there were emissions of CF<sub>4</sub> and C<sub>2</sub>F<sub>6</sub> in 1990. However, these two Söderberg plants were old, and despite the fact that they were refurbished in the 1980ies, emissions were not necessarily comparable to those of newer plants. They have since been closed. No quantitative assessment of SF<sub>6</sub> emissions was made.

62. The team noted that, although Austria had not submitted explicit projections of precursor emissions, it had accepted reduction commitments for NO<sub>x</sub> and NMVOC under the Convention on Long-range Transboundary Air Pollution, and made efforts to comply with them. According to the Ozone Act, a stepwise reduction of NO<sub>x</sub> and VOC is required (minus 40 per cent by the end of 1996, minus 60 per cent by the end of 2001 and minus 70 per cent by the end of 2006, based on 1985 for NO<sub>x</sub> and 1988 for VOC). The three-way catalytic converter also reduces emissions of CO from transport, which accounts for one third of these emissions.

## **V. EXPECTED IMPACTS OF CLIMATE CHANGE**

63. Austria has constructed a scenario if what climate change could mean domestically, based on information from international sources. However, interpretations are rough, given the limited size of the country compared, for example, to the resolution in general circulation models, and its special topography. The scenario included temperature changes, increased precipitation in winter and reduced in summer. The communication outlines possible effects, in particular for the water systems, ecology and vegetation. The hydrological scenarios are considered to be most uncertain. The mountainous areas and forests are already under multiple stress from pollution and population, and are seen as being sensitive to climate change. The water system is also vulnerable; problems related to the supply of surface water from glaciers and the sinking groundwater table are foreseen. Effects on health are believed to be small. Economic and social impacts have not yet been thoroughly assessed at the national level. There would, for example, be a need for new activities in the important tourist industry if there is less snow cover, and this could also lead to increased pressure on the high altitude areas. Indirect adverse effects of climate change in the form of impacts on trade and environmental refugees could be more important in economic terms than the isolated domestic impacts.

## **VI. ADAPTATION MEASURES**

64. Austria has not implemented specific adaptation measures to climate change and the subject was only briefly mentioned in the communication. However, the team discussed directions in which activities such as tourism could develop while adapting to changing conditions, as indicated by existing and planned research projects. It also noted that some activities, such as the testing of new tree species at different sites, could provide important information in an adaptation process.

## **VII. FINANCIAL ASSISTANCE AND TECHNOLOGY TRANSFER**

65. Austria was among the countries that made the highest contribution on a per capita basis to the Global Environment Facility in its pilot phase (US\$ 36 million), and it is also paying its agreed share (US\$ 20 million) in the first replenishment. Its official development assistance has fluctuated between 0.30 and 0.34 per cent of GNP since 1991, the 1994 figure being 0.33. The bulk of the project portfolio is screened for consistency with environmental priorities.

66. There are considerable assistance programmes aimed at improving environmental protection and reducing, for example, greenhouse gas emissions in other countries. A global environment cooperation trust fund with an annual budget of US\$ 1.5 million over a period of three years has been created in conjunction with the World Bank. The fund primarily targets countries with economies in transition.

67. Austria's geographical position and close contact with Eastern European countries at ministerial, expert and private sector levels has led to priority being given to environmental assistance to countries with economies in transition. Although many projects are directed at local and regional pollution, including precursors, there are also climate change mitigation projects in areas such as biomass utilization and demand-side management. The team noted that the programmes targeting Eastern Europe chiefly finance feasibility studies and "intangible" costs, while investments are left to financial institutions. Recently the target of the programme has been extended to cover other costs too. At the time of the team's visit, an electronic mailbox containing information on existing technologies that could be provided by Austrian firms was being developed for availability on the Internet.

### **VIII. RESEARCH AND SYSTEMATIC OBSERVATION**

68. Austria's response to climate change through the research community has been concentrated largely on the process of climate change itself. At the time of the team's visit, there was a move towards establishing a more comprehensive climate programme. However, the final content and structure had not yet been decided, although the need for a multidisciplinary approach was acknowledged.

69. The team noted that monitoring climate in the Alps, where the general findings on climate change have limited applicability because of the topography, is a particular responsibility that Austria is undertaking, in cooperation with its neighbours. It also provides locations for monitoring where there is little influence by human activities, which is rare in Europe. In this respect, the Hoher Sonnblick station, located at an altitude of 3105 metres altitude, is an important monitoring facility which records, among other data, the chemical composition of the atmosphere. Austria has a long history of monitoring temperature, precipitation and snow cover, which has been utilized in assessments of climate variability over the last 200 years. Being a small country, Austria places great reliance on active participation in international research programmes.

70. The communication provides a list of institutions involved in applied research and development relevant to climate change, financed by users of the results such as ministries. It also describes a number of these projects related to inventories as well as development of policies and measures. Compared to other IEA countries, Austria carries out relatively little energy-related research and development. The same seems to apply to industry involvement. Renewables and energy efficiency are given priority, which could be a reflection of the importance of some of these sources in the energy balance.

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

71. At the time of the team's visit, some of the information activities that were described as planned in the communication had actually been carried out. The team in particular noted a useful handbook containing guidelines for climate protection at the municipal level, which

had been compiled by environmental non-governmental organizations working closely with the ministry concerned. Information on energy conservation is provided to the public, an activity regarded as important by the team, as well as training programmes for persons involved in energy management at operational level. A major climate information campaign that was described as planned in the communication and for which the Ministry of Environment, Youth and Family Affairs had developed a detailed strategy, had still not been finally decided upon at the time of the visit. The extent which issues related to climate change are covered by the school syllabus remained unclear to the team. Consequent on the participation of a number of municipalities in the Climate Alliance, several public awareness initiatives have been taken at the local level.

72. The team noted the considerable involvement of the "social partners" in policy formation, an involvement that presumably leads to higher awareness of the climate change issue in general as well as possible mitigation measures, given the tasks of the working groups. It also noted that information is an integrated aspect of research and development projects, and that researchers are active in informing the public on climate change issues.

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