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SLOVENIA

Report on the in-depth review of the first national communication of Slovenia

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I. NATIONAL CIRCUMSTANCES RELEVANT TO GREENHOUSE GAS EMISSIONS AND REMOVALS

1. Slovenia ratified the United Nations Framework Convention on Climate Change (UNFCCC), hereinafter referred to as the Convention, on 1 December 1995 and the Kyoto Protocol on 2 August 2002. Slovenia submitted its first national communication, hereinafter referred to as the NC1, on 28 August 2002. In accordance with decision 11/CP.4 (1998), Slovenia chose 1986 as its base year.

2. An in-depth review of Slovenia's NC1 was carried out from November 2002 to March 2003, including a country visit by a review team on 9–13 December 2002. The review team consisted of Mr. Moussa Cisse (Mali), Mr. Domenico Gaudioso (Italy), Mr. Nerijus Pedisius (Lithuania) and Ms. Xin Ren (UNFCCC secretariat, coordinator). During the visit the review team met the national experts who participated in the preparation of the NC1, as well as representatives from the government, ministries, research institutes and environmental and business non-governmental organizations (NGOs).

3. Slovenia is located in central Europe and has a diverse topography ranging from the generally mountainous north and flat east to the coastal south-west. Although it is a small country, Slovenia has a diverse climate, in terms of average temperature, precipitation and hours of sunshine, owing to its location at the crossroads of the Mediterranean, moderate-continental and Alpine climate zones. The total land area is 20,273 km^2, of which 56–57 per cent is covered by forest and 38 per cent by agricultural land. About two thirds of the agricultural land is grassland. The forested area is increasing and agricultural land is decreasing due to a decline in agriculture during the 1990s.

4. The total population in Slovenia was 1.988 million in 2000, and a 2 per cent increase is expected by 2020. The population is moderately dense (98/km^2) but characterized by dispersed settlement, with only half of the population living in urban areas. This causes a high demand for transportation. Transit transport forms a substantial share of total transport in Slovenia because of the country's central location on important transport routes in Europe.

5. The transition to a market economy in Slovenia started in the late 1980s, earlier than other economies in transition (EIT), causing a drop in the gross domestic product (GDP) around 1990 (table 1). In 1993, the economy began to grow with an average annual growth rate exceeding 4 per cent. Restructuring of the economy after independence in 1991 resulted in a decline in agriculture and industry and a slight increase in the service sector. The shares of GDP for these sectors in 1990 and 1999 are: agriculture 5 per cent and 3.2 per cent, industry 37.8 per cent and 32.8 per cent and services 47.8 per cent and 51.4 per cent respectively.

Table 1. Main macroeconomic indicators, 1986–2000

	1986	1990	2000	Change (%)[a]
Population (millions)	1.95	1.95	1.99	2.2
Gross domestic product – GDP (billions US$ of 1995 ppp)	na	26.61	31.96	20.1
Total primary energy supply – TPES (million tonnes of oil equivalent, Mtoe)	na	na	6.54	na
CO_2 emissions (Tg[b] CO_2, without LUCF)	14.43	12.85	14.42	12.2
CO_2 emissions per capita (1000 kg CO_2)	7.28	6.42	7.25	13.0
CO_2 emissions per GDP unit (kg CO_2 per US$ of 1995)	na	0.469	0.451	–3.9

Source: The data for population, GDP, TPES and CO_2 emissions are from the International Energy Agency (IEA) database, 2002 edition, since Slovenia only submitted GHG inventory data until 1996.
Note: na = not available
[a] The change is calculated as: [(2000 – 1990)/1990] x 100.
[b] One teragram (Tg) is equal to 1,000 gigagrams (Gg) or one million tonnes.

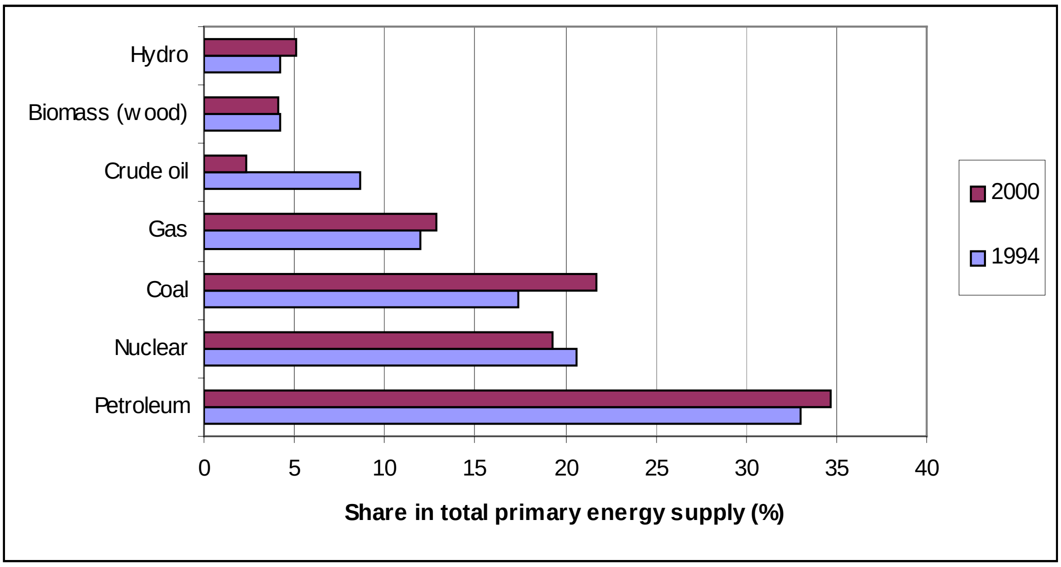
6. The efficiency of energy use in Slovenia is comparable to that in countries of the Organisation for Economic Co-operation and Development (OECD). In 2000 the ratio of TPES to GDP expressed at

1995 prices in purchasing power parity (PPP) was 0.205 toe[1] per US$ 1,000 for Slovenia, while it was 0.216 for the OECD on average and 0.177 for the European Community (EC).[2] The average electricity consumption for aluminum production is 15 kWh/kg worldwide; in Slovenia it is 13.5 kWh/kg, close to the world best (13 kWh/kg, Canada), according to Slovenian experts.

7. Slovenia will become an EC member state from May 2004 and is therefore obliged to harmonize its legislation with that of the EC. By December 2002, Slovenia had closed all chapters of its *acquis communautaire*, the principal document for accession to the EC. Some details are still being finalized or negotiated with the EC, such as the target for electricity from renewable resources. The *acquis communautaire* has a strong influence on Slovenian legislation in general and mitigation of greenhouse gases (GHGs) in particular.

8. Energy supply to Slovenia comprises domestic coal, hydropower and wood biomass, as well as imported fossil fuels, mainly gaseous, liquid and nuclear fuels. The use of coal has been decreasing since the early 1990s and has now stabilized. Coal, hydropower and nuclear power each contribute to approximately one-third of total electricity production in Slovenia, depending on hydrological conditions. Neither gas nor oil has been used for base load electricity generation, only for the peak load. Since its only nuclear power plant at Krško came into service in 1983, Slovenia has been a net exporter of electricity. Currently nearly 20 per cent of annual electricity produced in Slovenia is exported, mainly to Italy and Croatia, while in the meantime some electricity is imported from Austria. Fuel switching from coal to natural gas started in the late 1980s in the energy-intensive industry sector, driven by the demand for better air quality.

Figure 1. Structure of the total primary energy supply, 1994–2000



Source: Preliminary energy balance, prepared by the Institute "Jožef Stefan", on the basis of the energy yearbook of the Statistical Office. No complete data were available for years before 1994 at the time of the visit.

9. Slovenia is a parliamentary democracy. At local level, the country has 192 municipalities. The overall climate change policies are set by the parliament and implemented by the government. Local government (i.e. the municipalities) is responsible for implementation at the local level, such as district heating, local transport and waste management. The 15 biggest municipalities, mostly urban areas

[1] "toe" refers to tonnes of oil equivalent.

[2] *Source*: International Energy Agency (IEA) energy statistics.

including the capital, Ljubljana, are obliged to set up environmental departments funded locally. In the future, administration at the regional level may be established.

10. The Ministry of Environment, Spatial Planning and Energy (MoESE) has overall responsibility for the implementation of the UNFCCC commitment in conjunction with the Ministry of Transport and Communications (MoTC), the Ministry of Economic Affairs (MoEA), and the Ministry of Agriculture, Forestry and Food (MoAFF). In 2001, the function of energy sector management was transferred from MoEA to the then Ministry of Environment, which led to that ministry being renamed MoESE. A Climate Change Committee was set up in 1997 by an act of government, chaired by MoESE and comprising secretaries of state from all the ministries mentioned above as well as representatives from industry and commerce, academia and NGOs. It serves as a formal body for discussion, coordination of climate change policies and negotiations, as well as preparation of the NC1.

II. GREENHOUSE GAS INVENTORY INFORMATION

A. Inventory preparation

11. The inventory of GHGs completed in Slovenia in 1999 was a part of the Global Environment Facility (GEF)/United Nations Development Programme (UNDP) support project (SVN/97/G31) for the preparation of the NC1. Slovenia became involved in the UNFCCC process only in 1994 and started the preparation of its NC1 after receiving the above-mentioned funding. The host country considered low awareness among decision makers and academia, limited funding and knowledge as the main reasons for the late submission of its NC1 and absence of a GHG inventory after 1996. Slovenia plans to continue work on some parts of the NC1 and to obtain a complete inventory soon, as it received new GEF funding.

12. The Hydro-Meteorological Institute of Slovenia was appointed to draft and edit the NC1. The MoESE and the Climate Change Committee are the key elements of the national system for the GHG inventory. Many of the institutions listed in the NC1 contributed to the preparation of the inventories in their respective fields. In the energy sector, the MoEA provided the activity data related to the quantities of fuels and the energy values of fuels used based on energy statistics, energy yearbooks and energy balances, including energy exploitation of specific types of waste such as waste tyres and solvents. Some companies dealing with the transport of natural gas provided useful data. Institutions such as Studio Okolje and ERICO played an important role in the estimates of GHG emissions in the transport sector and fugitive emissions respectively.

13. Data on the consumption of resources provided by the national Statistical Office and companies dealing with these resources (metal, aluminium, cooling devices, soundproof windows, switching facilities) were the basis for the assessment of emissions in industrial processes. Some key institutions such as the Chamber of Commerce and the Institute of Metals and Technology contributed to collection of data on fluorinated gases: hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). The emissions in aluminium production were assessed on the basis of the number and duration of anodal effects, provided by the Aluminium company.

14. In the agriculture sector, the Agriculture Institute played an important role in the estimates of GHG emissions. Activity data were based on the databank of MoAFF; the Environmental Agency (abbreviated to ARSO in Slovene) of MoESE and Studio Okolje contributed to the estimates of GHG emissions from solid waste and wastewater treatment; and the Slovenian Forestry Institute dealt with the land-use change and forestry (LUCF) issues based on the data provided by MoAFF.

15. The inventory is generally in conformity with the “Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications,” (hereinafter referred to as the UNFCCC guidelines)

(FCCC/CP/1999/7). The methodology used was the *Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National GHG Inventories* (the IPCC guidelines).

16. Slovenia's national inventory was prepared using 1986 as the base year in accordance with decision 11/CP.4. The inventory covered 1986 and the period 1990–1996. The summary tables of the inventories of GHG emissions for 1986 and for 1990–1996 were presented in appendix 1 of the NC1. During the visit, the review team was provided with the inventory summary report in the local language (Slovene). In this summary report, many of these source categories were disaggregated into subcategories and an explanation was provided on the source categories that did not exist in Slovenia. International bunkers and carbon dioxide (CO_2) emissions from biomass were reported as memo items according to the IPCC guidelines. The figures presented in this summary report comply with the aggregated figures in the inventory section of the NC1. The review team noticed that the summary report was not referenced in the inventory of the NC1. Sulphur dioxide (SO_2) emissions were given only in total, not split into source categories.

17. The inventory included the three main GHGs, namely CO_2, methane (CH_4) and nitrous oxide (N_2O), as well as PFCs, for 1986 and 1990–1996. Emissions of HFCs were assessed only for 1995 and 1996, although HFCs began to be used in Slovenia in 1993. SF_6 emissions were assessed for 1986, 1995 and 1996. It is important to have complete assessment of these emissions for 1993–1996. The NC1 also includes estimates of indirect GHGs including carbon monoxide (CO), nitrogen oxides (NO_X), SO_2, and non-methane volatile organic compounds (NMVOC).

18. Total GHG emissions by sector and gas in the NC1 referred to aggregated emissions of CO_2, CH_4, N_2O, PFCs, HFCs and SF_6 expressed in terms of CO_2 equivalent, excluding CO_2 emissions or removals from LUCF. Estimates used the global warming potential (GWP) of individual gases for a time horizon of 100 years. The review team found that the total GHG emissions presented in the NC1 corresponded well with the sum of GHG emissions by sector, but not with that by gas (see table 2). The Slovenian experts attributed this to rounding. The review team recommended crosschecking and verifying some tables in the NC1 (such as table 14) in order to ensure that the figures are correct.

19. The national inventory section in the NC1 covered all the sectors (energy, industrial processes, solvent and other product use, agriculture, waste and LUCF). Estimates of emissions of different gases were reported per sector: CO_2 emissions from energy, industrial processes and sinks; CH_4 emissions from energy, industrial processes, agriculture and waste; N_2O from energy, solvent, agriculture and waste; PFCs from industrial processes (only for aluminium production); HFCs from industrial processes (around 37 per cent as coolants in cooling and air conditioning devices and 63 per cent as foaming agents in the production of polyurethane products); SF_6 from industrial processes (90 per cent from switching devices produced in Slovenia, of which the majority are then exported).

20. Slovenian GHG emissions estimates were mainly based on default IPCC emissions factors and CORINAIR[3] emission factors. The CORINAIR emission factors were used to estimate CH_4 and N_2O in road traffic. CORINAIR methodology was also used to estimate the emissions of NMVOCs resulting from the use of solvents. National emission factors were used for emissions in the transport of natural gas where the IPCC default emission factor for Eastern Europe is too high, as it is based on Russian gas pipe whereas Slovenia's piping is new. The emission factor applied to the fugitive emission of CH_4 in

[3] CORINE (COordination d'INformation Environnementale) was a work programme set up by the European Council of Ministers on 27 June 1985, aimed at gathering, coordinating and ensuring the consistency of information about the state of the environment and natural resources in the EC. One of its components was CORINAIR – the CORINeAIR emissions inventory under the European Monitoring and Evaluation Programme (EMEP) for the long-range transmission of air pollutants in Europe.

mining activities is lower than the IPCC default values. Slovenia reported using a CO_2 emission factor smaller than the default factor in fuel combustion because of the higher proportion of CH_4 in natural gas.

21. The key source categories assessed by Slovenia reflected the key sources provided in the IPCC guidelines according to the existing national source categories. Slovenia reported the use of different approaches (tiers) according to the importance of a source and the availability of data. The methodologies used to estimate the GHG emissions, as well as the assumptions, activity data, emission factors and technical coefficients, were provided in the inventory summary report and explained by Slovenian experts during the visit. The review team noticed that the inventory report contained uncertainties on activity data, emission data and technical coefficients, but these were not reported in the NC1. The uncertainty was estimated to be between 5 and 50 per cent, depending on the sector and the nature of data.

22. The Slovenian inventory was completed in 1999, before the requirements of the Good Practice Guidance[4] (GPG) such as the tables related to the common reporting format (CRF) were published. Slovenia had not submitted any inventory in the CRF to the UNFCCC secretariat by the time of drafting this report. It was therefore not possible for the review team to check the conformity and the consistency of the information in NC1 with the GPG and the CRF. The review team is of the opinion that these requirements should be taken into account in the preparation of national communications in future, and so should the issues of recalculations, quality assurance and quality control procedures.

B. Overall emission profile and trends by gas

23. The total GHGs reported in the NC1 decreased marginally overall in the 1990s (table 2). During the period 1986–1996, the relative share of CO_2 in total GHG emissions increased, while emissions of CH_4 and N_2O decreased and the overall share of fluorinated gases increased. In 1986 and 1996, the shares of GHG emissions by gas were: CO_2 (77 and 78 per cent); CH_4 (13 and 12 per cent); N_2O (9 and 8 per cent); fluorinated gases (around 1 and 2 per cent) respectively.

24. For CO_2 emissions, the decrease continued until 1992. From 1992 to 1996, the increase was 16 per cent, resulting in an overall increase for 1986–1996 of around 1 per cent. The distribution of CO_2 emissions by sector for the base year was: energy (94 per cent), industrial processes (6 per cent). In 1996, the distribution was energy (95 per cent) and industrial processes (5 per cent). Figure 2 shows that CO_2 emissions determine the trend and magnitude of GHG emissions.

Table 2. GHG emissions by gas (Gg CO_2 equivalent), 1986 and 1990–1996

	1986	1990	1991	1992	1993	1994	1995	1996	Change (%)[a]
CO_2	15 471	14 196	13 508	13 444	14 057	14 180	14 880	15 646	1.1
CH_4	2 526	2 386	2 442	2 392	2 386	2 360	2 358	2 369	–6.2
N_2O	1 820	1 662	1 652	1 606	1 609	1 615	1 624	1 646	–9.6
Fluorinated gases	283	258	303	244	251	282	343	289	2.1
GHG (sum by gas)	20 100	18 502	17 905	17 686	18 303	18 437	19 205	19 950	–0.7
GHG (from NC1)	**20 181**	**18 595**	**17 995**	**17 757**	**18 373**	**18 518**	**19 312**	**20 042**	**–0.7**

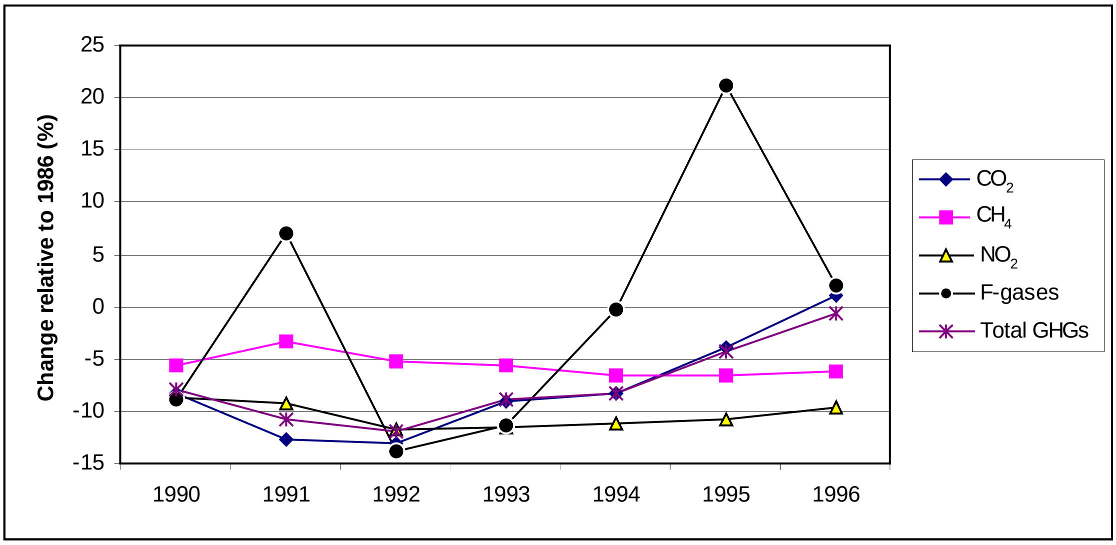
[a] The change is calculated as: [(1996 – 1986)/1986] x 100.

25. CH_4 emissions decreased by 6 per cent during the same period. This decrease is visible in all sectors with the exception of waste management where the increase was 15 per cent. The trend was very erratic as a result of a combination of factors: a falling number of cattle, the reduction of fugitive emissions in energy supply, and the increasing quantities of waste disposed of. The distribution of CH_4 emissions by major sources for 1986 and 1996 was as follows: agriculture 42 per cent and 38 per cent, waste 37 per cent and 46 per cent, and energy 20 per cent and 16 per cent respectively.

[4] *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, IPCC, 2000.

26. The overall decrease in N_2O emissions is the most significant (nearly 10 per cent) during the same period, although since 1992 the N_2O emissions have increased slightly (by about 2 per cent). N_2O emissions for both 1986 and 1996 were dominated by agriculture (84 per cent and 85 per cent). The share for the remaining sectors was 16 and 15 per cent for 1986 and 1996.

Figure 2. GHG emission trends by gas



27. The NC1 shows an increase of 2 per cent in fluorinated gases between 1986 and 1996 and a wide fluctuation. The review team was of the opinion that this might be due to the wide variation in completeness of data for different gases estimated within this group. The estimate for PFCs was more complete because the single recorded source of PFC emissions during 1986 and 1996 was aluminium production. Normal fluctuation in aluminium production will significantly affect the PFC emissions and, in turn, the total emissions of fluorinated gases, since PFCs dominated the fluorinated gases emissions in Slovenia. Emissions of SF_6 were recorded in the production of soundproof windows for 1986, 1995 and 1996. The review team was informed that at that time Slovenia did not have magnesium production, which also emits SF_6, but had started a magnesium foundry by the time of the visit. According to the Slovenian experts more than 95 per cent of HFCs used in Slovenia were HFC 134a.

C. Key emission sources and trends by sector

28. In 1986 most emissions came from the energy sector (75 per cent of total GHG emissions) followed by the agriculture sector (13 per cent), industrial processes (6 per cent) and waste (5 per cent). In 1996, some changes could be noticed: there was an increase in emissions from energy (from 75 to 77 per cent) and the waste sector (from 5 to 6 per cent) whereas those from agriculture and industrial processes decreased from 13 to 11 per cent, and 6 to 5 per cent, respectively.

29. Within the energy sector, the distribution of emissions by sub-sector for 1986 and 1996, respectively, was as follows: energy industries 31 per cent and 27 per cent of total GHG emissions; manufacturing 21 per cent and 12 per cent; transportation 10 per cent and 22 per cent; other sectors 11 per cent and 15 per cent; and fugitive emissions 2 per cent and 2 per cent. The share of emissions from energy industries and manufacturing decreased, while those from transport and other sectors increased, with a particularly large increase in transport.

30. Although there was some fluctuation, **GHG emissions from energy industries decreased by 15 per cent** from 1986 to 1996 (table 3 and figure 3). This is mainly due to the general economic decline associated with political changes (economic transition and independence) from the late 1980s to the early

1990s, and later mainly because of a decrease in electricity generation at thermal power plants as nuclear power and electricity imports increased. Throughout this period, energy industries remained the largest contributor to GHG emissions in Slovenia, even though their share has decreased.

Table 3. GHG emissions by sector and sub-sector, 1986 and 1990–1996 (Gg CO_2 equivalent)

	1986	1990	1991	1992	1993	1994	1995	1996	Change (%)[a]
Energy	15 219	13 851	13 301	13 309	13 973	13 969	14 718	15 468	1.6
Fuel combustion	14 745	13 428	12 914	12 915	13 604	13 603	14 297	15 072	2.2
Energy industries	6 344	5 944	5 363	5 896	5 877	5 496	5 750	5 381	–15.2
Manufacturing	4 163	3 044	2 923	2 559	2 378	2 485	2 484	2 389	–42.6
Transport	2 039	2 706	2 560	2 634	3 040	3 429	3 710	4 312	111.4
Other sectors	2 199	1 734	2 068	1 826	2 309	2 194	2 354	2 991	36.0
Fugitive emissions	474	423	387	394	369	366	421	396	–16.5
Industrial processes	1 241	1 216	1 101	950	883	1 049	1 111	1 070	–13.8
Agriculture	2 597	2 477	2 455	2 395	2 387	2 354	2 329	2 304	–11.3
LUCF	–2 950	–4 334	–4 748	–5 086	–5 173	–5 331	–5 677	–5 560	88.5
Waste	996	971	1 067	1 042	1 080	1 094	1 105	1 145	15.0
GHGs (without LUCF)	20 180	18 595	17 995	17 757	18 373	18 518	19 312	20 039	–0.7

[a] The change is calculated as: [(1996 – 1986)/1986] x 100.

Figure 3. GHG emission trend by sector

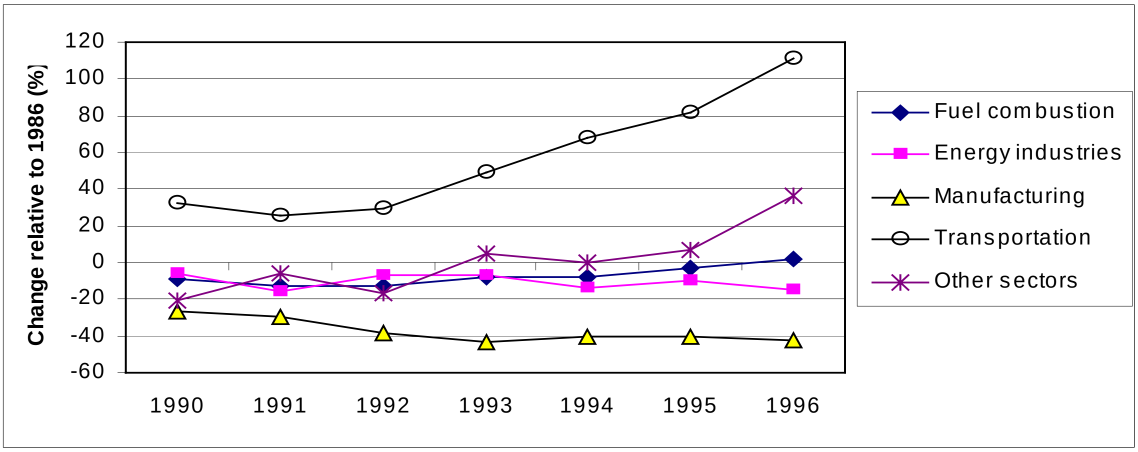
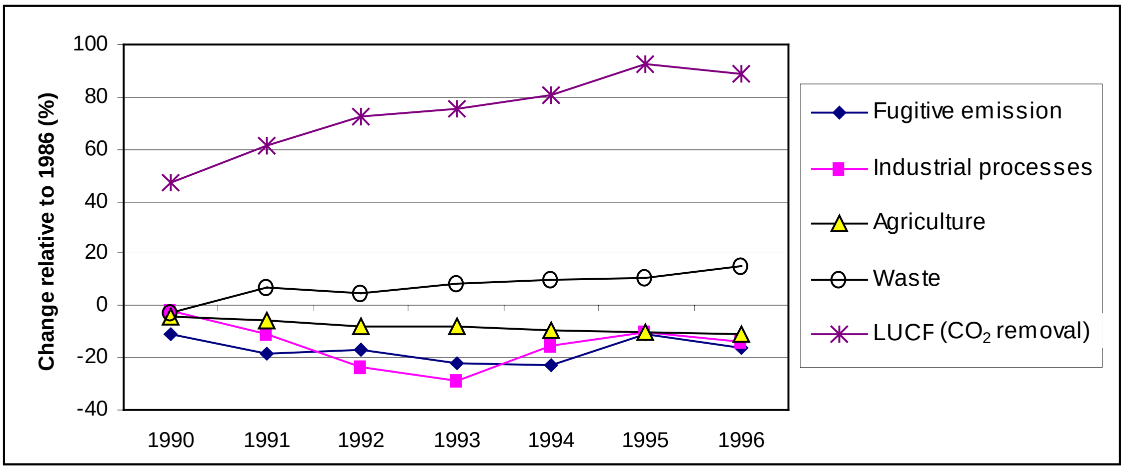


Figure 4. GHG emission trend by sector



31. **GHG emissions from manufacturing and construction** have decreased steadily, with the level in 1996 around 43 per cent lower than in 1986. The Slovenian experts explained that the reasons are the fuel switch from coal to natural gas in industries in the 1990s and efficiency improvements through technology innovation. An example is the iron and steel industry, which has mostly replaced coal with natural gas as a fuel. Moreover, pig iron production from ore gradually stopped after 1986 and steel is now made from scrap. This avoids the CO_2 emissions from the reducing process[5] that transfers ore into iron and steel. Consequently, the GHG emissions decreased at the same time as metal production has increased, stimulated by the increase in exports.

32. **GHG emissions from transport** increased the most (by 111 per cent) from 1986 to 1996. In 1996, transport became the second largest contributor to GHG emissions in Slovenia after energy industries, but the fastest growing source of GHG emissions. This was mainly due to the growth in the number of cars and road transport as a result of an early revival of the economy and subsequent growth. The number of vehicles with catalytic converters and air conditioning has also increased in recent years, with the former having contributed to the increase in N_2O emissions since the middle of 1990s and the latter to HFCs. The Slovenian experts believed that leakage of HFCs from vehicle air-conditioning coolant continued to increase after 1996, although they lacked the means to estimate the increase.

33. The improved living standards and the structural change of the economy toward service were the main reasons for the increase of **GHG emissions from other sectors (mainly the residential and public sectors)** by 36 per cent during the same period. The NC1 stated that the use of solid fuels in households and the service sector decreased, leading to a decrease of CH_4 emissions from these sectors. During the review team's visit, the national experts provided the clarification that solid fuel here referred to biomass and fuel wood only, which have high CH_4 emission factors. Decreased use of these fuels reduced CH_4 emissions. However, CO_2 emissions from this sector still increased, resulting in an overall increase in GHG emissions. Referring to the NC1, the acquisition and consumption of fossil fuels in 1986 and 1996 showed an increase in the public and services sector (from 4 per cent to 7 per cent) and in households (from 7 per cent to 11 per cent). The increases could be explained by the increased consumption of gas in these two sectors.

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[5] Slovenian experts reported in the NC1 and during the visit that the GHG emissions from the use of coke in ironworks were counted into energy, not under industrial processes as a reducing agent.

34. **GHG emissions from fugitive sources** have decreased by about 17 per cent as a result of the reduced volume of coal mining after the closure of coal mines, as well as the complete replacement of cast-iron pipes in gas distribution, which significantly reduced leakage. CO_2 accounted for about one third of fugitive emissions in Slovenia and has increased from 1986 to 1996. This is mainly because of the wider application of desulphurization of flue gas from thermal power plants since the mid-1990s, which is one of the main sources of fugitive CO_2 emissions. The other is CO_2 from the ventilation of mines.

35. **GHG emissions from industrial processes** decreased by about 14 per cent from 1986 to 1996 (Figure 4), as a result of the reduction in cement and lime production, and the improvement of the aluminium production process even though its production volume has increased.

36. **GHG emissions from the waste sector** increased by 15 per cent during the period and constituted a big environmental concern in Slovenia. The main reasons are the increasing amount of waste disposed of, while management practices did not improve greatly.

37. **GHG emissions from agriculture** decreased by 11 per cent from 1986 to 1996, and were expected to decrease further in 2000 (16 per cent lower than the 1986 level), as estimated by Slovenian experts during the visit. The main driving forces were a decline in agricultural production, in particular a 12 per cent decrease in cattle numbers from 1986 to 1996, and the lower input of nitrogen into soil because the decrease in consumption of organic fertilizers exceeded the increase in consumption of mineral nitrogen fertilizers.

38. **CO_2 removal by LUCF** is considerable, increasing by 9 per cent per year on average, with an overall increase close to 90 per cent during the period. The fluctuation by year primarily reflects the natural change in forest and annual logging mainly for insect control purposes (so-called sanitary felling). The increase in forest is the result of natural regeneration of abandoned agricultural land and less logging than allowed by the Slovenia Forest Service.

III. POLICIES AND MEASURES

A. General

39. In Slovenia, implementing international environmental agreements (e.g. those concerning trans-boundary air pollution) has been an important element of the policy process. Accession to the EC is the main driving force behind the renewal of Slovenia's legislation in general, and formulation of climate change policies and measures in particular. Slovenia's *acquis communautaire*, already adopted and enforced to a great extent, includes several items of legislation relevant to climate change.

40. In order to comply with the reduction target established under the Convention and Kyoto Protocol, Slovenia has prepared a Strategy and a Short Term Action Plan of Reduction of GHG Emissions (hereafter referred to as the Strategy). It was approved in November 2000, following a public discussion. The Strategy did not provide any timetables or detailed targets for their implementation, nor the estimated effect of measures. According to Slovenian experts, this information will be available in the National Programme of Reduction of GHG Emissions (hereafter referred to as the National Programme), which was under preparation at the time of the visit and was to be submitted to the parliament at the beginning of 2003. The Short Term Action Plan, which has a summary of 30 measures, bridged the operational gap between the Strategy and the National Programme and included activities that the Government planned to implement in 2001.

41. In parallel with the above-mentioned National Programme, Slovenia is also preparing a National Energy Programme for the enforcement of the 1999 Energy Act. This programme will define targets and procedures for the liberalization of the electricity and gas market already taking place as required by the

relevant EC directives. This program has been discussed in the Climate Change Committee and will be ready for submission to the parliament in early 2003.

42. The NC1 includes planned measures and those under investigation that were officially proposed for the first time. Despite the clear indication in the UNFCCC guidelines, Slovenia did not include in its NC1 “a quantitative estimate of the impacts of individual policies and measures or collections of policies and measures”, except for measures under the MoESE’s Programme of Energy Use of Wood Biomass. The main reason for this omission, given by the national experts, was that Slovenia’s level of involvement in the Kyoto Protocol process was not clear at the time the NC1 was prepared.

43. After the NC1 was completed in 2000, further technical and economic analyses of policies and measures were carried out, in particular those by the Institute “Jožef Stefan”. The major results of this study were provided to the review team during the visit. The review team noticed that these analyses were preliminary and characterized by significant uncertainties, mainly due to the uncertain outcome of energy liberalization and the close links between the economy of Slovenia and its larger neighbours: Italy, Austria, Hungary and Croatia. Nevertheless, since Slovenia has ratified the Kyoto Protocol, information on the effects of policies is not only required by the UNFCCC guidelines, but is also in the interest of the country. It helps the policy makers and the general public in selecting policies and in monitoring their implementation. This study further indicates that in Slovenia policy choice for GHG reductions has been and continues to be mainly based on economic effectiveness.

B. Energy

1. Crosscutting measures

44. Green tax reform was considered by Slovenia as the fundamental instrument for the reduction of GHG emissions. The first step was made in 1996, when Slovenia was the first country in central and southern Europe to introduce a CO_2 tax. The tax is charged for the exploitation of fossil fuels for energy purposes and the rate was increased to 3 Slovenian tolar (SIT)/kg CO_2 (15 EUR /ton CO_2) in 1998. Following the tax increase, partial exemptions were offered mainly to protect the competitiveness of Slovenian industries and to encourage cleaner and more efficient energy exploitation:

- power plants (92 per cent), industry (66 per cent) and co-generation of heat and power (CHP) fuelled by natural gas (50 per cent)
- self-producers of power, whose CO_2 tax was exempted on the basis of 0.44 kg CO_2 per kWh[6] released into the distribution network, i.e. for every kWh saved, the tax will be reduced by 1.32 SIT
- companies reducing their maximum annual fuel consumption from the reference year
- companies investing in energy conservation.

45. The effectiveness of the CO_2 tax in improving energy efficiency and promoting low-carbon fuels had not been assessed, owing to lack of experience. The Slovenian experts suspected that it was not effective, since even after tax, the prices of fuel oil, gasoline and diesel in Slovenia were still significantly lower than in its richer neighbours. This also triggered the export of fuels at the borders, so-called “fuel tourism”. Although the CO_2 tax has been mainly used for budgetary purposes (approximately 1 per cent of the total budgetary income), Slovenian experts considered it to be a useful instrument for mitigation, since it provides incentives for other more specific policies and contributes to awareness of the problem.

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[6] According to the Slovenian experts, the criterion for tax was obtained as follows: on average, a modern gas-fired power plant emits 0.4 kg CO_2 for each kWh produced. In Slovenia, the figure is 0.47 kg CO_2 per kWh. Therefore the Slovenian government chose 0.44 kg CO_2 per kWh as the tax-paying basis.

46. The review team was informed that a new CO_2 Act would revise the CO_2 tax in 2003. The tax level will be further raised, with two-thirds exemption for heat production and full exemption for CHP. Exemption for power plants will be reduced from 92 to 80 per cent with 2002 as the reference year. At the time of the visit, existing exemptions were already undergoing an annual reduction of 8 per cent until 2009. Consequently, most companies will pay more in CO_2 tax. In future, Slovenian experts believed that the CO_2 tax scheme should be made compatible with the EC emissions trading scheme and should be able to provide funds for mitigation by earmarking the tax revenue. It was envisaged that the future emissions trading would cover only big companies, particularly those already regulated under the EC Integrated Pollution Prevention and Control (IPPC) Directive. Therefore, the CO_2 tax will retain its effect on households, services and small and medium-sized enterprises. In the future, Slovenia intended to require companies to report the CO_2 reduction achieved by the CO_2 tax in order to receive the mitigation fund from the government. By doing this, Slovenia hoped that it could better monitor the effectiveness of the CO_2 tax.

47. In order to support activities aimed at reducing environmental impacts, Slovenia established the Environmental Development Fund in 1995. Modernization of public passenger transport is among the priorities supported by the Fund. The Agency for Efficient Use of Energy (AfEUE) under the MoESE set up another fund, the Investment Fund for Efficient Use of Energy. Both funds are financed by the state, but the EC PHARE[7] programme has also provided important support. The chapter in the *acquis communautaire* regarding the energy market was closed in 1999, with some practical details remaining open. As a result, Slovenia will open 65 per cent of its energy market externally by 1 January 2003. Slovenian experts considered that market liberalization in general would favour a reduction of GHGs in future.

2. Energy supply

48. As in the NC1, electricity produced in Slovenia is still comprised of roughly one third each of nuclear power, hydropower and coal. Natural gas is mainly used in industry in co-generation of power for self-use, accounting for only 2 per cent of total electricity generation. No large-scale plan to use natural gas for electricity generation was envisaged for the foreseeable future. Currently natural gas is imported from Austria and Italy.

49. Slovenia is a net electricity exporter (around 2 TWh in 2000) thanks to the electricity generated by the nuclear power plant at Krško (capacity 700 MW and annual production 4.5 TWh). This position will most likely be maintained after full integration into the open European electricity market and at least until 2023 when this US-designed plant will reach the end of its official 40-year lifetime, although there are plans to extend its lifetime.

50. Overall coal consumption has gradually declined since the mid-1980s but has stabilized since the mid-1990s. Nevertheless, one third of the electricity is still generated by coal-fired thermal power plants. This percentage is expected to decline, despite significant social implications, mainly because coal mined in Slovenia is expensive in relation to its quality (low calorific value). After the gradual closure of the Trbovlje-Hrastnik brown coal mine, the only mine in operation will be the Velenje lignite mine. The growing demand for electricity in the future (a 6 per cent increase observed in the past two years) will be met mainly by gas-fired or wood-fired CHP and from other renewable sources, mainly hydropower. Slovenia will remain a net electricity exporter in the foreseeable future.

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[7] PHARE is an EC programme providing a major means to help candidate countries to adopt, implement and enforce all the required *acquis*. Since 1998, the main aims of PHARE have been to train the candidate countries to manage the Community funds available for accession and to focus on certain crucial needs for accession.

51. The share of renewable energy sources is planned to increase to 15 per cent of the total primary energy supply in 2010 by the National Energy Programme. In 2000, this figure was about 9 per cent, about 4 per cent from wood biomass and 5 per cent from hydropower (other renewable sources are negligible). Negotiation with the EC regarding the target for electricity from renewable sources resulted in a target of 30–32 per cent by 2010, although the EC intended to double this considering that hydropower already contributes nearly 30 per cent of the country's electricity generation. Renewable sources are being actively promoted in order to meet these targets through general instruments such as the CO_2 tax and a feed-in tariff, and more specific actions such as: (i) implementation of the Programme for Energy Use of Wood Biomass; (ii) increased utilization of hydroelectric potential; and (iii) promotion of CHP.

52. The Programme for Energy Use of Wood Biomass includes ambitious targets: the installation of 50 new biomass district heating systems with average capacity of 50 MW thermal energy, 100 new biomass-fired boiler systems in industry (average capacity 300 kW thermal energy) and 5000 small biomass heating systems (average capacity 30 kW thermal energy). The Slovenian experts estimated that the success of this programme would result in a 1.8 per cent increase in the share of renewable sources in total primary energy. The programme will be implemented through grants corresponding to 30 per cent of the investment. The national experts considered the economic incentive for biomass (mainly wood) use was not sufficient. Therefore, as in the projections, they assumed 20 per cent more taxation on fossil fuel in future, to encourage more use of wood. Improvement in technical efficiency (wood-fired boilers require a higher combustion temperature and smoke scrubbers) will also help to increase the market share of wood as a fuel.

53. These programmes will be built on the existing capacity for wood processing in Slovenia. The review team raised concerns about the availability of sufficient woodwaste, other biowaste and forest wood needed for such a large scale of biomass utilization to be economically viable. In Slovenia, the wood-processing industry produces mainly furniture and building materials. Incentives might be needed in order to increase the wood harvest, particularly by small private owners.

54. The target of 15 per cent of total primary energy supplies coming from renewable resources by 2010, set by the National Energy Programme, consists of 10 per cent from wood biomass, approximately doubling its current share of more than 4 per cent. The remainder will be made up mainly by hydropower, with its share in TPES already around 5 per cent in 2000. Nevertheless, an additional 0.7 TWh was planned and a new chain of hydropower plants on the river Sava will be fully operational in 2018. Together with planned gas-fired power plants, these will replace brown coal-fired thermal plants that will eventually be decommissioned by 2012.

55. MoESE is also promoting the development of CHP, which had stalled in recent years as a result of uncertainties about energy prices and other issues related to energy market liberalization and lack of structural measures. Discussion on fuel switching is ongoing at a 125-MW coal-fired CHP plant located in Ljubljana. The review team was informed that the National Energy Programme would set targets for CHP and outline further incentives.

56. Although negligible so far, wind energy is being promoted through tax incentives, and a fixed price for electricity generated from wind sold to the grid. However, development of wind energy in such a small territory as Slovenia is constrained. Local communities have often opposed installation of wind turbines for environmental reasons.

3. Energy use in industry and other sectors

57. Implementation of the IPPC and LCP (large combustion plant) directives of the EC in Slovenia is expected to result in a reduction of emissions from major industrial sources, such as aluminium plant,

steel works, and power plants. The IPPC Directive does not regulate fluorinated gases related to industries (except for PFCs from aluminium smelting). Voluntary agreements between the government and large industrial consumers were also considered as an alternative to a heavy tax on their energy consumption.

58. CO_2 emissions from energy use in the residential and public sectors, accounting for 11 per cent of the total in 1986, increased to 18 per cent in 1996. There is therefore considerable potential for GHG reductions in this sector. Slovenian experts estimated that improved energy efficiency could bring down energy consumption by 2 per cent per year within 10 years. Since 1997, advice, information campaigns and incentives have been undertaken by the AfEUE to promote energy efficiency for major consumers. The AfEUE co-ordinates all the activities aimed at increasing energy efficiency in buildings, focusing on the public sector and on low-income households. Since May 2002, new buildings have been subject to stricter standards in line with the EC building codes. The Slovenian experts expected that further gains in efficiency could be achieved through the introduction of energy profile cards for buildings.

59. Introduction of ISO 14000 standards has also promoted energy and material efficiency in industry. MoESE is promoting the implementation of the Environmental Management Audit Scheme (EMAS), a European version of ISO 14000, viewed as more effective than ISO 14000 in terms of GHG reduction. The EC Ecolabel is not yet used in Slovenia, but a few companies apply the German ecology label *"Blauer Engel"* for products. Energy labelling of appliances and devices will be introduced in the future, mainly as an effect of the enforcement of the relevant European legislation, such as the so-called SAVE Directive addressing the energy performance of end-use equipment.

60. According to the 1999 Energy Act, every year energy suppliers shall provide their consumers with information on the trends and basic characteristics of their consumption. In future, the costs for promoting efficient use of energy, including demand side management, by non-commercial suppliers will be covered from the energy price. The AfEUE is currently preparing a 3-year action plan, defining procedures, financial resources and possible amendments of the Energy Act.

61. At the local level, only two municipalities (Ljubljana and Gornji Grad) had assumed voluntary commitments concerning the reduction of GHG emissions. MoESE decided to support this process by providing technical assistance in preparing municipal energy plans and energy balances.

C. Transport

62. A CO_2 tax on engine fuels (now included in the fuel duty) and technical inspection of vehicles are the only existing measures addressing GHG emissions from the transport sector. The Slovenian experts considered the current legislation regulating technical inspections to be not properly defined, and its implementation to be insufficient. Enforcement of relevant EC Directives is expected to result in a reduction of 2–3 per cent in specific CO_2 emissions of older vehicles, and less for newer ones.

63. In addition to the new regulation on exhaust gases, an excise duty on the purchase of new vehicles, based on their specific fuel consumption, was envisaged with a view to promoting fuel-efficient models. Since the vehicle fleet has almost doubled in the last 10 years, the Slovenian experts agreed that further growth at the same rate was unlikely. Therefore the excise duty will only have an effect on the renewal of vehicles. The renewal rate of the car fleet in Slovenia in the last decade has been around 10 per cent per year, higher than the EC average, which justified Slovenia's choice of excise duty on car purchase rather than on use (though the EC recommended the latter). However, given that the enthusiasm for new cars in Slovenia was nearing its end as the market was becoming saturated, the review team felt that the structure of excise duty and other relevant taxes might need to be examined in order to be more effective in curbing GHG emissions from road transport.

64. To address the continuous growth of emissions from urban traffic at the national level, the central administration, in conjunction with local communities, will draw up programmes aimed at managing urban traffic and promoting public transportation. Such initiatives are crucial from both the environmental and social point of view, but the review team felt that financial resources and coherent implementation are needed. Public awareness is important, since behaviour changes are required.

65. The NC1 identified an increase in the share of rail in freight transport as one of the mitigation measures. This can be achieved only through a combination of economic measures (e.g. a toll on freight carried on road vehicles, to make this less attractive) and administrative means coordinated with the EC as well as the neighbouring countries. Although these measures may control the increase in road traffic, their effect on GHG emissions is less certain, as GHG emissions from transport are estimated on the basis of fuel consumption rather than traffic volume, under the IPCC methodology. Nevertheless, such efforts will contribute to GHG mitigation.

66. A similar logic applies to the discussion on the impact of transit transport on GHG emissions. There is considerable freight traffic through Slovenia, mainly on the east–west route, although north–south transit transport may increase in the future as a result of the stabilization of the political situation in the Balkans. Initiatives by some neighbouring countries, such as Austria, to reduce the traffic crossing their territories may affect transit traffic through Slovenia. The growth in transit traffic may lead to higher GHG emissions only if this growth were fuelled in the country in question due to, for example, lower fuel prices than neighbouring countries, which is the case for Slovenia. It is impossible to identify the amount of fuel sold within the country but consumed outside its borders, although the Slovenian experts put forward a rough guess of 10 per cent, and the review team found that this issue required more investigation.

D. Industry

67. PFCs emissions from aluminium production decreased by 13 per cent between 1986 and 1996, in spite of increased production, mainly owing to technological improvement. The NC1 mentioned a voluntary agreement between industry and the government. Enforcement of the IPPC Directive, started in 1999 and thus too late to be reflected in the NC1, will also affect the emissions.

68. Slovenia is a large exporter of cooling devices. Its industries have anticipated the replacement of CFCs and HCFCs by HFCs in the past, and are already replacing HFCs by hydrocarbon mixtures, at least for exports to markets where this is required. Future reductions might be achieved through replacement of HFCs, environmentally sounder maintenance and disposal, and promotion of the EC Ecolabel on cooling and freezing devices. No specific measure addresses emissions of HFCs from production of polyurethane footwear, despite their increasing trend.

69. For SF_6 emissions from electrical equipment, the NC1 proposed a voluntary agreement with companies responsible for electricity transmission and distribution both during operation and at the system's end of life. The NC1 does not include any measure addressing SF_6 emissions from the production of soundproof windows in Slovenia.

E. Agriculture

70. Accession to the EC has substantially influenced Slovenian agricultural policy, particularly subsidies. Slovenia has already begun the transition from subsidies per unit of food produced to subsidies per area of arable land. This promoted less intensive, more sustainable agriculture as well as reduction in GHGs. Direct payments to farmers for environmentally friendly farming are already envisaged in the Slovene Agri-Environmental Programme 2001–2006, adopted in 2001.

71. CH_4 emission was expected to further decline as a result of the drop in cattle and poultry population and the introduction of new slurry separation techniques and anaerobic digesters in pig production in line with the EC regulations. The Slovenian experts noted that efficiency in animal husbandry is being improved, though research is needed to improve the utilization of local feeds. The Chamber for Agriculture is providing special financial and technical support to farmers to introduce anaerobic digesters at family farms. However, this system is now under pressure since there was a proposal to privatize it in order to cut the expenses of MoAFF.

72. In line with the EC Nitrate Directive, a decree was implemented aimed at protecting underground waters against contamination by nitrates. It treats the entire territory of Slovenia as a vulnerable zone from 2001, limiting the annual input of nitrogen from organic fertilizers to 170 kg/ha instead of 210 kg/ha, the average requirement at the EC level. Reductions in the use of mineral fertilizers are being considered in the context of the transition towards less intensive agricultural practices through the adoption of Good Agricultural Practices in fertilizer application (published in 2000). All these efforts will help to reduce N_2O emissions from agriculture.

F. Forestry

73. By the time of the visit, Slovenian forests covered 56-57 per cent of the country's total land area. Natural afforestation of abandoned land and reduced harvesting have led to a 45 per cent increase in the timber stock and a 16 per cent increase in the forest area in the last 47 years. The National Forest Development Programme, established on the basis of the 1993 Forest Law, adopted a comprehensive approach to forest management, taking into account the environmental, productive and social function of forests.

74. With the increase in forest, Slovenian experts estimated that it was possible to raise wood harvest from 40 to 60 per cent of the annual increment in order to facilitate the utilization of wood biomass as a renewable energy source, while at the same time allowing carbon stocks to increase continually. This target also took into account the Marrakesh Accords, which allow Slovenia to receive credits from forest management equal to 0.36 million tonnes of carbon per year.

G. Waste management

75. The central instrument in the waste sector is the waste disposal fee implemented since 2001. According to the draft *Decree on the Environmental Burden Fee for Waste Disposal*, the fee was levied on CH_4 emissions, the amount of which was estimated on the basis of the quantity of waste disposed of and the biodegradable fraction. This fee was actually the CO_2 tax converted to CH_4, equal to 63 SIT/kg CH_4, based on the GWP of CH_4. Tax exemptions were granted for the flaring of landfill gas, plus a refund of CO_2 tax equal to 0.44 kg CO_2 per kWh produced by co-generation from landfill gas.

76. Although the waste disposal fee is a useful instrument, it may not be sufficient to meet the waste management practice required by the EC Landfill Directive. Substantial investment and involvement of municipalities are needed. Public awareness campaigns are also necessary for source reduction and separate collection of municipal wastes, which has just started. The separate collection rate is currently less than 10 per cent. The Slovenian experts believed that the landfill fee would also provide an incentive for source separation. However, no effort has been made or planned to monitor the effectiveness of the whole scheme.

IV. PROJECTIONS AND THE TOTAL EFFECT OF POLICIES AND MEASURES

A. Preparation and reporting

77. The Institute “Jožef Stefan” performed the projections for the CO_2, CH_4 and N_2O emissions from the energy sector. The Chamber of Commerce and Industry did the projections of CO_2 and PFC emissions from industrial processes. The Agricultural Institute was in charge of the projections of emissions from agricultural activities. MoESE was responsible for the projections of emissions from the waste sector, HFCs and SF_6, and the total GHG emissions. Since this is the NC1 of Slovenia, there is no possibility to compare and crosscheck internally. The review team therefore used the internationally recognized independent source, the IEA report *CO_2 emissions from fuel combustion 1971–2000* (2002 edition), to evaluate the projections. Although this report does not present any projections, it provided the most recent statistics (up to 2000) which fell in the range of projections in Slovenia’s NC1. This IEA report estimated the CO_2 emissions from fuel combustion using the IEA energy data, its default methods and emission factors were from the 1996 IPCC guidelines.

78. The projections in the NC1 generally followed the UNFCCC guidelines. They covered six direct GHGs (CO_2, CH_4, N_2O, PFC, HFC and SF_6) for the years 2005, 2010, 2015 and 2020, in five sectors: energy, industrial processes, solvent and other product use, agriculture and the waste sector. Projections by sector and by gas were presented in a tabular format for projected years (2005, 2010, 2015, 2020) and for four actual years (1986, 1996, 1997 and 2000). The projections of total greenhouse gas emissions under the two scenarios are also presented in diagrammatic format in the NC1.

79. The UNFCCC guidelines recommended Parties to provide projections of indirect greenhouse gases, namely SO_2, CO, NO_X and NMVOCs, but the NC1 did not have such projections. The Slovenian experts explained that at the time of preparing the NC1, Slovenia did not adopt the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone, a 1999 protocol to the Europe-wide Convention on Long-range Transboundary Air Pollution. Therefore it was difficult to conduct such projections.

80. The overall presentation of projections follows the UNFCCC guidelines except:

- The emissions relating to fuel sold to international ships and aircrafts were merged with the projections of the transport sector. They should be reported separately;
- The projections of CO_2 sequestration in LUCF were not presented;
- Total effects of policies and measures were not included in the NC1, although the UNFCCC guidelines define this as a compulsory element of projections in the NCs.

B. Scenarios, assumptions and methodology

81. The NC1 contained a short description of how GHG emissions for the period 1986–2020 were projected. Two scenarios were defined. Scenario A was with currently implemented and adopted measures without any intensification. Scenario B was with additional measures, that is planned policies and measures and measures under investigation. The additional measures were not clearly defined, but mainly contained the following:

- Strengthen the national programmes and improve institutional arrangements;
- Use economic instruments, including intensive incentive programmes, financed by the current 2 per cent charge for energy consumption and CO_2 tax; increase the charge on energy consumption by households and the service sector to 20 per cent;
- More active participation of industry through voluntary agreements on energy efficiency;

- Encourage the use of alternative transport and improve the energy efficiency of vehicles**;**
- Establish new entities, programmes and national funds in addition to the AfEUE and the Environmental Development Fund to promote efficient use of energy and renewable renergy; encourage actions by energy suppliers.

82. Scenario B (with additional measures) did not include complete information about the projected emission reductions from energy, industry, agriculture, transport and waste management sectors because, at the time of preparation of the NC1, the final decisions on which additional policies and measures would be chosen had not been made. According to the NC1 the GHG emissions in 2010 will fall short of Slovenia's target under the Kyoto Protocol. Therefore information on emission reductions from these sectors under scenario B is very important for a complete assessment of Slovenia's implementation of its commitment. During the visit, Slovenian experts provided more information about the planned measures and measures under investigation, which will be discussed later.

83. The projections of CO_2 emissions are based on the macroeconomic model of Slovenia's energy system implemented in the MESAP (Modular Energy Systems Analysis and Planning) programming environment. The MESAP was developed at the Institute for Energy Economics and the Rational Use of Energy (IER) at Stuttgart University (Germany) for simulation of complex energy supply and demand systems and calculation of energy and material flows, emissions and associated costs. The model covers processes, commodities, links between various processes, definition of different scenarios, strategies, cases and objective comparison of competing strategies. This model is simulation and scenario-based, containing no optimization elements, except for the production of electricity. The model is based on the time-series-oriented database management system. It is also technologically oriented, and especially detailed for some energy-intensive technologies. For some technologies, gradual replacement with improved technologies was assumed (e.g. motors, electrical arc furnaces, paper production, boilers, compressed air, household insulation, improved appliances, heating devices, improved cars, etc.). For other technologies, a decrease in energy intensity, defined as energy per physical product, of 0.5 per cent annually was assumed. The projections of CH_4 and N_2O emissions from the energy sector are assessed using the same MESAP model.

84. The review team felt that all assumptions regarding GDP growth and other macroeconomic variables were reasonable (table 4). However, even with good assumptions, the output of the simulation model depends very much on the availability and quality of the most recent and detailed input data. The data for projection of CO_2 emissions from the transport sector were collected from the Traffic Master Plan 1996, which described the old scenarios of transport development and thus were not up to date.

Table 4. Key assumptions for the projection of GHG emissions in Slovenia

	Assumptions in projections	IEA report[a]
Base year for projections	1997	
GDP growth	3.8% per year for 1997–2020	3.5–4.5% for 1997–2020
GDP structure in 2020	Service 72.5%, industry 25%	
Population growth	0% per year	0% per year
Physical product industry growth	2.4% per year	
Emission factors used	In line with those of IPCC for inventory	
Discount rate	10% per year	
Dwelling area growth	0.65% per year	
Transport growth by passenger	2% per year in passenger km	
Transport growth by freight	4.6% per year in tonne km	
Energy taxation	20% (currently 2%)	
Technology efficiency growth	Energy intensity decrease 0.5% per year; gradual replacement for other technologies	
Imported and domestic energy, fuel prices	Details not provided	

[a] Only a few indicators can be crosschecked between the two reports, as the IEA report is more related to the energy sector. Nonetheless it offered a possible way of ascertaining the credibility of key assumptions underlying the projections.

85. The projections using this model were carried out in 1997 and supplemented later for the preparation of the NC1. Therefore, 1997 was chosen as the base year for the projections, although UNFCCC guidelines required using the latest year for which actual inventory data is available, which is 1996 in the case of Slovenia. The Slovenian experts on projections explained that they were not aware of this requirement. This indicates that communication and coordination among experts in different fields needs to be enhanced in preparing the NCs.

86. The projections of non-energy-related GHG emissions were generally carried out using the default IPCC methodology and emission factors and based on the different assumptions. The projection of CO_2 emissions from industrial processes was conducted by expert estimation using IPCC theoretical methodology with the assumptions that the volume and structure of physical production will remain unchanged under both scenarios. The difference between scenarios A and B is the planned modernization of aluminium production owing to voluntary agreement between the producer and the state. As the level of aluminium production was expected to be almost stable, the projections of CO_2 emissions from both scenarios were similar but PFCs would decrease under scenario B.

87. The projections of CH_4 and N_2O emissions from agriculture were assessed by IPCC methodology assuming that emission factors would remain constant. Both scenarios shared the assumption that the volumes of agricultural production will also remain constant. Scenario A envisaged no changes in CH_4 emissions. Scenario B foresaw a reduction of CH_4 emissions owing to the additional measures, mainly the reduction in cattle population, introduction of new slurry separation techniques and anaerobic digesters in pig production, reduction of poultry flock, and reduction of N_2O emissions by reduction in nitrogen-containing excretions from livestock, especially cattle and poultry.

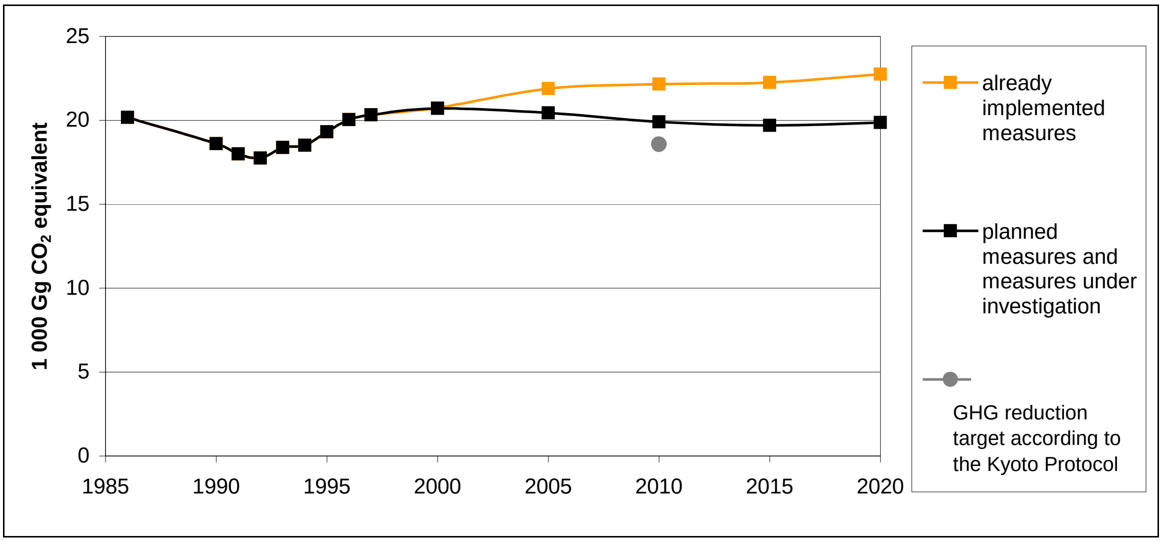
88. CH_4 emissions from landfills were calculated using the IPCC methodology for both scenarios. Scenario A projected that the CH_4 emissions from solid waste management would not change substantially. In contrast, scenario B projected a considerable reduction of CH_4 emissions due to wider adoption of environmentally friendly waste management practice. Both scenarios projected that CH_4 emissions from wastewater treatment, which were 10 times smaller than emissions from solid waste management, would remain unchanged due to the improvement assumed for wastewater treatment and water saving. Both scenarios assumed that CH_4 emissions from production of methanol will remain unchanged, as no major technology change was foreseen for methanol production in future.

89. The projections of HFCs and SF_6 emissions were undertaken using the IPCC methodology and constant emission factors. Scenario A foresaw a significant growth of the HFCs emissions due to an increase of air-conditioning devices installed in vehicles. Scenario B envisaged replacement of HFCs by other substances. The SF_6 emissions according to scenario B will be reduced by implementing additional measures such as installing devices with lower leakage.

C. <u>Results of projections</u>

90. The total GHG emissions were projected to be about 10 per cent higher in 2010 than in 1986 under scenario A with implemented and adopted measures (figure 5). The growth in GHG emissions is mostly owing to a 12 per cent increase in CO_2 emission. All other emissions (CH_4, N_2O, PFCs, HFCs and SF_6) will continue to have a much smaller share of the total GHG emissions and the amounts will be reduced by currently implemented measures, except for fluorinated gases, which will be more than two times higher than the 1986 level mainly because of a substantial increase in HFCs.

Figure 5. Projections of total GHG emissions for Slovenia



91. With additional measures under scenario B, the total GHG emissions in 2010 are projected to be 1 per cent below the 1986 level, while the target for Slovenia under the Kyoto Protocol is 8 per cent lower than the 1986 level. CO_2 emissions were projected to increase by 4 per cent, instead of 12 per cent. CH_4 and N_2O emissions will decrease further, down to 75 and 92 per cent of the 1986 levels, respectively. These figures were 80 per cent and 102 per cent respectively in the NC1 because they were calculated relative to 1996, not 1986, the base year for Slovenia. There are also other mistakes in the NC1; some are typing errors clarified during the visit. The review team felt that future national communications should be prepared more carefully and checked more closely.

92. The NC1 provided a breakdown of projections for fluorinated gases under two scenarios in gigagrams only which shows that all fluorinated gases will be further reduced with additional measures. However, the overall figure for fluorinated gases as a group under scenario B was not provided in the NC1 or during the visit.

93. By source, the energy industries will remain the most polluting sector with GHG emissions 10 per cent higher in 2010 than in 1986. However, implementing additional measures could reduce this increase to 2 per cent above the 1986 level. GHG emissions from industrial processes will significantly increase (by 44 per cent) in 2010 under scenario A. Using additional measures, it is possible to greatly slow this growth down to 4 per cent (scenario B). GHG emissions from agriculture in 2010 were projected to be 11 and 15 per cent below the 1986 level under scenario A and B respectively. GHG emissions from waste in 2010, with current measures, will be 23 per cent above the 1986 level, but with additional measures this increase will be reversed to 20 per cent below the 1986 level by 2010.

94. The projections presented GDP, export, industrial production[8] and residential area per capita for actual years of 1997 and 2000, and projected years 2005, 2010, 2015 and 2020. All those factors are constantly growing and cause the steady increase in GHG emissions. The review team is of the view that it is necessary to have data for all years during the period 1986–2000 in order to have a complete view of the consistency between projections and actual development in emissions.

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[8] Originally, "index of physical volume of industrial production" was used in the table 16 of the NC1. The review team understood it as the ratio of industrial production (expressed in terms of currency or other forms) between the actual year and reference year (1997 for Slovenia's projections).

95. The CO_2 emissions from the energy sector under scenario A in the NC1 differed from the IEA report. Table 5 compares CO_2 emissions results from the NC1 and from the IEA report. The differences for 1986 and 1997 are not remarkable, and can be attributed mainly to different methodology and selection of base year. The major differences occur in 1996 and 2000 as a result of a different assessment of the transition period in industry and a warmer year in 2000 (12 per cent higher in average temperature in comparison with the 10-year average). In addition, the IEA Secretariat reviews its energy databases each year and its energy activity data may differ from that of the NC1. IEA uses average net calorific values while national experts may be able to calculate more detailed energy content of fuels.

Table 5. Comparison of the NC1 and IEA report (Gg CO_2 emissions from the energy sector)

	1986	**1996**	**1997**	**2000**
NC1 of Slovenia	14 553	14 927	15 156	15 375
IEA report	14 200	14 040	15 400	14 450

96. The total effect of policies and measures was missing in the NC1. The gap was partly filled by the policy study on GHG emission mitigation at the Institute “Jožef Stefan”, mentioned in the last chapter. The original purpose of this study was to investigate the possibility and feasibility of Slovenia achieving its Kyoto targets. The study concluded that a total potential reduction of 5,881 Gg CO_2 equivalent can be achieved with measures listed in table 6, among which 43 per cent have an annual cost of less than 5 EUR /t CO_2 equivalent, 52 per cent have a cost of 5–20 EUR /t CO_2 equivalent, and the remainder have a higher cost of up to 100 EUR /t CO_2 equivalent. Under the current projections, the reduction needed for meeting the Kyoto Protocol target without using a LUCF sink is around 3,632 Gg CO_2 equivalent, achievable through the low-to-medium-cost measures identified in this study. Such an outcome, as indicated by the Slovenian experts, finally convinced the Slovenian parliament and the government, and was decisive for their ratification of the Kyoto Protocol. After the visit, Slovenian officials and experts further updated the review team regarding the implementation status, entities and objectives of these measures listed in table 6.

Table 6. Summary of policies and measures and their estimated effects

Sector	Policies and measures	Objective	GHG affected	Implement. status	Implement. entity(ies)	Potential reduction ($Gg\ CO_2$ eq.)
Energy						**2015**
Power plants	Fuel switching from coal to gas	Emission reduction	CO_2	Planned	Unclear	850
CHP	Fuel switching from coal to gas	Emission reduction	CO_2	Planned	Unclear	500
	Reduce losses in heat network	Emission reduction, energy conservation	CO_2	Planned	Unclear	70
	Switching from heat to electricity CHP	Emission reduction	CO_2	Planned	Unclear	
Renewable	Construct large hydropower stations on Sava river	Cleaner electricity	CO_2	Adopted	MoEA	120
	Construction of 50 biomass-fired CHP	Emission reduction, Use domestic fuels	CO_2	Adopted	MoEA, municipality	150
	Construction of small hydropower, wind power, geothermal, photovoltaic power stations	Emission reduction	CO_2	Planned	Unclear	275
Coal mining	Reduction of coal mining	Emission reduction	CO_2	Implemented	MoEA	50
Manufacture construction	Energy efficiency measures	Emission reduction, energy conservation	CO_2	Planned	Unclear	443
	CHP	Emission reduction	CO_2	Planned	Unclear	298
	Fuel switching	Emission reduction	CO_2	Implemented	Enterprises	214
	Use of biofuels	Emission reduction	CO_2	Planned	Unclear	40
Transport	Greater efficiency of vehicles	Emission reduction, energy conservation	CO_2, N_2O	Adopted	MoTC	185
	Increase production and use of biodiesel	Emission reduction, energy conservation	CO_2, N_2O	Planned	Unclear	106
	Co-natural use of the land	Integrated land use	CO_2, N_2O	Planned	Unclear	65
	Increase and improve public transport	Improve local air quality	CO_2, N_2O	Planned	MoTC, municipality	140
	Use new efficient vehicles	Improve local air quality	CO_2, N_2O	Planned	Unclear	150
	Habit change	Emission reduction, energy conservation	CO_2, N_2O	Planned	Unclear	150
	Improve car efficiency by joining EC	Fulfil EC agreement with car manufacturers	CO_2, N_2O	Adopted	MoTC	250
Other sector	Increase efficiency of appliances	Energy conservation	CO_2	Adopted	AfEUE	99
	Improve thermal insulation of buildings	Energy conservation	CO_2	Implemented	AfEUE	309
	Renewable (biomass, geothermal, solar , biogas)	Energy conservation	CO_2	Planned	Unclear	140
Industry	Change of the industrial processes	Production efficiency	GHGs	Implemented	Enterprises	75
Agriculture	Introduce anaerobic digesters for largest pig farms	GHGs reduction	CH_4, N_2O	Planned	MoAFF	21
	New slurry separation techniques in small pig farms	GHG reduction	CH_4, N_2O	Planned	MoAFF	7
	Increase the share of grazing	EC CAP	CH_4, N_2O	Adopted	MoAFF	13
	Reduce dairy cattle population and increase breed herds; increase productivity per animal	EC CAP	CH_4, N_2O	Planned	MoAFF	–2
	Introduce anaerobic digesters for pig and cattle farms	GHGs reduction	CH_4, N_2O	Planned	MoAFF	1
Waste	Paper recycling	EC Landfill Directive	CH_4, N_2O	Adopted	MoESE, municipality	8
	Upgrade existing landfills, construct new ones according to EC regulations and standards	EC Landfill Directive	CH_4, N_2O	Planned	MoESE, municipality	243
	Introduce separate collection, reuse biodegradable waste	EC Landfill Directive	CH_4, N_2O	Adopted	MoESE, municipality	575
	Increase waste incineration in order to reduce landfill volumes	EC Landfill Directive	CH_4, N_2O	Planned	MoESE, municipality	336
Total						**5881**

Note: EC CAP: EC Common Agricultural Policy.

97. The uncertainty of projections in scenario B is quite high because of the lack of final decisions on which policies, measures and financial resources would be chosen at the time of preparing the NC1. Without clear knowledge of this, it is difficult for the review team to evaluate the outcomes of the current projections very precisely.

98. Future work in the projection of GHG emissions and the effects of measures includes:

- Preparing the energy scenarios and balances for the National Energy Program and its application for the updated projections of the GHG mitigation plan;

- Improving the input for the model;

- Improving the modelling of non-energy emissions sources and sinks in agriculture, waste, forestry and industrial processes, using simulation models similar to that for the energy sector.

V. VULNERABILITY ASSESSMENT, CLIMATE CHANGE IMPACTS AND ADAPTATION MEASURES

99. Some key institutions were involved in dealing with various aspects of vulnerability assessment, climate change impacts and adaptation measures. Among these institutions, MoESE contributed to the estimate of damage and related costs of extreme events; the Hydrometeorological Institute was in charge of climatological parameters, water cycle, tourism, human well-being and biodiversity; the Biotechnical Faculty at the University of Ljubljana was involved in climatological parameters, forestry, agriculture and regional scenarios; and Studio Okolje was in charge of adaptation and policy.

100. Many of the contributions of the institutions came from their previous or recent assessments or ongoing research. Systematic research on climate change is still new in Slovenia. Nevertheless, the information was presented in a systematic and comprehensive way in the NC1, with respect to the IPCC technical guidelines and United National Environmental Programme (UNEP) handbook on vulnerability and adaptation assessment. For the purpose of the NC1, Slovenia selected nine sectors: agriculture, forestry, water cycle, biologic diversity, sea and costal zones, alpine world, tourism, energy, human health and well-being. The rather broad range was intended to give an overview of vulnerability and adaptation, which was at an embryonic stage in the country.

101. During the visit, institutions involved in the preparation of the NC1 presented some relevant studies on, for example, the damage and related costs of extreme weather events (drought, floods, hail, landslides); trend analysis of climatological parameters; regional climate change scenarios; and sectoral studies on vulnerability and adaptation. According to the results of long-term measurements of meteorological parameters at some stations, an increase of temperature and a decrease of rainfall in some regions were observed, affecting the microclimatic conditions. However, the Slovenian experts noticed that the trends observed have low statistical significance, because of the short period of measurements and the wide variability of the climate.

102. Slovenia designed an incremental climate change scenario for temperature and rainfall because of the uncertainties in using the Global Circulation Model (GCM) on a regional scale. The main assumptions concerned the greater probability of extreme weather events and the uniformity of climate change in the country. As a result of the diverse climate conditions in Slovenia, the effects of climate change will be different in the various regions of the country.

103. Slovenia is currently experiencing climate variability and extreme climate events, such as flooding. The government has taken specific actions and measures to address the effects of the current variability. It is recognized that Slovenia’s vulnerability to climate change, as well as the impacts could continue to be of similar severity in the long term. The vulnerability assessment used experts’

assessments. The main findings in terms of potential impacts of climate change were reported in the NC1. These studies gave more emphasis to ecological impacts than to socio-economic impacts.

104. A systematic adaptation assessment was not conducted for all the sectors selected. The adaptation measures were identified according to the expected impacts. They concerned infrastructure, technology, and institutional, legal and financial requirements. Although the adaptation measures suggested are very relevant, the NC1 did not mention their costs or the status of their implementation. During the visit, the review team was informed that climate change adaptation measures had not yet been undertaken or planned in Slovenia, owing to the uncertainty of regional scenarios, in particular the changes in the rainfall regime. Both impact assessment and adaptation planning require better regional cooperation with neighbouring countries to develop more accurate regional scenarios and an adaptation strategy.

105. The NC1 did not mention any action in terms of cooperation programmes with non-Annex I Parties to meet commitments under article 4.1(b) and 4.1(e) of the Convention. This is understandable, as Slovenia is still in a learning process. In this regard, the review team is of the opinion that Slovenia needs to enhance its capacities in sharing experience with non-Annex I parties.

VI. FINANCIAL RESOURCES AND TRANSFER OF TECHNOLOGY

106. International cooperation was regarded as essential for the successful development of Slovenia as a small country. Since independence in 1991, its policy and strategy has been to maintain previously established ties, institutionalize cooperation at the formal inter-State level with all important countries, and attain full membership of the most relevant international programmes and organizations, especially European ones. However, it is difficult for Slovenia to qualify for international support from relevant financial institutions further, probably because of its already relatively high GDP per capita.

107. The Ministry of Foreign Affairs coordinates international cooperation, and directly manages politically relevant programmes and initiatives. MoESE is responsible for activities related to environmental treaties and conventions, the Ministry of Science and Education for scientific activities and MoEA for trade and economy.

108. As for the financial mechanisms of the UNFCCC, Slovenia received financial support of 345,000 US$ from the GEF for the preparation of its NC1. Other enabling activities supported by the GEF were the removal of barriers to biomass district heating projects (US$ 98,000) and the establishment of early-warning systems for floods (US$ 95,000).

109. Bilateral cooperation with neighbouring countries was important for issues relating to climate change. For instance, Austria has used innovative financing schemes for a natural gas co-generation system in Slovenia, and Italy has been supporting various coastal zone management projects in the framework of the Trilateral Commission for the Protection of the Upper Adriatic and Coastal Areas (ASEMP). A co-generation development plan for Slovenia has also been prepared through bilateral cooperation between the Institute “Jožef Stefan” and FIRE of Italy. The Slovenian private sector has also been contributing to international cooperation. The steel and metal industry, which has reached high productivity and efficiency standards comparable with OECD levels, is active in providing capacity-building support to developing countries.

VII. RESEARCH AND SYSTEMATIC OBSERVATION

110. The Research and systematic observation chapter of the NC1 was mostly dedicated to systematic observation. Systematic observation and measurements are performed mainly by ARSO, which has been investigating the climate conditions on the basis of long-term measurements of air temperature, relative humidity, air pressure, the quantity and types of rainfall and wind, the duration of solar radiation and

solar energy, etc. Slovenia has so far not participated in the Global Climate Observing System (GCOS) programme.

111. The Energy Efficiency Centre of the Institute "Jožef Stefan" at Ljubljana has undertaken most of the overview and strategic studies on GHG abatement in the economy and households, in cooperation with specialist institutions in various sectors, such as the Milan Vidmar Institute in Ljubljana and the Faculty of Electrical Engineering and Informatics at the University of Maribor (for the electricity generation sector), the Institute for Chemistry (for waste management), the Faculty for Agriculture and Forestry at the University of Ljubljana, the Institute for Transport and Studio Okolje on the transport sector.

112. The research results on climate change are comprehensively presented in the NC1 under vulnerability assessment. During the visit, Slovenian experts discussed their experience with GCM modelling and mentioned some difficulties with downscaling the GCM. The GCM is more applicable for large-scale modelling and it is difficult to adapt GCM modelling to the small size of the Slovenian territory. Some efforts were made but not sustained. The review team pointed out that international cooperation, particularly with neighbouring countries that have similar geographical and climatic patterns and share similar problems would be very useful in tackling this issue. So far the international projects and activities related to various climate change issues are still limited. The main barriers are the limited capacities of research personnel, low incentives, and insufficient funding and attention from the government to support research in this field.

VIII. EDUCATION, TRAINING AND PUBLIC AWARENESS

113. Slovenia's late inclusion in the UNFCCC negotiating process has been mentioned as the main reason for limited awareness of climate change issues. However, the general public, professionals and decision makers have come to realize that climate change mitigation is closely related to other important challenges that Slovenia has to face in order to join the EC, which is at the top of the country's political agenda.

114. The situation is now improving with greater interest from the media, changing attitudes among professionals and gradual involvement of the education sector. The drafting of the NC1 has been an important step in raising the awareness of professionals, particularly among those involved. The draft NC1 was sent to environmental NGOs for comment before being submitted to the Climate Change Committee and final approval at ministerial level.

115. NGOs have contributed to the process also through information campaigns. During the visit, representatives of SEF, an expert-based environmental NGO, provided interesting examples such as the establishment of a "Climate and Energy Detectives" network in schools, co-sponsored by the Dutch and Canadian Embassies, Lombardy Region of Italy, Stop Acid Rain-Sweden, UNDP-GEF, World Resources Institute, the Regional Environmental Center (REC) for Central and Eastern Europe, Climate Alliance and also MoESE in the last two years. After the country's accession to the EC, most contributions will disappear except that from the government.

116. The review team found it crucial that targeted information be provided to local administrators and business representatives to facilitate implementation. Except for the biggest one, Ljubljana, and a small city, Gornji Grad, municipalities have not been actively involved in the climate-change-related process so far. They should play a more important role such as in urban transport and waste management, and in informing and educating their citizens. Involvement of local administrators in the preparation and implementation of national programmes relating to climate change is crucial.

IX. CONCLUSION

117. The information provided in the NC1 of Slovenia is in general comprehensive. It covers all major sectors and all GHG emissions required by UNFCCC guidelines on national communications and IPCC guidelines on inventory. Some inconsistencies in the inventory identified by the review team were discussed in detail in the relevant chapter. Key climate change policies and measures are reflected sufficiently and concisely. The estimation of effects of policies and measures was missing in the NC1 but a preliminary estimation was provided during the visit, which was reflected in this report. The NC1 included projections for CO_2, CH_4, N_2O and fluorinated gases, and major sectors. However, there was no projection on CO_2 removal by LUCF, though LUCF constitutes a significant and increased net sink in the period 1986–1996. Inconsistencies in the inventory and mistakes in the NC1 projections are identified.

118. The review team analysed the information contained in the NC1 and information provided during the visit. The analysis suggests that Slovenia's GHG emissions in 1996 were 0.7 per cent below its 1986 (base year) level. No data were available for the years after 1996 by the time this report was finished. Therefore, it is impossible to judge whether Slovenia has met its commitment for reduction of GHGs under the UNFCCC.

119. Slovenia is unique in that the economic decline due to political disturbances occurred in the late 1980s, earlier than in most EIT countries. Consequently its transition to a market economy took place earlier, resulting in an earlier revival of economy and growth. These are the main reasons for the GHG emission trends observed in Slovenia. Few policies are in place directly dealing with climate change mitigation, although many are under investigation and in planning. The bulk of the policies are driven mainly by the accession process to the EC. Nevertheless, Slovenia is among the first countries to have implemented a CO_2 tax, and the only one in southern Europe and the EIT countries. This demonstrates impressively that Slovenia has the will, capability and practical experience to devise and execute sophisticated policy instruments to abate GHG emissions.

120. Slovenia's target under the Kyoto Protocol is to limit GHG emissions to 8 per cent below their 1986 level during the first commitment period (2008–2012). With the policies and measures currently implemented, the GHG emissions (without LUCF) were projected to be 10 per cent higher by 2010 than the 1986 level (20,181 Gg CO_2 equivalent). With additional measures, this figure would be 1 per cent below the 1986 level. Slovenia is facing a challenge not encountered by other EIT countries in meeting their commitments under the Convention and the Kyoto Protocol in future. Slovenia indicated that it might have to employ Kyoto mechanisms, particularly emissions trading, in which it will appear as a buyer, unlike most EIT countries. In spite of such challenges, an earlier economic revival and a higher GDP per capita than in other EIT countries, modern industry equipped with almost up-to-date technology, and a highly educated population constitute tremendous strengths and opportunities for Slovenia in its endeavour to curb GHG emissions.

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