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Report on the in-depth review of the third national communication of Switzerland

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I. INTRODUCTION AND NATIONAL CIRCUMSTANCES RELEVANT TO GREENHOUSE GAS EMISSIONS AND REMOVALS

1. Switzerland's first national communication (NC1) under the United Nations Framework Convention on Climate Change (UNFCCC) was submitted in 1994; the second (NC2) followed in 1997, and the third (NC3) on 7 November 2001. The in-depth review of the NC3 was carried out from February to May 2002 and included a country visit by a review team to Bern from 18 to 22 March 2002. The team comprised Dr. Rafael Okoola (Kenya), Mr. Samuel Raboqha (Lesotho),[1] Mr. Jiri Zeman (Czech Republic), Mr. Christopher Lamport (Austria), Mr. Sergey Kononov (UNFCCC secretariat) and Ms. June Budhooram (UNFCCC secretariat, coordinator). During the visit, the team met federal Government officials involved in the preparation of the NC3, and business and environmental non-governmental organizations.

2. The Swiss Agency for the Environment, Forests and Landscape (SAEFL) assisted the secretariat in making the necessary arrangements for the review and, together with other government agencies, provided the review team with updated and additional information, both during and after the visit, for added transparency on issues covered by the NC3.

3. Switzerland is a confederation of 26 cantons. The Constitution accords the cantons considerable authority and legal responsibilities, including on energy issues. The cantons have so far authorized the federal Government to carry out a national energy policy in pursuit of common goals, such as energy efficiency and the development of renewables. The implementation of policy measures is mostly done at the cantonal level and almost all cantons have their energy laws. Strong formal and informal elements of direct democracy, such as national referendums and popular initiatives on important policy issues, are another important feature of the Swiss political system. Although Switzerland is not a member of the European Union (EU), economic relations with the EU exist under a 1972 free-trade agreement, and for this reason, most new Swiss legislation is compatible with EU regulations.

4. Switzerland has about 7.1 million inhabitants (1999) and occupies a total area of 41,300 square kilometres. It is landlocked, and its location in the heart of Europe has made it an important transit area for the flow of goods and services between the north and south of Europe, especially given that most of its external trade is with the EU. Switzerland's gross domestic product (GDP) remained relatively unchanged in the early 1990s but has been increasing since 1995, at a rate of 0.5 (1995) to 3.3 (2000) per cent annually.[2] In parallel with rising unemployment, overall government spending at all three administrative levels (federal, cantonal and municipal) has exceeded revenues since 1990. This has led to a rise in public debt and is having a negative effect throughout the economy, but particularly so for the energy sector where certain budgets are required to implement existing as well as new programmes for greenhouse gas (GHG) mitigation. It should be noted, however, that over the past few years this gap between expenditure and income has been closing rapidly.

5. In 1999 Switzerland met about 40 per cent of its total primary energy needs through energy sources such as hydropower (10 per cent), nuclear power (25 per cent) and renewables such as wind, solar energy and wood and waste (5 per cent). Having no locally produced fossil fuel resources, it imported some 60 per cent of its total primary energy in 1999. Energy policy in Switzerland evolved in the course of the 1990s. From 1990 to 1999, the shares of gas, renewables, nuclear and hydro energy increased while those of coal and oil fell, in part to meet Switzerland's stated national objective to stabilize gross carbon dioxide (CO_2) emissions at 1990 levels by 2000. As seen in table 1, Switzerland

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[1] The Swiss Government covered the cost of the participation of an additional non-Annex I expert for the review.

[2] "Energy policies of IEA countries: 2001 review", OECD/IEA Paris, 2001.

was able to maintain these emissions at the same level between 1990 and 2000 in spite of a population increase of 6 per cent. Taking sinks into account, net CO_2 emissions decreased in the same period.

Table 1. Main macroeconomic indicators, 1990–1999

	1990	1995	1999	(1995–1990) 1990	(1999–1990) 1990
Population (millions) [a]	6.7	7.0	7.1	+4.5 %	+6.0 %
GDP, $US billion (1995 dollars) [a]	181.4	180.7	188.7	-0.4 %	+4.0 %
Total primary energy (Mtoe) [a]	25.1	25.3	26.7	+0.8 %	+6.4 %
Electricity (TWh) [a]	50.4	52.1	55.5	+3.4 %	+10.1 %
CO_2 gross emissions (Gg CO_2) [b]	44 409.0	43 805.0	44 826.0	+1.4 %	+1.0 %
Net CO_2 sinks (Gg CO_2) [b]	3 188.0	4 310.0	4 226.0	+35.2 %	+32.6 %
CO_2 net emissions (Gg CO_2) [b]	41 221.0	39 495.0	40 600.0	-4.2 %	-1.5 %

[a] "Energy balances of OECD countries, 1998–1999", OECD/IEA, Paris, 2001.
[b] Third National Communication of Switzerland to the UNFCCC, 2001.

6. Switzerland ratified the United Nations Framework Convention on Climate Change on 10 December 1993. It signed the Kyoto Protocol to the UNFCCC on 16 March 1998. In meeting its commitment to reduce GHG emissions, Switzerland is challenged by the fact that its electricity generation is virtually carbon-free. In 2000, 57.9 per cent of electricity was produced by hydro plants and 38.2 per cent by nuclear plants. The remaining 3.9 per cent was produced from waste, biomass, and solar and wind energy. Electricity generation from solar and wind energy increased notably between 1990 and 2000, from 0.1 GWh (wind) and 2.0 GWh (solar) in 1991 to 3.0 GWh (wind) and 10.8 GWh (solar) in 2000. Another important factor for electricity generation is the current moratorium on licensing new nuclear power plants. The extent to which existing nuclear power plants should be operated is still being debated; proposals open for discussion range from an early (and complete) nuclear phase-out to an open door for the construction of new plants. The final choice will have a major impact on future approaches to limit GHG emissions.

7. In 1991, Switzerland embarked on a federal programme entitled 'Energy 2000' in response to the commitments it had made at the Second World Climate Conference in 1990, where it adopted the target of stabilizing its CO_2 emissions by 2000 at their 1990 levels and reducing them thereafter. Ten years later, most of the programme's objectives had been met, including the key objective of stabilizing CO_2 emissions at 1990 levels. Recognizing that the latest energy scenarios show an increase in energy consumption, especially of motor fuels (particularly for air and goods traffic) and for industrial processes and electricity production, the Swiss Government intends to strengthen efforts in these areas. Building on the experience gained from the Energy 2000 programme it launched the 'SwissEnergy' programme in 2001.

8. Another important and direct response to climate-change concerns is the new federal law on the reduction of CO_2 emissions, which entered into force in May 2000 and contains a "legally binding" target of 10 per cent reduction in CO_2 emissions by 2010 compared to 1990. This measure contemplates a first phase (2000 to 2004) which is implemented through other measures such as the SwissEnergy programme which includes voluntary measures by industries and households. If the reduction target is not likely to be met, a CO_2 tax, not exceeding Sw F 210 per tonne of CO_2, will be levied in a second phase after 2004, when the parliament will approve the tax rates fixed by the Federal Council.

9. The SwissEnergy programme is Switzerland's latest initiative to further reduce GHG emissions, and one to which voluntary measures are expected to make an important contribution. Its objectives are to reduce the consumption of fossil fuels by 10 per cent between 2000 and 2010, to establish a 5 per cent ceiling on the growth of electricity consumption, and to increase heat and electricity generation from

renewables by 3 terawatt hours (TWh) and 0.5 TWh by 2010, respectively. Among other important elements of the legal framework of the energy and environmental policy are the Federal Energy Law, Decree on Energy Use, Federal Environmental Protection Law and a new distance-related heavy vehicle fee.

10. In 2000, a new law on electricity market deregulation was adopted by the parliament (to be considered in a national referendum in 2002). The law outlines a step-by-step process to improve the scope for choosing an electricity supplier, and to provide free access to the grid for electricity produced from renewables. Incentives for electricity generation from renewables are foreseen. In introducing the possibility of competition in the natural gas sector, this law may have important consequences for the energy mix for electricity generation and subsequently affect the level of GHG emissions, since they depend on the fuel mix.

11. Climate change considerations are taken into account both through specific actions and within the more general policy framework across all sectors. For example, the Federal Energy Law, the Decree on Energy Use, the Federal Environmental Protection Law and SwissEnergy all contain specific measures to reduce GHG emissions.

12. As a result of many factors, including a successful Energy 2000 programme, low energy intensity, progress in improving energy efficiency and slow to moderate economic growth between 1990 and 2000, Switzerland was able to meet its objective of stabilizing CO_2 emissions between 1990 and 2000. Under the Kyoto Protocol, Switzerland has agreed to cut its total GHG emissions by 8 per cent of its 1990 emission levels between 2008 and 2012. The review team is of the opinion that this objective is consistent with the new and more stringent national measures that the Government intends to implement to address GHG mitigation. National experts explained that the Swiss Government is also considering making use of the three international flexibility mechanisms under the Protocol as a means of complementing domestic measures for GHG mitigation.

13. Climate change is addressed within the context of sustainable development, which is a strategic element of the Swiss Constitution. The institutional framework for climate policy in Switzerland incorporates numerous departments, with overall coordination by the SAEFL, which forms part of the Federal Department for Environment, Transport, Energy and Communications. This Department also includes the Swiss Federal Office for Energy, and the Federal Office for Spatial Development, which oversees the transport policy. These offices all have direct responsibilities for overseeing specific sectoral measures for GHG mitigation.

14. A working group including representatives of the above-mentioned federal offices and coordinated by the SAEFL was responsible for preparing the NC3. The Federal Office for Agriculture, the Agency for Development and Cooperation and the Swiss Meteorological Institute also participated in the preparation of the NC3. The SAEFL establishes links with cantons and with the private sector at all stages of development of policies and measures for GHG mitigation. As the Department for Environment, Transport, Energy and Communications is responsible for most of the federal data acquisition, processing and reporting, it provides a sound basis for the establishment of a process of harmonization of energy statistics and energy balances with EC (European Community) and International Energy Agency (IEA) methods, as well as for the inventories presented in the national communications.

15. An informal group of representatives from several ministries periodically monitors progress in achieving international commitments under the UNFCCC and the Kyoto Protocol. In addition, several committees comprising representatives from industry, cantons, universities and other organizations deal with specific areas such as energy efficiency, research and technological development. Ratification of the Kyoto Protocol is to be considered by the parliament in late 2002. The officials at the SAEFL

considered ratification likely. If the Protocol is not ratified by mid-2003 there may be difficulties in implementing the CO_2 law and some other domestic measures.

16. The review team concluded that the NC3 provides a comprehensive coverage of the evolution of Switzerland's climate change policy between 1990 and 2000. In formulating a strategy to further reduce GHG emissions, new and innovative measures have been introduced, as a result of the experience gained over the past 10 years in GHG mitigation. The team believes that Switzerland intends to strengthen its climate change policies, as more federal financing is expected to be allocated for implementing these measures.

17. In preparing the NC3, the 1999 UNFCCC Guidelines for the Preparation of National Communications by Parties included in Annex I to the Convention (the UNFCCC reporting guidelines) were adhered to for the most part. However, the review team noted that important stakeholders such as representatives of non-governmental organizations were not involved in the preparation of the NC3, unlike the case of the NC2. The review team also noted that there was no peer review of the document at the national level. Experts pointed out that a decision had been taken to consider the NC3 as a federal document intended primarily to satisfy reporting commitments under the UNFCCC. Accordingly, the document exists only in English and not in any of Switzerland's three official languages. It was the opinion of the review team that this approach may have decreased the usefulness of the document as a planning tool in the country.

II. GREENHOUSE GAS INVENTORY INFORMATION

18. The SAEFL is responsible for compiling data and preparing the greenhouse gas inventory. Energy statistics, which form the bulk of the activity data, are provided by the Federal Office for Energy. Data for the transport sector are provided by other government agencies such as the Federal Office for Spatial Development and the Federal Office for Civil Aviation. Data for the agricultural sector come from the Federal Office for Agriculture. National inventory experts explained that, in general, non-energy data are more difficult to assess and are therefore less reliable. There is a high degree of cooperation among departments to ensure that information contained in the inventories is timely and that it is consistent with data used for analysing the effects of policy and measures on emissions.

19. The CORINAIR methodology is utilized to develop the national GHG inventories using a combination of default and specific national emission factors. Emissions for the transport sector are calculated using two methods: the CORINAIR detailed modelling based on types of vehicles, distances travelled, etc., and the IPCC method based on the amount of fuel sold.[3] The value for the emissions is derived from the results of these two methods and a process of reconciliation. The review team was of the opinion that the national climate policy team is well aware of the strengths and weaknesses of the existing data collection method and the system of reporting.

20. In accordance with the UNFCCC reporting guidelines, the NC3 included summary information on Switzerland's GHG inventories for 1990–1999. The base year used for the inventories is 1990. The inventory data include the three direct greenhouse gases CO_2, methane (CH_4) and nitrous oxide (N_2O), together with hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). Inventory trends information for CO_2, CH_4 and N_2O is complete from 1990 through 1999. The NC3 did not follow the UNFCCC reporting guidelines in the case of the HFCs, PFCs and SF_6. As the development of consistent and reliable emission statistics back to 1990 is still on-going, the summary

[3] Accurate reconciliation is important because of the existing "fuel tourism": on average, gasoline is 20 per cent cheaper in Switzerland than outside its borders while diesel fuel is more expensive. Thus, calculations based on the amount of fuel sold lead to a result different to distance-based calculations.

data presented in the NC3 only cover the time period 1997–1999. They are considered preliminary by Swiss experts and are thus not suitable for trend assessments. Some estimates for SF_6 for 1990 are provided in the projections section of the NC3, but not in the inventories. The NC3 also contained inventory trends for precursor gases such as nitrogen oxides (NO_X), carbon monoxide (CO) and non-methane volatile organic compounds (NMVOCs). Information on these gases is shown graphically for 1990–1999 but actual annual data are provided only for 1999. Sulphur dioxide (SO_2) emissions are reported for the year 1999; the trend between 1990 and 1999 is also shown but not the annual data.

21. A description of the emission trends for all gases, and pertinent diagrams, are included in the NC3 as required by the UNFCCC reporting guidelines. The emissions are shown both in gigagrams (Gg) emitted as well as in Gg of CO_2 equivalent, using the 1995 IPCC global warming potential values for a 100-year time horizon. Information on aviation international bunkers, as well as on biomass-related CO_2 emissions for the years 1997–1999, is in line with the UNFCCC reporting guidelines, in that it is presented separately from the inventory summary tables.

22. The team noted some differences in emission data between the NC2 and NC3: gross CO_2 emissions and CO_2 absorption by sinks were lower in the NC3, and total net CO_2 emissions were higher, as shown in table 2. Although the UNFCCC reporting guidelines recommend that such differences should be fully explained, the NC3 did not explain them. During the review the Swiss experts pointed out that the main reason for CO_2-related changes is the use of revised emission factors and a different approach in estimating forest growth. Actual calorific values of some main fuels were measured in the period between the NC2 and NC3, and these corrected calorific values resulted in corresponding changes in the emission factors, i.e. the default emission factors used in the NC2 were replaced by actual national emission factors.

Table 2. Comparison of 1990-1995 emissions between NC2 and NC3

	NC2		NC3		NC3/NC2[a]	
	1990	1995	1990	1995	1990 (%)	1995 (%)
Gross CO_2 emissions (Gg)	45 060.0	44.170.0	44 409.0	43 805.0	-1.4	-0.8
CO_2 emissons LUCF (sinks)[b] (Gg)	4 360.0	5 100.0	3 188.0	4 310.0	-26.9	-15.5
Net CO_2 emissions (Gg)	40 700.0	39 070.0	41 221.0	39 495.0	+1.3	+1.1
CH_4 (Gg)	244.0	235.0	241.9	233.2	-0.9	-0.8
N_2O (Gg)	11.5	11.8	11.3	11.6	-1.7	-1.7

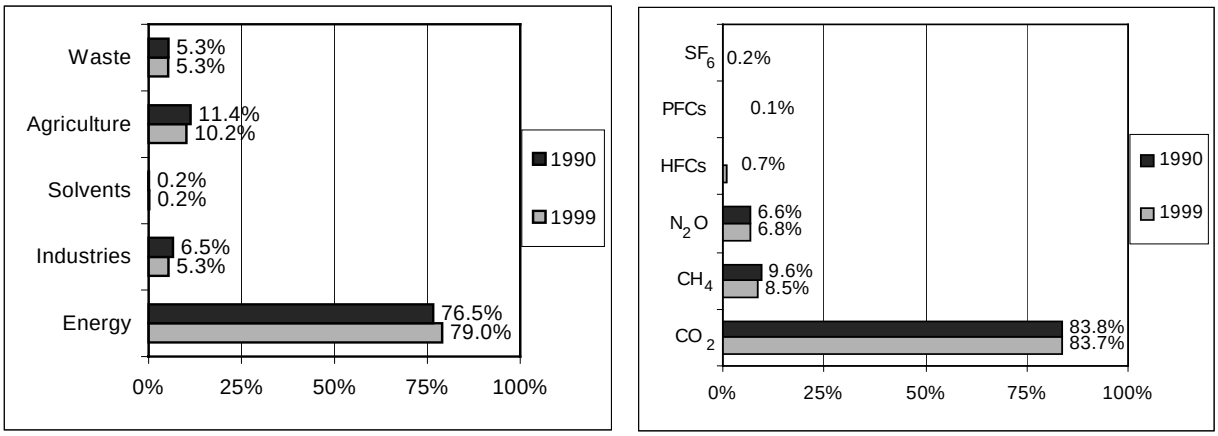
[a] Percentage change in data between the NC2 and the NC3.
[b] LUCF = land-use change and forestry

23. Regarding CO_2 absorption by sinks, a growth model which was used for producing data presented in NC2 was replaced by the comparison and analysis of the first and the second national forest inventory, the latter of which became available only after completion of the NC2. In order to maintain consistency of the data, the entire series of emissions and removals from the base year 1990 to 1999 was recalculated. This resulted in a marked difference between the inventory figures in the NC2 and in the NC3. Small changes were also observed in the emissions data reported in the NC2 and in the NC3 for CH_4 and N_2O. The review team was informed that for CH_4 this was a direct result of changes made to the emission factors in the transportation model that is used to calculate emissions originating from this sector. For N_2O, the primary reason is the application of a new calculation method called IULIA. IULIA is an IPCC-derived method for calculating N_2O emissions from agriculture that basically uses the same emissions factors, but adjusts the emission categories to the particular situation of Switzerland. Both the CH_4 and N_2O series for 1990–1999 were recalculated to reflect these changes.

A. GHG emissions structure

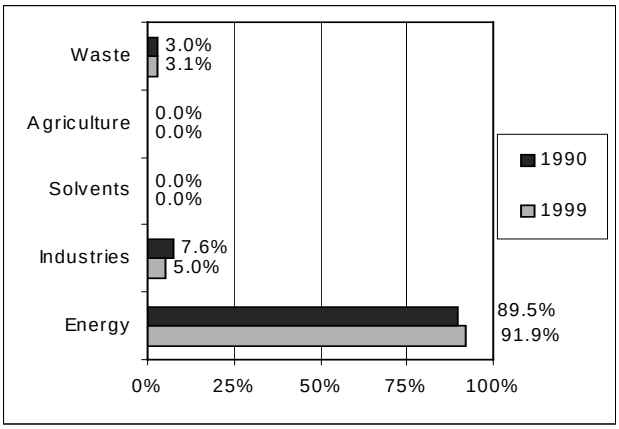
24. The structure of GHG emissions in CO_2 equivalent by sector and by gas is shown in figure 1. In 1999 Switzerland produced a total of 53,527 Gg of GHGs, of which gross CO_2 emissions were 44,826 Gg, CH_4 emissions 4,567 Gg and N_2O emissions 3,615 Gg. HFCs, PFCs and SF_6 together accounted for less than 1000 Gg: the individual emission figures in terms of CO_2 equivalent are 366 Gg for HFCs, 28 Gg for PFCs and 125 Gg for SF_6.

Figure 1. Structure of GHG emissions in CO_2 equivalent in Switzerland in 1990 and 1999 by sector and by gas



25. On a gas-by-gas basis, CO_2 accounted for 84 per cent of total emissions, CH_4, for 8 per cent, N_2O for 7 per cent and HFCs, PFCs and SF_6 together for about 1 per cent. This distribution has remained unchanged when compared to the 1990 structure of GHG gases. Figure 1 also indicates that the energy sector in Switzerland generated 79 per cent of all GHGs in 1999, agriculture 10.2 per cent and the industrial and waste sectors 5.3 per cent each.

Figure 2. Structure of CO_2 emissions in 1990 and 1999



26. In the case of the main GHGs (see figure 2), most of the CO_2 emissions originated in the energy sector, especially in the commercial and household sector (43 per cent of the energy emissions), in transport (37 per cent) and to a much lesser extent (3 per cent) in energy-related combustion, owing to the carbon-free nature of electricity generation in Switzerland from hydro and nuclear sources. The remaining CO_2 emissions were generated by industries and the incineration of solid waste.

27. In 1999, the agricultural sector was the main source of both CH_4 (63 per cent of total methane emissions) and N_2O emissions (71 per cent of total nitrous oxide emissions) in Switzerland (see figures 3 and 4). Enteric fermentation in animals accounted for most of the CH_4 produced and agricultural soils were the major source of N_2O emissions, followed by the use of catalytic converters in the transport sector.

Figure 3. Structure of CH_4 emissions in 1990 and 1999

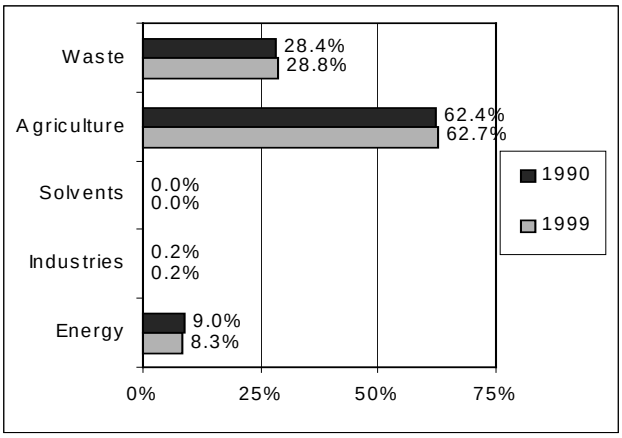
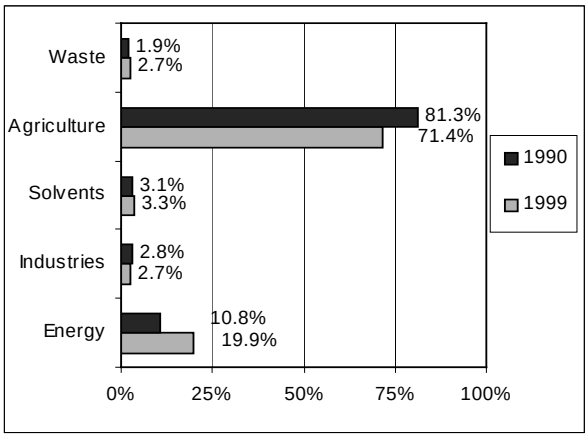


Figure 4. Structure of N_2O emissions in 1990 and 1999



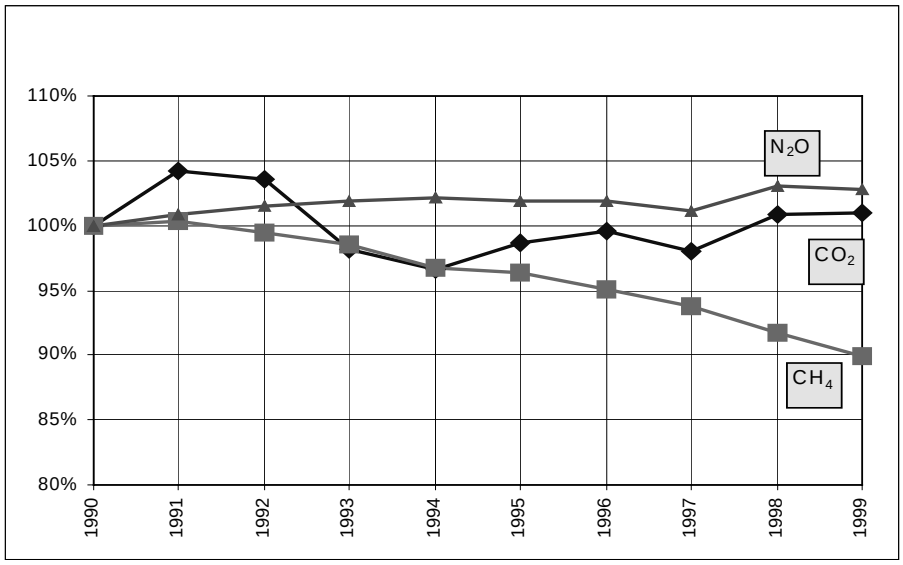
B. Emission trends

28. The GHG emissions in Switzerland for the period 1990–1999 are presented in table 3. On analysing the trends in GHG emissions (see figure 5) it can be observed that CO_2 emissions remained stable between 1990 and 1999, except for climate-related variations of the order of ±4 per cent. In general terms, slow economic growth in the early 1990s, the effects of the policies and measures implemented between 1990 and 1999 under the Energy 2000 programme, and structural changes in industry, contributed to this stabilization (see section III). CH_4 emissions have followed a downward trend since 1990, mostly as a consequence of the new agricultural policy implemented in the 1990s. The slight increase in N_2O emissions between 1990 and 1999 can be attributed to the increase in the car fleet and in the use of catalytic converters.

Table 3. Main GHG emissions by gas, 1990–1999 (thousands of Gg of CO_2 equivalent)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	(1995–1990) 1990	(1999–1990) 1990
CO_2 gross	44.41	46.29	45.99	43.57	42.93	43.81	44.21	43.55	44.81	44.83	-1.4 %	+0.9 %
CH_4	5.08	5.10	5.05	5.00	4.92	4.90	4.83	4.76	4.66	4.57	-3.5 %	-10.0 %
N_2O	3.52	3.55	3.57	3.58	3.59	3.58	3.58	3.56	3.62	3.62	+1.7 %	+2.8 %

Figure 5. Trends in GHG emissions by gas (relative to the 1990 level)



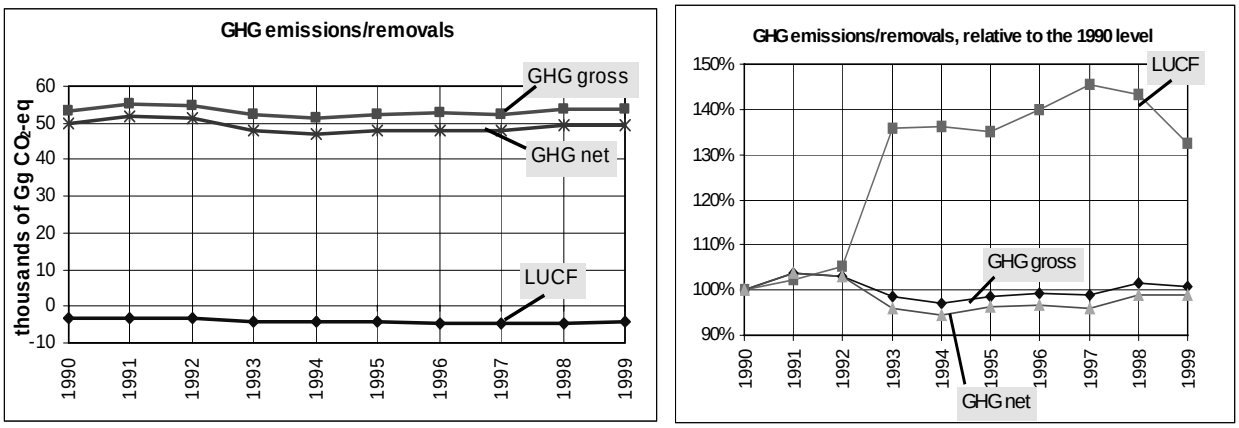
29. Although total GHG emissions remained stable (with slight fluctuations), there was a notable increase in the sink capacity. Inventory experts from the forestry department explained that CO_2 absorption by sinks was low as a result of a storm in 1990, which led to a loss in sink capacity of about 1.7 Tg of CO_2. There was a gradual recovery of sinks in the following years. However, the increase registered in this figure can also be attributed to the IPCC three-year averaging of the data. The increase in sink capacity between 1990 and 1999, presented in table 4 and figure 6, contributed to the observed decrease in the net GHG emissions in this period. Carbon sequestration in soil was not calculated because of the lack of data and is therefore not included in these trends. A study mandated by SAEFL (Perruchoud et al., 1999) estimated carbon sequestration in forest soils to be approximately 0.35 Tg C/year. Validation of this figure is expected to be available from the Third National Forest Inventory, to be conducted between 2004 and 2006.

Table 4. Effect of sink capacity on GHG emissions, 1990–1999 (thousands of Gg of CO_2 equivalent)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	(1995–1990)/1990	(1999–1990)/1990
GHG-gross	53.01	54.93	54.61	52.15	51.44	52.29	52.62	52.45	53.79	53.53	-1.4 %	+1.0 %
LUCF (sinks)	3.19	3.26	3.36	4.33	4.34	4.31	4.46	4.64	4.57	4.23	+35.1 %	+32.6 %
GHG-net	49.82	51.68	51.25	47.83	47.10	47.98	48.16	47.82	49.22	49.30	-3.7 %	-1.0 %

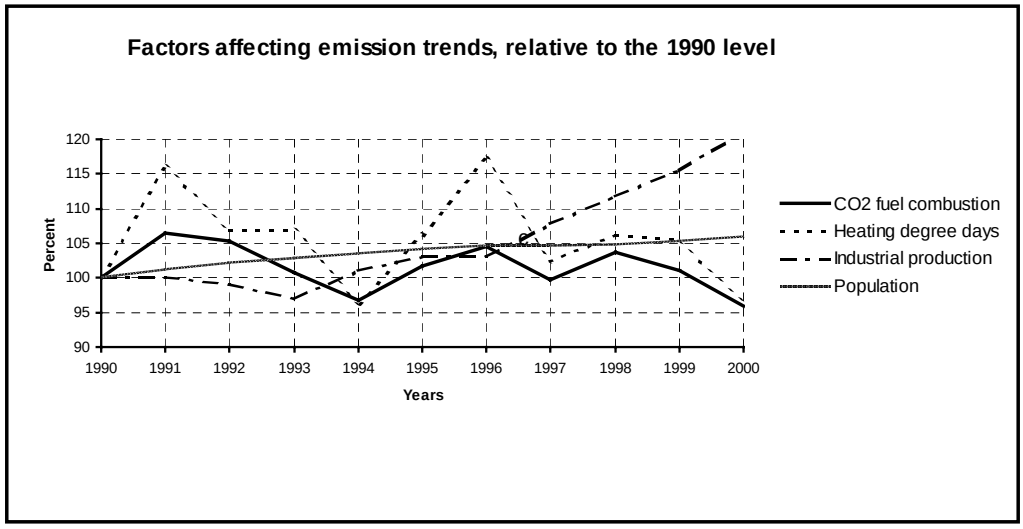
30. The NC3 does provide some information on key emissions drivers, such as population, GDP growth and real energy prices, to help understand the trends and establish a link between the inventories and the projections. However, the review team felt that more information was required to ensure complete transparency of the inventory data. The particular point of importance in this respect is the structure of primary energy supply for 1990–1999. It was not provided in the NC3, although most of the required statistical data are available and some of them were submitted to the review team during the visit. The review team also felt that there was a potential for deeper analysis of the inventories. A simple description of the trends is available, but it is not always easy to determine what are the variables actually driving the emissions.

Figure 6. Trends in the total GHG emissions and sink capacity



31. Figure 7 provided by Swiss experts during the review visit, illustrates such in-depth analysis, showing, in particular, the impact of climate variations on the emissions. The review team supported such national studies that might become particularly useful for gaining a better understanding of the main drivers of GHG emission trends. Other areas of possible improvement include the methodology for assessing non-energy GHG emissions, the size of CO_2 sinks, and the evaluation of uncertainty in emission calculations as required by the UNFCCC reporting guidelines

Figure 7. Correlation of the amount of fuel combustion (by households, commerce and industry) with the heating-degree days



III. POLICIES AND MEASURES

32. The review team considered that there was a marked improvement in the presentation of information on policies and measures in the NC3 when compared to the NC2. The team noted that the NC3 is presented in a way that allows a third party to understand the Swiss policy-making process and the GHG mitigation objectives of the main policies, as well as to generally assess the results that have been attained**.** In terms of compliance with the UNFCCC reporting guidelines on policies and measures, the team was of the opinion that these have been fulfilled satisfactorily. Policies and measures are

reported by sector and by gas. Information is presented using the suggested sectoral allocation of the UNFCCC reporting guidelines (energy, transport, industry, waste, agriculture, and forestry). Summary tables with the information on policies and measures are also included**.** However, the team believed that the presentation of the effects of individual or combined policies and measures to be implemented is not sufficiently transparent for a third party to evaluate their effectiveness in GHG mitigation. Based on the information provided to the team during the review week, it was clear that such information is available and, if presented, could enhance the usefulness of the NC3.

33. The NC3 effectively outlined the criteria used in policy design and implementation. Climate change is just one of many important components of policy formulation in the various sectors. Other important considerations include employment, trade, investment, energy market liberalization and a reduction in energy intensity. Of particular importance to national policy design is harmonization with EC policy direction. Although Switzerland is not a member of the EC (a referendum in 1992 was not supportive of membership of the European Economic Area), bilateral negotiations and treaties with the EC on major policy areas have shaped many national polices and most new laws or changes to existing laws are compatible with EC law.

34. The NC3 also reported on the costs of policies and measures, as required by the UNFCCC reporting guidelines. However, these data included only the federal Government's public expenditure budget allocation for the specific measures. National experts explained that details of financial contributions from cantons were not available at the time the NC3 was prepared. The review team noted that there was little analysis to assess the cost-effectiveness of individual or combined policies and measures for GHG mitigation at the macroeconomic level, given that the federal Government is considering the introduction of a carbon tax in 2004 to assist in meeting GHG reduction commitments.

35. The Government is committed to meeting any future GHG mitigation commitments under the UNFCCC. It should be emphasized, however, that the Swiss strategy to combat climate change depends on the specific national circumstances of policy-making. One such circumstance is direct democratic rights, which implies a strong role of the public in policy development and in the all-important public consultation process. Another specific national circumstance is the high degree of subsidiarity that exists with regard to the cantons, which, national experts claim, can sometimes make coherent implementation of policies and measures difficult.

36. Despite the above-mentioned challenges, the review team acknowledged that climate change policies in Switzerland evolved throughout the 1990s. The main thrust of the policies and measures as defined in Energy 2000 was renewable energy and energy efficiency enhancement through a combination of institutional initiatives and voluntary and regulatory instruments. Drawing on the experience gained with the programme, and in order to ensure continuity and achieve a sustained impact, Energy 2000 was replaced by a more stringent follow-up package of policies and measures (SwissEnergy) in 2001, which would be supplemented, for the first time, by market-based instruments, namely the CO_2 tax, if the objectives of the package are not fully met by voluntary measures.

37. Important as well to policy development is the legal framework. The Federal Energy Law of 1998, and the new law on the reduction of CO_2 emissions (the CO_2 Law) contain the general provisions of GHG reduction activities in all economic sectors. The Energy Law, in particular sets out the basic principles of energy development and management and, together with the CO_2 Law, provides the major legal basis for the entire GHG mitigation initiative in Switzerland.

38. The NC3 reported on the results of an independent evaluation of energy polices. The team was informed that the Swiss Constitution obliges the Government to report regularly on the effectiveness of the energy policy which, in turn, has direct implications for GHG mitigation policies and measures.

More than 60 independent evaluations of the Energy 2000 programme were conducted at a total cost of Sw F 7 million, between 1996 and 2001.[4] The evaluators were experts from independent institutions, who were subject to a transparent selection process. All the reports were published and submitted to the relevant parliamentary commissions as well as to specialist media. Recommendations arising from these evaluations were taken into account in formulating SwissEnergy.

B. Energy sector

39. The main "cross-sectoral" initiative to reduce CO_2 emissions from energy production and consumption is the CO_2 Law, which entered into force in May 2000. The general approach and the stringent target setting of that policy impressed the review team, given that Switzerland is one of the few countries planning to introduce a GHG specific tax. This law aims to reduce CO_2 emissions by 10 per cent by 2010 compared to the 1990 level by mandating a reduction in CO_2 emissions from petrol and diesel by 8 per cent and from other fossil fuels by 15 per cent by 2010. A remarkable feature of this initiative is that the reduction target of the law was accepted, in principle, by the business sector. But this can be explained by the fact that, if the CO_2 tax is introduced, exemptions will be made for industries entering into legally binding CO_2 reduction commitments with the Government. The law also stipulates that the tax must be revenue-neutral, i.e. that revenues must be returned to households on a per capita basis and to the economy on a per-wage basis, and used for social insurance.

40. The review team expressed doubts about the effectiveness of the law, which were partly confirmed in the discussions with representatives from the federal administration and from non-governmental organizations. Of particular concern is the distribution of the reduction target (10 per cent) among the different economic sectors. Although there is a provision for differentiation in emissions reductions between combustion and transport fuels, no further indications are given on the quantitative GHG reduction responsibilities at the sector-wide level, such as in industry, energy, and commercial and household sectors. The law establishes a specific and separate GHG reduction target of 8 per cent for the transport sector. In addition, it stipulates that the Government may set targets for specific sectors in consultation with them.

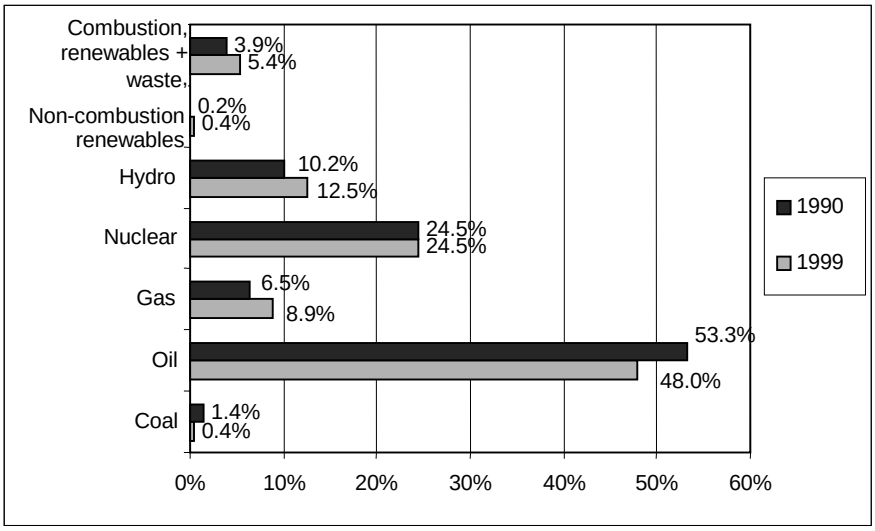
41. CO_2 emissions from energy use in the commercial and household sectors are quite considerable, accounting for about 43 per cent of the energy-related emissions, or some 40 per cent of the total CO_2 emissions in 1999. However, the voluntary approach that was chosen for the first phase of the implementation of the CO_2 Law does not apply to private households; and its applicability to the service and buildings sector is still not clear. Labour intensive industries have little incentive to take action because of the basis on which revenues from a possible CO_2 tax will be redistributed. By March 2002, it was only in the transport sector that a voluntary agreement has been signed between the Swiss Government and the car importers on increasing the fuel efficiency of cars.

42. In the light of the above, the review team expressed serious doubts as to whether voluntary agreements with individual sectors could ensure compliance with the overall GHG reduction target of the CO_2 Law. It is also doubtful whether increased efforts at GHG reduction by other sectors will be able to compensate for any shortfall in CO_2 emissions reduction from transport. The review team felt that the period until 2004 when the Federal Council would decide on whether to introduce a CO_2 tax was too short a time (2002–2003) for effectively monitoring and assessing the CO_2 trends. This may affect the timeliness in introducing the tax as well as its efficiency in reducing GHG emissions.

[4] "Energy 2000 final programme report and 10th annual report", Swiss Federal Department for Environment, Transport, Energy and Communication, December 2000.

43. Switzerland has a unique energy supply structure (see figure 8). Almost 41 percent of the energy supplied in 1999 was locally generated, namely, nuclear energy (25 per cent), hydropower (10 per cent) and coal and renewables (6 per cent combined). The rest of the energy, (59 per cent) in the form of oil (54 per cent) and gas (5 per cent) is imported. Due to the extraordinarily high level of carbon-free electricity production (58 per cent generated from hydro and 38 per cent from nuclear sources in 1999), CO_2 emissions from energy production are very low in comparison with other OECD countries: 5.58 tonnes CO_2/capita in 1999 vs. 10.96 tonnes CO_2/capita for OECD countries on average.[5] The largest share (around 45 per cent) of CO_2 emissions from energy consumption comes from "small combustion" in households, and the trade and service sectors. Fossil fuels clearly dominate the heating sector, and in this regard climatic conditions directly influence CO_2 emission trends. Industry's contribution to CO_2 emissions is relatively small because of the particular structure of industrial energy demand (high demand for electricity that is produced 'carbon-free' in Switzerland).

Figure 8. Structure of primary energy supply in Switzerland, 1990 and 1999[a]



[a] "Energy balances of OECD countries, 1998–1999", OECD/IEA, Paris, 2001.

44. The Energy 2000 programme implemented in 1991–2000 was the main policy framework in Switzerland for achieving GHG reduction. Whereas the overall programme was a success, the team noted that some of its specific targets (see table 5) were not met. In addition, just under one third of the funding that had been allocated at the outset became available, and some legislative measures did not materialize.

45. In spite of this, the review team recognized the effectiveness of the programme with respect to target setting, public awareness raising, institutional arrangements for programme management and the monitoring and evaluation process that was in place. Table 6 summarizes the energy savings and the reductions in GHG emissions between 1990 and 2000 resulting from policies and measures included in Energy 2000. With a total investment of Sw F 4.4 billion from both government and private sector sources, the programme resulted in an energy saving of 165.5 PJ or approximately 20 per cent of total energy consumed between 1990 and 1999, and CO_2 emitted was reduced by 10–14 million tonnes in the same period.

[5] "Key world energy statistics from the IEA: 2001 edition", OECD/IEA, Paris, 2001.

Table 5. Objectives and results of Energy 2000[a]

Area	Target 2000	Change 1990–2000	Compliance with the target
Fossil fuel consumption	Stabilization	+8.9 %	Not met
Electricity consumption	Max. +16 %	+12.0 %	Met
Share of renewable energy (heat)	+3 %	+40.1 %	Not met: 70% (2.1 % instead of 3 % in total heat generation)
Share of renewable energy (electricity)	+0.5 %	+84.3 %	Met: 142% (0.7 % instead of 0.5 % in total electricity)
Hydro power	+5 %	+4.7 %	Almost met: 94 %
Nuclear capacity	+10 %	+8.9 %	Almost met: 89 %

[a] "Energy 2000 final programme report and 10th annual report", Swiss Federal Department for Environment, Transport, Energy and Communication, December 2000.

46. The Energy Law of 1998 and SwissEnergy appear to be an appropriate response to future energy perspectives of Switzerland, in that they are aimed at more rational and efficient use of energy while at the same time addressing climate change concerns. Whether the as yet voluntary approach will suffice remains to be seen. The expert team noted that public funding under SwissEnergy to meet the stated objectives of the plan may not be adequate, given that one of the main reasons for Energy 2000 not meeting its GHG reduction target was the lower-than-expected funding at both federal and cantonal levels. The amount of funding earmarked for SwissEnergy is approximately the same as that for Energy 2000 (Sw F 50 million annually) whereas the objectives of the new programme seem to be more ambitious.

Table 6. Energy Savings and GHG reductions of the Energy 2000 Programme[a]

Measures	Energy saving (Petajoules)	CO_2 reduction (millions of tonnes)	Employment (person-years)	Total Investment (millions of Sw F)
Voluntary	73.3	4.3–6.0	19 690	2 400
Statutory	90.3	5.4–7.5	9 305	1 000
Others	1.9	0.1–0.2	9 300	1 000
TOTAL	**165.5**	**9.9–13.7**	**38 295**	**4 400**

[a] Third National Communication of Switzerland to the UNFCCC, 2001.

47. The review team noted that future growth in electricity consumption may result in increased GHG emissions. While the economy grew at 6 per cent between 1990 and 2000, electricity demand increased by 12.5 per cent, in spite of several measures which were put in place to curb its growth. For this reason, the SwissEnergy programme expects to contain this growth of electricity consumption to within 5 per cent between 2000 and 2010. This goal is much more ambitious than that of the Energy2000 where a 16 per cent ceiling was planned and 12 per cent was actually achieved. Swiss experts explained that with the high projected growth in GDP and electricity market liberalization, the resulting fall in electricity prices may make it difficult to achieve the 5 per cent target.

48. Moreover, the future structure of electricity supply in Switzerland remains unclear. Hydropower is reaching its technical limits and the nuclear power option is under increasing public pressure. New nuclear plants or the replacement of existing ones do not appear viable with a moratorium in place. Further liberalization of the Swiss electricity market compounds this situation, as it may pose economic barriers to further construction of hydro or nuclear power plants. The future of nuclear power is a subject of popular initiatives aiming at a gradual phase-out. Although it is not expected that phasing-out of nuclear power will take effect before 2010, alternatives need to be evaluated soon. Unfortunately, such an evaluation was not provided in the NC3. However, projections made by a Swiss forecasting

institute and discussed during the in-depth review[6] show a substantial increase of CO_2 emissions in the long term with the nuclear phase-out option clearly running counter to the stabilization objective of the UNFCCC.

49. On the other hand, renewable energy sources for electricity production – with the exception of hydropower – are not sufficiently exploited in Switzerland. The review team had the impression that reluctance of the power-producing industry and the cantons was mainly responsible for the limited openness to innovative policy approaches to promoting 'green electricity'. Despite these somewhat restrictive circumstances, between 1991and 2000 electricity production from renewables increased considerably as a result of Energy 2000. However, this was mainly due to increased incineration of waste with organic content. Electricity generation from waste grew from 644 GWh in 1990 to 1,284 GWh in 2000, but the total for solar and wind generation was only 13.8 GWh in 2000.[7] Very little was done to promote wind, photovoltaics (PV), biomass and other sources of 'green power'. Some cities in Switzerland are active in direct marketing of green power, but given the price difference with conventional power, broad success cannot be expected. The current draft law on electricity liberalization (under discussion at the time of the review) may provide an opportunity to establish a framework for future promotion of renewable energy sources. The team noted that expectations in that regard were low due to the availability of cheap electricity from the existing hydro–nuclear power system.

50. Buildings account for a notable share of energy-related CO_2 emissions. The cantons are responsible for implementing effective measures in the buildings sector. Although improvements were made in that sector between 1990 and 2000 (increasing number of apartments, relatively stable emission trends), more stringent efficiency improvement will be required if the projected targets are to be achieved. (The "with planned measures" scenario shows a 16.5 per cent reduction for residential, commercial and institutional sectors until 2010, after stabilization between 1990 and 2000). The federal Government can only influence the buildings segment to the extent that measures are taken in the framework of SwissEnergy. It is questionable whether all cantons will take the necessary measures to promote more efficient buildings in the future (both in terms of financial incentives and more demanding building standards), unless federal funding is provided under SwissEnergy.

51. Effective measures with respect to public awareness were commendable under Energy 2000, such as the 'Minergie' standard for new buildings. There are some incentives in place to improve the energy efficiency of the existing building stock and this, coupled with the educational programme of the Confederation on sustainable construction, should continue to have some positive impact on the gradual improvement of construction and renovation and consequently on energy efficiency. The review team was not convinced that considerable emissions mitigation in the commercial sector is realistic under the assumption of higher GDP growth.

B. Transport

52. Swiss transport-related CO_2 emissions increased slower than in other European countries during the 1990s. Low GDP growth between 1990 and 1994 and strengthened efforts to improve public freight transport at both the municipal and regional/national levels were important factors contributing to this end. As shown in table 7 and figure 9, a modal shift from road to rail has been seen over the past decade and was instrumental in curbing growth in GHG emissions from transport, especially in freight transport.

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[6] "Szenarien zu den Initiativen 'Strom ohne Atom' sowie 'MoratoriumPlus'", Prognos AG, Basel, 2001.

[7] Source: "Schweizerische Gesamtenergiestatistik", Bundesamt für Energie, Bern, 2000.

Figure 9. Trends in the structure of personal and freight transport, 1980–1995

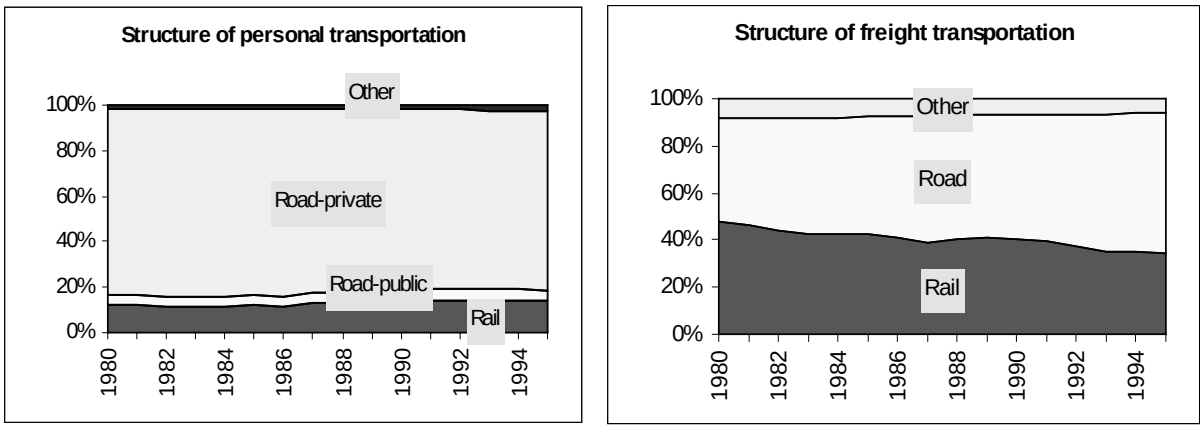


Table 7. Rail:road distribution of transport for selected years

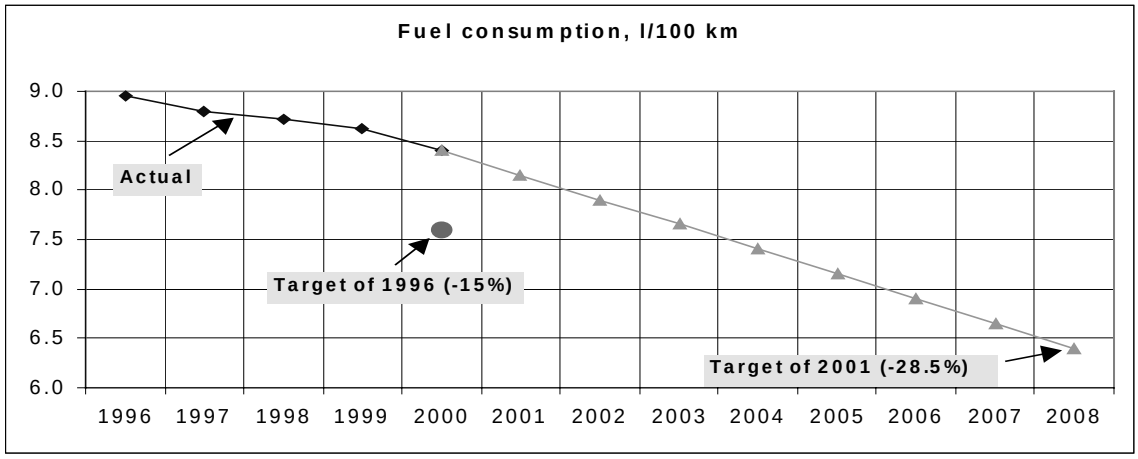
Rail:road ratio							
Personal transportation				Freight transportation			
1980	**1985**	**1990**	**1995**	**1980**	**1985**	**1990**	**1995**
0.145	0.138	0.157	0.163	1.070	0.860	0.767	0.581

53. Petrol prices in Switzerland are low in comparison with neighbouring countries as fuel taxes have remained unchanged over recent years. For diesel, the reverse is true, as Switzerland is one of the few countries where tax levels are the same for both petrol and diesel. As a result, diesel passenger cars make up a low share of the car fleet (16 per cent of new cars sold in 1999) and 'fuel tourism' takes place in two directions: large quantities of petrol are purchased in Switzerland by French and German drivers (regional tax rebates in Italy did bring cross-border fuel shopping of Italians to a halt), while Swiss consumers and truckers crossing Switzerland tend to buy diesel in the neighbouring countries. Both factors distort estimates of actual CO_2 emissions from transport.

54. One of the objectives of Energy 2000 was to reduce the specific fuel consumption of passenger vehicles. However, the voluntary agreement in that respect failed to meet the target. Instead of the envisaged reduction of specific fuel consumption of 15 per cent per car in comparison to 1996, only 7.6 per cent was reached by 2000 (see figure 10).

55. The review team was informed that, under SwissEnergy, a voluntary agreement was recently concluded between the Confederation and the association of car importers for increasing fuel efficiency. Although commendable, the agreement warrants action by car manufacturers at the European level given that cars are not produced in Switzerland. This voluntary agreement was the first one concluded under the SwissEnergy programme. This measure is expected to result in a reduction in the specific fuel consumption of new passenger cars by 28.5 per cent by 2008 compared to 1990 (see figure 10). Given the level of fuel consumption in 2001, this target is more ambitious than the one set under the Energy 2000 programme, of reducing specific fuel consumption by 15 per cent by 2001. However, even under the assumption of full compliance with this agreement, the actual emissions reductions will depend on the share of new cars in the fleet and will risk being offset by the increasing use of cars and distances driven. Although the use of innovative car engines (electric, fuel cells, etc.) was not reported in the NC3, Swiss experts highlighted that there is research in this area.

Figure 10. Actual and projected reduction in fuel consumption for new passenger cars[a]



[a] Source: Swiss presentation during the in-depth review.

56. During consultations with business non-governmental organizations, representatives of the car importers' association explained that the efficiency target can be reached only if diesel and petrol tax rates are differentiated in the future (reduction of diesel taxes). Although it is true that diesel passenger cars have a higher energy efficiency, lower diesel taxes may result in more intensive car use and/or the purchase of bigger cars. Additionally, lowering diesel taxes would run counter to the positive effects of the recently introduced heavy vehicle fee and to the ultimate objective of shifting freight from road to rail.[8]

57. Within the Energy 2000 programme the federal Government, together with municipalities, was active in raising public awareness on the issue of more efficient mobility (EcoDrive, energy efficient cars, and mobility management). Despite active participation in the different measures – 39,100 EcoDrive participants, 40,000 car-sharing participants – the NC3 states that the impact on fuel use was limited, because the reduction of fuel consumption as an effect of these "soft measures" amounted to only 1 per cent for the year 2000. This indicates that public-awareness-raising efforts could lead to higher success if accompanied by regulatory measures and clear price signals.

58. A public poll in 2000 on the use of public passenger transport concluded that "despite efforts by politicians and transport companies at national level, there has been no overall shift towards public transport".[9] Especially important is the large share of leisure travel by car (44 per cent of the total distance travelled and 49 per cent of the daily travelling time) that may continue to increase in the future unless alternatives to such travel are improved or made better use of.

59. The review team was impressed by efforts in 2002 to transfer freight transport from road to rail, which have been undertaken to implement a successful popular initiative (Alpeninitiative). High expectations for success are associated with the 2001 heavy vehicle fee, which will increase in steps over the coming years. A first evaluation of the effectiveness of the measure shows a slight decrease of road freight transportation in 2001 in comparison with the previous year. Because parts of the revenue are earmarked for substantially raising the capacity for freight transport by rail (in particular through the new

[8] Distance-related heavy vehicle fee, introduced in January 2001. The fee is calculated as a function of (a) the kilometres driven, (b) the maximum weight of the vehicle and (c) the emission class of the vehicle. The expected effect is a 20–25 per cent reduction in CO_2 emissions from trucks.

[9] U. Seewer, "Mobility in Switzerland – Results of the 2000 Travel Behaviour Microcensus", paper presented at the 2nd Swiss Transport Research Conference, Monte Verita/Ascona, 20-22 March 2002.

transalpine tunnels currently under construction), successful stabilization and a subsequent further modal shift from road to rail can be expected at least for transalpine freight transport.

60. Despite the strengthened policies and measures for freight transport, reaching the target of 8 per cent reduction in CO_2 emissions from transport fuels may be problematic. General trends in transport in other industrialized countries show a clear link between transport development and economic growth. The "with implemented measures" scenario shows a moderate increase of transport emissions between 2000 and 2010, whereas the scenario with the CO_2 tax option would lead to a slight reduction against 2000 and stabilization against 1990. The review team was informed that a CO_2 tax rate of Sw F 160 per tonne CO_2 after 2004 was assumed in the second scenario, leading to substantial increases in fuel prices. The scenario is in contradiction with the attempts to lower the actual rate of tax on diesel, demonstrating possible political limitations to a target-oriented "Kyoto legislation".

C. Waste

61. Waste management policy in Switzerland aims at waste avoidance, increased recycling and limiting landfill to an absolute minimum. The regulatory approach to that end was a clear success during the 1990s. The prohibition on depositing "burnable" waste on landfills led to a substantial increase of incineration capacities over the past few years, resulting in a steady reduction of CH_4 emissions from waste management and an increase in energy recovery for heating and electricity production. The review team confirmed that the technical potential to reduce CH_4 emissions is being well exploited.

D. Industry

62. Process-related emissions from the industrial sector accounted for 5 per cent of total CO_2 emissions in 1999, compared to 7 per cent in 1990. This decrease in non-energy-related CO_2 emissions during the 1990s (15 per cent by 1996) was mainly due to a substantial reduction in the production of cement in Switzerland; such large one-time decreases may not be possible in the future, and structural changes within the industries and energy-saving measures are more likely. All energy-related efforts to reduce industry's CO_2 emissions are covered under the CO_2 Law (voluntary agreements in a first phase; CO_2 tax as an option for the second phase from 2004 with the possibility of "escaping" from taxation by entering into a "voluntary commitment"). In the review team's consultation with business non-governmental organizations, industry representatives favoured the voluntary approach, given that some sectors would find themselves "on the winning side", taking redistribution of the tax revenues to business and households into account.

63. Industry representatives were confident that the target of 15 per cent reduction of CO_2 emissions from fuel combustion is attainable. One of the reasons for this optimism is the expectation that flexibility mechanisms under the Kyoto Protocol may be used to meet GHG reduction commitments in this sector. Another reason is the composition of Swiss industry. Although the energy intensity of the industrial sector is low in comparison to that in other countries, there still exists a high potential for energy saving in other sectors, especially with electricity gaining increased importance as an energy source in the residential and commercial sectors. Electricity-consuming sectors such as pharmaceuticals and machinery make up a relatively large share of total product output. Rising industrial electricity consumption does not necessarily imply higher fossil fuel consumption in industrial plants, as long as demand can be covered from non-fossil fuel sources and/or imports. Voluntary agreements under consideration need to ensure that negotiated targets not only mirror the expected business-as-usual reduction in CO_2 emissions, but also offset increasing industrial production.

64. Efforts to target HFC, PFC and SF_6 emissions in Switzerland have only recently entered the political agenda. These gases contribute roughly 1 per cent to the overall GHG emissions. As scant data

were available for these gases (no inventory data were presented in the NC3 for 1990–1996 and projections are rough expert judgements). The review team recommended that data gathering efforts in this respect be strengthened. Nevertheless, the trends are quite clear. As in other industrialized countries, HFC emissions are expected to increase substantially in a business-as-usual scenario, especially in the refrigeration and foam sectors. It was confirmed during the review that, in addition to voluntary measures, regulatory measures are under consideration to limit the use of fluorinated gases for which other substances or techniques are available.

E. Agriculture

65. Agricultural policy in Switzerland was fundamentally reformed in 1992. The transformation of the subsidy system from production orientation to direct payments to farmers with a strong emphasis on environmental aspects did result in a concomitant considerable reduction of N_2O and CH_4 emissions. Around 90 per cent of farmland is already regulated by the scheme. The reduction of almost 10 per cent in agricultural CH_4 emissions in 2000 compared with 1990 resulted mainly from a reduction in livestock population. The reduction of 10 per cent in N_2O emissions between 1990 and 1999 was triggered by the reduced use of mineral fertilizers, also a result of the application of the 1992 agriculture reform policy.

66. Agricultural reform in Switzerland has been accompanied by fundamental structural changes in agricultural production. The number of farms is constantly decreasing, and the average size is increasing. From today's perspective, it is difficult to estimate what impact this will have on numbers of livestock and intensity of crop production in the mid-term future (2010, 2020) and on GHG emissions from this sector. Projections in the NC3 are "best-guess" estimates. They are less conservative than those in the NC2, but the available data and the clear success of the new agricultural policy suggest that they are credible and not just wishful thinking.

67. The review team was informed that there is practically no potential use for biogas in Swiss agriculture. The few attempts made to utilize the gas all failed. Direct subsidies in that respect seem to be absent and the current electricity market framework does not provide for preferential access to the grid. Biogas utilization would have some mitigation impacts on CH_4 emissions from manure management and also on CO_2 emissions if fossil fuels can be replaced.

F. Land-use change and forestry

68. Swiss forest policy is based on a long tradition of sustainable use of forests, with very strict prohibitions and obligations for deforestation and reforestation. To date, the forested area has been steadily increasing. This development has also led to discussions on the future economic use of the resources. Despite the given natural circumstances, Switzerland today is a net importer of timber, owing to high domestic timber-production costs. Swiss forest and environment policy aims at increasing the use of domestic timber, both for long-living products and for energy use, by substituting wood chips for fossil fuels. The Energy Law and the SwissEnergy programme highlight clear intentions to enhance the use of renewable energy. In that regard, biomass would be a logical source of renewable energy for Switzerland due to its abundance.

69. The review team was not fully convinced that these interests and policies are compatible with the expected CO_2 sink capacity of forests, as indicated in the NC3 projections. Should a notable increase in the use of biomass occur, its impact on the current large sink capacity should be estimated. In addition, the possible increase in frequency of extreme weather events due to changing climatic conditions would lead to a higher vulnerability of Swiss forest resources. At least temporarily, such damage can reduce sink capacities considerably, as heavy storms in 1990 and 1999/2000 have shown. It should be noted that the sink allowance for Switzerland, as defined in the Marrakesh decisions (some 1,800 Gg CO_2), is

considerably lower than the actual and projected net CO_2 removals as shown in the NC3 (some 3,000–4,500 Gg CO_2). Swiss experts explained that, pending outstanding political decisions, there are still large uncertainties on how timber use or sink capacity will increase in the future.

IV. PROJECTIONS AND THE TOTAL EFFECT OF POLICIES AND MEASURES

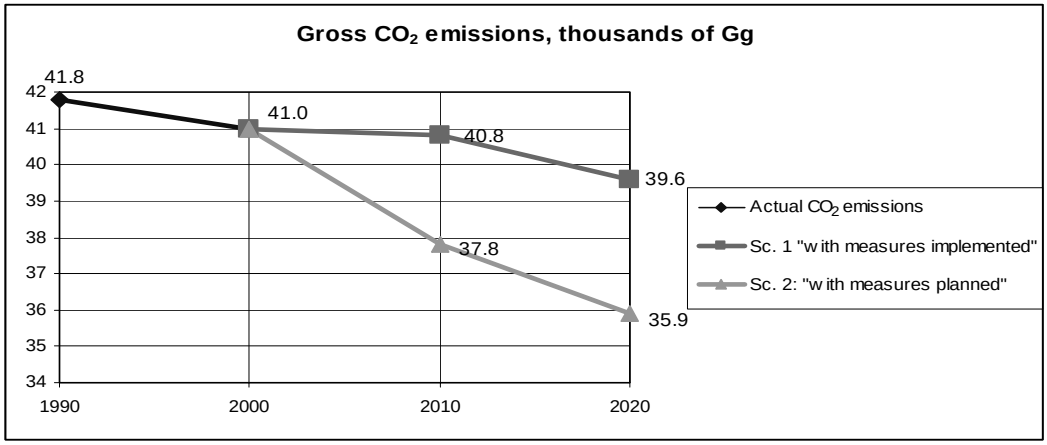
70. The projections for energy-related emissions contained in the NC3 were the result of a major forecasting exercise led by the Federal Office for Energy and prepared by an external consulting firm. Several Swiss expert groups from various government departments and agencies provided input to the exercise on target definition, scenario definition, CO_2 taxation levels, macroeconomic trends, etc. Four bottom-up models were used for preparing energy-related emissions projections (one of which was the FOE/Prognos 2001 model for energy supply) supported by four detailed sectoral models for households, industry, services and transport. In addition, an official forecast of pollutants, developed by SAEFL in 1995 for non-energy emissions, for the assessment and forecast of individual emissions (mainly for the new GHGs) was presented in the NC3. The Federal Office for Agriculture projected future emissions using a sector-specific IPCC method and projections of removals by sinks and reservoirs were prepared by the SAEFL and based on linear extrapolation. An additional econometric model was used for assessing macroeconomic implications of the projected sectoral scenarios. Finally, a general equilibrium model was prepared and used for compiling and integrating the results generated by the individual sectoral models.

71. The review team was of the opinion that there was a substantial improvement between the NC2 and the NC3 regarding the presentation of GHG emissions projections. In general, the information presented conforms to the reporting guidelines. The projections were reported by sector and by gas as well as on a CO_2 equivalent basis. They included all six GHGs, namely CO_2, CH_4, N_2O, HFCs, PFCs and SF_6, as well as the precursor gases NO_X, CO, NMVOCs, and SO_2 in five-year periods until 2020, for both baseline and mitigation scenarios. Projections of GHG emissions from international bunker fuels were not included.

72. The NC3 included two scenarios for GHG emissions by 2020: the first is the “with measures implemented” scenario, which models the effects of implemented and adopted measures; and the second is the “with planned measures” scenario, which models the effects of “additional measures”. Although numerical data were presented for GHG projections of both scenarios, only one scenario was included in the trends diagram. The review team pointed out that the clarity of the projections would be greatly enhanced if both scenarios were shown together and supported by inventory data, as recommended by the UNFCCC reporting guidelines. Based on information presented in the NC3, such a diagram was prepared during the review week and is presented in figure 11.

73. Information on the modelling approach, the strengths and weaknesses of models and approaches used, the sensitivity of the projections to the strengths of the underlying assumptions, and the level of uncertainties of the projected emissions, was not presented in the NC3. Some information on key assumptions was presented in the NC3, so that, formally, there is compliance with the guidelines. However, the team felt that the NC3 would have benefited greatly if it had extended the presentation of underlying assumptions by including graphs or tables on the projected structure of primary energy supply and the expected evolution of some key indicators such as primary energy consumption per unit of GDP and per capita, and CO_2 emissions per unit of GDP and per capita.

Figure 11. Comparison of the two CO_2 emission scenarios



74. The key general assumptions are common to the two scenarios presented ("with measures implemented" and "with planned measures"). These assumptions are: GDP growth at 2.2 per cent per year between 2000 and 2010 and 1.3 per cent per year between 2010 and 2020; population estimated at 7.1 million in 1999 and assumed to grow to 7.4 million in 2020; nuclear capacity remaining unchanged, i.e. there is no phase-out of nuclear plants until 2020; and world oil prices rising from US$ 16.5 per barrel in 2005, to US$ 17.0 per barrel in 2010, and US$ 21.5 per barrel in 2020. The key difference between the two scenarios is that the second one models the introduction of the CO_2 tax as a means of reaching the 10 per cent CO_2 reduction target by 2010. In contrast, the "with measures implemented" scenario assumes a continuation of current policies, without application of the CO_2 tax.

75. The review team was unable to determine whether there was consistency between the projected GHG trends for 1995–2000 presented in the NC2 and observed data for that period, given that the relevant information is presented differently in the NC3 and in the NC2. But for the CO_2 emissions in 2000 there is good correspondence between the results projected in the NC2 and the actual figures reported in the NC3: for example, gross CO_2 emissions of 46,600 Gg had been projected and the actual emissions were 44,826 Gg (–4 per cent difference). Actual CH_4 emissions turned out to be lower than those projected in the NC2: 213 Gg versus 229 Gg (–7 per cent difference). For N_2O, there is a similar trend: 11.1 Gg versus 11.7 Gg (–5 per cent difference). The precursor gases and SO_2 were also overestimated in the NC2 by 10–20 per cent. It was difficult to compare data for HFCs, PFCs and SF_6 due to the limited information in the NC2.

76. Figure 11 illustrates that under the "with measures implemented" scenario Switzerland may not be able to meet the CO_2 reduction target of 10 per cent below 1990 levels. Based on the projected data, by 2010, there is a reduction of only 2.4 per cent and by 2020 only 5.3 per cent. Given the large share of CO_2 in total GHG emissions, one can assume that the Kyoto target of 8 per cent reduction for GHGs in 2008–2012 would not be met under this scenario. On the other hand, under the "with measures planned" scenario, the target required by the CO_2 Law is met by 2010. Further reductions occur between 2010 and 2020, reaching 14 per cent by 2020.

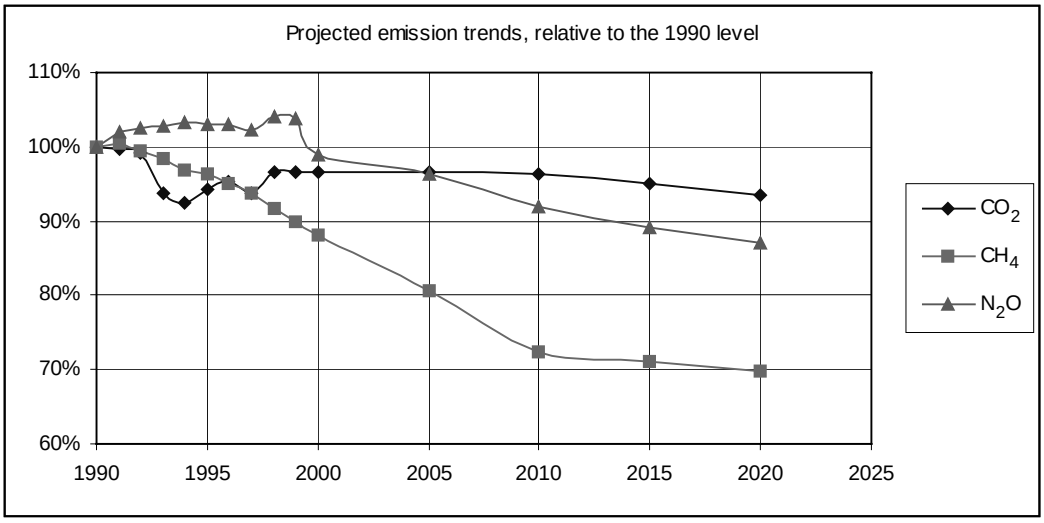
77. The review team had difficulty in understanding how these results were to be achieved. First of all, it was not clear how the tax was modelled (this may be a consequence of insufficient information on the models). Accordingly, the team could not distinguish clearly whether the reduction target was a result of the modelling or one of the initial assumptions. In this regard, Swiss experts explained that the CO_2 target was a restriction imposed on the model and not a result of the modelling exercise. On the important issue of voluntary measures in industry and transport, the extent of such measures envisaged

by the CO_2 Law was not specified in detail by sector, and the difference in voluntary measures between scenario 1 and scenario 2 was not shown. The combination of the tax impact and the voluntary measures is critically important because of the size of the required reductions by 2010: 12 per cent in the residential sector (actual reduction in 1990–2000 was only 7 per cent), 3.3 per cent in transport (4.9 per cent increase during 1990–2000), 6.2 per cent in industry (9.7 per cent in the previous decade).

78. The projection experts also used the modelling exercise to determine the level of taxes (which could vary between 0 and the maximum of Sw F 210/tonne CO_2) that may be applied to achieve the target. Although this information was not presented in the NC3, during the visit experts indicated that a value of Sw F 160/tonne CO_2 for the transport sector and a value of Sw F 100/tonne CO_2 for the combustion sector may be sufficient to meet the objectives of the tax. However, in the particular case of the transport sector, the team was informed that the model results also indicate that, even with the maximum tax level of Sw F 210/tonne, the transport sector will only be able to stabilize emissions. Based on the modelled data and information provided by the national experts, the review team is very unclear as to the prospects of the CO_2 tax achieving the –10 per cent target by 2010.

79. Figure 12 shows that CH_4 and N_2O emissions are reduced much more between 2010 and 2020, than are CO_2 emissions. The projected reduction of 30 per cent of CH_4 between 1990 and 2020 is based mainly on the assumption that the number of cattle will decrease in the future. This assumption is less conservative than the corresponding one in the NC2, but the Swiss experts considered it reasonable, notwithstanding the associated uncertainty. Still, projections of CH_4 emissions from waste need to be checked against implementation of the ban on landfilling to confirm the rapid emissions decrease of 52 per cent between 2000 and 2010.

Figure 12. Projected emission trends for CO_2, CH_4 and N_2O (source: NC3, "with measures implemented" scenario)



80. The projected reduction of N_2O is less drastic than that of CH_4 but the emissions still decrease by 8 per cent in 2010 and by another 4 per cent in 2020. Along with the reduction in agriculture, it is assumed that the N_2O emissions from transport will start to decline after 2000. This important assumption should be reviewed as the effects of policies in the transport sector become clearer.

81. For HFC emissions, a growth from 530 Gg in 2000 to 970 Gg in 2010 is expected. For SF_6, there was a decrease from 160 Gg in 1990 to 130 Gg in 2000; for the future, growth to 150 Gg by 2010 is

projected. No projection is presented for PFCs but their share is estimated to be small (about 5 per cent of all 'new gases' in CO_2 equivalent).

82. The sinks in land-use change and forestry are projected to be constant for the period 2005–2020 at the estimated 'normal' level of 4,500 Gg CO_2. However, during 1990–2000 Switzerland experienced two heavy storms that dramatically reduced the sink capacity for a short period. Accordingly, the actual sink capacity in the period 1990–2000 was often lower than 4,500 Gg. It is not clear how such natural disasters can be taken into account in projecting sink capacity unless the frequency of forest-damaging storms can be predicted with some certainty (e.g. one or two storms per decade).

83. In a related area, some inconsistency between the projections of wood demand and the associated policy and measures was identified. The wood demand is assumed stable in the projections while there is a policy (Energy 2000 and SwissEnergy) which calls for further promotion of renewable energy, including biomass and wood utilization. Should consumption of wood for energy production increase significantly, the size of the sinks may be affected. This discrepancy should be reconciled in future.

84. Having reviewed both the projections and the policies, the review team came to the conclusion that the link between the two could be strengthened. On the one hand, the policies and measures appear targeted and effective for GHG mitigation, and the projections are in general well prepared. However, there are problems in correlating the projected GHG data with the policies and measures that are expected to attain the GHG reduction target. There are several examples where the link between the policies and the projections appeared weak: extent of voluntary agreements by sector to cut CO_2 emissions, size and efficiency of the CO_2 tax and mitigation effect of the heavy vehicle fee.

85. There are numerous well-developed impact analyses of implemented policies and measures, including a thorough analysis of the results of Energy 2000. The review team felt that a similar analysis of planned policies and measures should be done as this omission may have had an impact on the format and content of the projections reported in the national communication. Another inconsistency lay in the macroeconomic costs associated with the implementation of policies and measures. A comparison of the macroeconomic costs associated with the two scenarios was not made, although the data exist in several national studies. An evaluation of such costs and their sectoral breakdown might be useful for determining which are most promising GHG mitigation actions. Such comparisons may also help in comparing the domestic actions with the use of international flexible mechanisms for achieving emission reduction.

86. The voluntary measures contemplated under the CO_2 Law are a potentially effective tool for meeting the GHG reduction targets. However, as there was no sector-specific target or individual targets, it was not clear to the team how the new voluntary measures differ from business-as-usual. Incorporation of the business-as-usual scenario (a "without measures" projection) into the projections would increase their robustness and transparency.

87. During the visit, the team discussed with the Swiss experts and the non-governmental organizations the possible impact of an early nuclear phase-out on the amount of GHG emissions. This issue is important because of the currently debated popular initiative to discontinue operation of Swiss nuclear power plants as soon as possible. There is an extensive study on this impact[10] where several pertinent scenarios are investigated, including their CO_2 emissions. The NC3 does not present any such scenarios, although one of the results, a 12 per cent increase in CO_2 emissions by 2030, is briefly mentioned. This increase is apparently related to the expansion of gas-fired combined heat-and-power units. In the opinion of the team, a more extensive presentation of a phase-out scenario would have

[10] "Szenarien zu den Initiativen 'Strom ohne Atom' sowie 'MoratoriumPlus'", Prognos AG, Basel, Feb. 2001.

allowed the NC3 to contribute more to the process of informed decision-making in climate policy and to improve the robustness of the projected GHG data.

V. VULNERABILITY ASSESSMENT, CLIMATE CHANGE IMPACTS AND ADAPTATION MEASURES

88. Switzerland is a hazard-prone country. Due to its topographical features, the country is exposed to the natural risks associated with extreme climatic conditions, such as floods, avalanches, mud slides, storms and droughts. Such risks are well understood and managed on a regular basis, by both the federal Government and the cantons.

89. Climate change is expected to result in increased precipitation and temperature. This will in turn exacerbate natural hazards, with a negative bearing on various socio-economic sectors such as tourism, forestry, financial services and insurance. Efforts are being made to assess the impacts of climate change on the country. Recent statistical analyses concluded that the average temperature in Switzerland increased by about 0.5 degree centigrade per decade in the period 1970 to 2000[11] as compared to 0.1 to 0.2 degree centigrade per decade at the global level; precipitation also increased in this period.

90. Experts informed the review team that, at the moment, it is difficult to ascertain the magnitude of the climate-related impacts because of methodological difficulties in distinguishing the climate-change related component. This has so far precluded planning specifically for climate change adaptation. However, it is generally accepted that the country will be exposed to increased hazards. The level of knowledge in this respect has not changed much since the NC2, but financial and technical resources are being made available to conduct integrated assessment studies to evaluate the impacts of climate change.

91. The review team recommended that, in the light of difficulties for determining the effects of climate change, Swiss experts make use of the minimal available tool for doing so, which is the IPCC methodology and making comparisons of output between this methodology and those that are available nationally.

VI. FINANCIAL RESOURCES AND TRANSFER OF TECHNOLOGY

92. The chapter on technology transfer in the NC3 is comprehensive and prepared in accordance with the UNFCCC reporting guidelines. Switzerland has met its obligations with regard to financial assistance and technology transfer to developing countries. Viable institutional mechanisms have been put in place for efficient coordination and management of financial resources for international commitments. As part of the federal Government, the Swiss Agency for Development and Cooperation (SDC) and the State Secretariat for Economic Affairs are mandated to plan and implement development aid. The SDC also executes programmes of bilateral development cooperation with Eastern Europe. The Swiss Agency for Environment, Forestry and Landscape is a custodian of federal environmental planning and policy implementation.

93. In line with the provisions of Article 3.4 of the UNFCCC, Switzerland's policy is aimed at promoting sustainable development. It also provides a framework for incorporation of climate change concerns in related programmes and projects. Least-developed countries are a priority for assistance. A capacity-building element is usually integrated into specific programmes and projects.

94. In 2000, Switzerland allocated 0.37 per cent of its GDP to official development assistance, and it has set a target of 0.4 per cent for 2010. From 1991 to 2002 a total of Sw F 187 million were allocated for the Global Environment Facility. The country also provided additional funding through the national

[11] OcCC – Advisory Body on Climate Change for Switzerland.

Global Environmental Programme, started in 1992. During 1997–2000, Sw F 24.7 million were allocated to that programme for conducting 18 projects. Most of these projects are environment- or energy-oriented. Financial resources are also being made available by the Swiss Government on an annual basis to support vulnerability and adaptation activities under the United Nations Development Programme until 2003.

95. Bilateral cooperation on climate change exists with countries in Central and Eastern Europe, and with countries of the Commonwealth of Independent States. The assistance provided to these countries through either grants or credit guarantees is of the order of several million Sw F yearly. It varies greatly over time depending on type and size of projects.

96. As part of efforts to promote the transfer of environmentally sound technologies, Switzerland supported the creation of cleaner production centres in Brazil, Colombia, Costa Rica, El Salvador, Guatemala, Morocco and Vietnam. Similar centres are planned for China, India and Peru. On a pilot basis, activities implemented jointly (AIJ) are being tested through the Swiss AIJ Pilot Programme, launched in 1997. For example, a joint project with Romania, "Swiss thermal energy project", is currently being implemented.

Table 8. Financial contributions to the operating entity of the financial mechanism, regional or other multilateral institutions and programmes, 1990–2000 (millions of Swiss francs)[a]

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Global Environment Facility		**4.4**	**8.6**	**14.6**	**14.5**	**13**	**13**	**10.6**	**10.6**	**8.1**	**11.2**
Multilateral institutions	**144**	**170**	**328**	**187**	**217**	**235**	**240**	**232**	**237**	**266**	**306**
World Bank (IBRD)	*-*	*-*	*57.5*	*57.6*	*55.4*	*55.2*	*50*	*5.9*	*5.4*	*0.2*	*3.4*
Int. Dev. Association (IDA)	*-*	*-*	*93*		*14.5*	*43.7*	*72.5*	*94.9*	*108.5*	*140*	*140*
African Development Fund (FAD)	*36.8*	*44*	*49.1*	*42.7*	*49.1*	*23.3*	*21.2*	*28.6*	*49.8*	*46*	*92*
UN Development Programme (UNDP)	*59*	*60*	*60*	*58*	*56*	*62*	*58*	*57.4*	*57*	*52*	*52*
Other	*47.8*	*66*	*68*	*29*	*42*	*51*	*38*	*45*	*16*	*28*	*18*
Multilateral scientific programmes	**14.5**	**15.4**	**13.6**	**10.8**	**31.0**	**29.3**	**28.2**	**25.3**	**35.9**	**20.7**	**14.9**
Consultative Group on International Agricultural Research (CGIAR)	*8.6*	*10.3*	*8.6*	*9.5*	*11.6*	*14*	*11.5*	*11*	*10.4*	*10.9*	*4.4*
European Co-operation in the Field of Scientific and Technical Research (COST)	*-*	*-*	*-*	*-*	*7.8*	*9.8*	*7.4*	*7.4*	*8.7*	*7.6*	*7.7*
Other	*5.9*	*5.1*	*5*	*1.3*	*11.6*	*5.5*	*9.3*	*6.9*	*16.8*	*2.2*	*2.8*
Multilateral technology programmes	**3.4**	**5.8**	**7.2**	**7.1**	**9.9**	**7.6**	**8.7**	**9.3**	**8.8**	**8.8**	**8.6**
UN Environment Programme (UNEP)	*2*	*3.5*	*4*	*3.1*	*5.4*	*3.8*	*4.1*	*4*	*3.9*	*3.8*	*3.7*
Other	*1.4*	*2.3*	*3.2*	*4*	*4.5*	*3.8*	*4.6*	*5.3*	*4.9*	*5*	*4.9*
Multilateral training programmes	**0.0**	**0.0**	**0.0**	**0.0**	**0.7**	**0.6**	**0.0**	**0.5**	**0.6**	**0.6**	**0.6**
Total	**162**	**196**	**357**	**220**	**273**	**286**	**290**	**277**	**293**	**304**	**341**

[a] Source: information provided by Swiss experts after the review visit.

97. New guidelines for aid agencies will be in operation soon. The country has also introduced an additional mechanism (Eco-Fund) to enhance debt relief for developing countries that promote preservation of the environment. Switzerland participates in the work of multilateral funding organizations such as the World Bank, Inter-American Development Bank, Asian Development Bank and African Development Bank. The structure and magnitude of Swiss financial assistance is presented in table 8. Switzerland's financial assistance grew in 1990–2000. The largest part of the assistance is provided through multilateral financial institutions, but the support of multilateral programmes is also substantial. Funding for the Global Environment Facility was provided consistently, with a small decrease in 1997–2000 in comparison with 1993–1996.

VII. RESEARCH AND SYSTEMATIC OBSERVATION

98. In 2000, there were about 420 research projects on global issues, including climate change, with a total budget of some Sw F 40 million. Of these, 120 projects dealt specifically with climate change, and are funded at about Sw F 12 million. The amount of financing has been stable over recent years. However, the focus of the research has shifted from establishing evidence for climate change to identification of impacts and mitigation measures. Another important research component is energy-related research, for which about Sw F 180 million per year are allocated from the federal budget. Industries contribute roughly an additional Sw F 800 million to energy research.

99. The research is conducted both domestically and internationally. Switzerland actively contributes to several international research projects such as the World Climate Research Programme and the International Geosphere–Biosphere Programme.

100. A new national centre of competence in research on climate change was created in April 2001 with funding amounting to Sw F 8.2 million for the first three years. The centre promotes integration of various related scientific disciplines into a knowledge network for climate-change problems. Switzerland supports a system of general environmental monitoring, with climate-related observation being a part of it. The system is well developed. It includes both domestic research and participation in numerous international projects. For transportation, the completion of the five-year National Research Programme 41 on “Transport and Environment” in 2001 was an important milestone. At present, there is no ongoing national programme of similar scope for transport.

VIII. EDUCATION, TRAINING AND PUBLIC AWARENESS

101. The corresponding chapter in the NC3 is prepared in accordance with the UNFCCC reporting guidelines. Switzerland has put in place a dynamic system for the promotion of capacity-building on climate change at all layers of the community. The target audience for education ranges from ordinary citizens to school children, engineers and policy-makers. There are tailored climate change programmes and climate-related training involving a number of institutions. The federal Government is working closely with the cantons to promote national awareness on climate change.

102. Recent developments include the establishment of a national climate database (Climate Facts), the development and implementation of a teachers education programme (1997–1999), and the promotion of awareness among students through participation in climate-data collection and exchange. Further initiatives to promote technical expertise on climate change issues include the establishment of the National Forum on Climate Change (ProClim, 1988), the OcCC (1997) and the Climate Change Information Centre (InfoClima, 1998). In order to facilitate national dialogue at the policy level, the Parliamentary Group on Climate Change was established in 1996. These initiatives have assisted the country in achieving a high level of awareness on climate change.

103. As reported in the first and second national communications, Switzerland had initially embarked on broad-based public awareness programmes to build basic knowledge on climate change among its population. Having attained a high level of general climate change awareness, the country shifted its policy focus to specific sectors. Particular attention is given to promoting awareness in the energy sector, which accounts for most of the GHG emissions. Programmes in this sector are intended to improve energy efficiency and promote the use of renewable energy. There are related awareness programmes for programmes on planning and design for engineers, operators (the PENTA project), and property owners and tenants.

104. A budget of about Sw F 0.8 million is earmarked annually to support training and education programmes. The country is also expanding its efforts to support countries with economies in transition

and developing countries in promoting training and awareness to a wider global dimension. Monitoring of activities has been initiated to assess the impacts of awareness programmes.

IX. CONCLUSIONS

105. Switzerland has made great progress in its overall approach to climate change, and has provided for a good policy base for the future, which is by and large consistent with the country's GHG reduction commitments under the UNFCCC. Climate change and GHG mitigation are being given priority at all levels of government (federal, cantonal and municipal). The objective of stabilizing 2000 CO_2 emissions at the 1990 level was expected to be met, based on GHG emissions presented in the Swiss inventory data submitted for 2000. There are major issues that are being addressed further, in part to fulfil the need to achieve energy and environmental policy objectives. These include the Energy 2000 programme, which formed the basis for stabilizing CO_2 emissions in 2000. The most recent measures are included under the SwissEnergy programme, which commenced in 2001, the CO_2 Law, which entered into force in May 2000, and the heavy vehicle fee in place since January 2000. These actions will have a major impact on energy policy and are expected to reduce GHG emissions further.

106. In general, the NC3 complies with the reporting guidelines and is well prepared. Although there are some omissions and inconsistencies, most of them were clarified during the review, and additional data were provided to this effect. Unlike the NC2, the NC3 was not discussed with important stakeholders such as non-governmental organizations or cantons. A decision was taken to consider the NC3 as a federal document intended primarily for submission to the UNFCCC, in fulfilment of the country's reporting obligations. Accordingly, the document exists only in English. The review team felt that this approach may have decreased the usefulness of the document as a planning tool in the country.

107. Switzerland recently established a new national target of reducing CO_2 emissions by 10 per cent by 2010. This is consistent with its emissions reduction target under the Kyoto Protocol of 8 per cent for all gases. Ratification of the Kyoto Protocol is to be considered by the parliament in late 2002 and is deemed likely. However, if Switzerland does not ratify the Protocol, the CO_2 Law and some other domestic measures are expected to encounter difficulties in implementation. During the review, the team learned that there is interest in all flexibility mechanisms under the Protocol, which may be under consideration as part of a contingency plan on the part of stakeholders, in the event that domestic actions are not on track to reduce emissions as targeted.

108. The stabilization of GHG emissions in the 1990s was achieved in conditions of low economic growth. With a recovery of GDP growth, GHG emissions will most likely increase and, as a result, policy makers may need to strengthen the present GHG mitigation strategy.

109. The new CO_2 Law aims to reduce CO_2 emissions by 10 per cent by 2010 compared to 1990 levels. In its initial phase, the law relies heavily on voluntary action. However, the potential of such action is unclear, especially for the transport sector which accounted for 34 per cent of CO_2 emissions in 1999. The review team also questioned the efficiency of the projected CO_2 tax. The CO_2 Law stipulates that if voluntary measures prove unsatisfactory by 2004, the federal Government is authorized to introduce a CO_2 tax. The law also stipulates that the size of the tax and steps taken for its introduction will be defined in a political process, which adds some uncertainty to its future. Moreover, the time until 2004 seems to be too short to determine whether the voluntary measures would work. Thus, close monitoring of progress made in reducing GHG emissions between 2002 and 2004 is vital.

110. Under its "with measures implemented" scenario, Switzerland may not be able to meet the CO_2 reduction target of 10 per cent of 1990 levels. Based on the projected data, by 2010 there will be a reduction in these emissions of only 2.4 per cent, and by 2020 only 5.3 per cent. Given the large share of

CO_2 in total GHG emissions, one can assume that the Kyoto target of 8 per cent for GHGs in 2008 to 2012 would not be met under this scenario. On the other hand, under the "with measures planned" scenario, the target, as required by the CO_2 Law, is met, and there will be further reductions between 2010 and 2020 of up to 14 per cent. The review team noted that the projections of GHG emissions presented in the NC3 seem to correspond only partially to the relevant policies and measures. As a result, the link between the planned measures and the modelled scenarios which mainly focus on energy demand appears weak in some aspects. Although the impact of a possible nuclear phase-out on the level of CO_2 emissions was not analysed in the NC3, it is still a very important consideration for the evolution of GHG emissions in the future and should be included in scenario development.

111. Particular attention needs to be given to the development of GHG emissions in 2000–2010 in both the electricity generation and the transport sectors. For electricity generation, measures may be required to retain the carbon-free nature of generation because of the effects of electricity-market liberalization, possible expansion of gas-fired combined heat-and-power units, and the currently debated early closure of nuclear units. For transportation, the degree of success in managing the increasing mobility of the population and growing freight transport is still a challenge that should be monitored more effectively in order to evaluate the effectiveness of sectoral policies and measures aimed at reducing GHG emissions from this sector.

112. The macroeconomic costs of emissions reduction were not evaluated. As a result, the marginal costs of GHG reduction by economic sectors are still unknown. Therefore, it is difficult to compare the efficiency of domestic actions among sectors with that of international flexibility mechanisms.

113. In spite of the above-mentioned constraints, the new legal framework (the CO_2 Law and the Energy Law) has improved the overall conditions for possible success of the new long-term GHG mitigation programme. The review team feels that the GHG reduction target can be met if this framework is combined with the effective allocation of funding for the regulatory measures outlined in the NC3.

114. Switzerland provides considerable and well-targeted financial assistance to developing countries, and in particular, least developed countries, and its coverage of countries with economies in transition expanded between 1990 and 2000.

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