United Nations
Framework Convention on Climate Change

Liechtenstein National Climate Report, 2001

October 2001

Government of the Principality of Liechtenstein

Contents

Foreword

In 2001 the international group of experts on climate change (IPCC) issued the results of its third study on the effects of global warming. The results of the study are clear: emissions caused by human activities are influencing our climate and could have a serious impact on it in the future. The Principality of Liechtenstein is also affected by this process, and has therefore taken up its responsibility and has ratified the United Nations Framework Convention on Climate Change (1995) and signed the Kyoto Protocol (1998).

Liechtenstein is therefore obligated to establish a periodic inventory of climate-altering emissions and report on its policies and measures in this area, in accordance with the guidelines established by the United Nations secretariat for climate-related activities. Its first national report was submitted in 1995. Since then, various new instruments have been developed and implementation measures introduced.

The present report fulfils Liechtenstein's obligations as an Annex 1 party to the United Nations Framework Convention on Climate Change. It contains information on the current status of activities in climate-related areas. Given Liechtenstein's small size and its bilateral and multilateral cooperation agreements, cooperation with other States (in particular under its customs treaty with Switzerland) is an important factor.

Vaduz, October 2001

1. Executive Summary

Introduction

This report provides a summary of the activities, and the basis therefore, of the Principality of Liechtenstein as regards climate. With a population of 32,400, Liechtenstein is a small central European country situated in the Alpine region. Its structure is comparable to that of its neighbours Switzerland and Austria. Liechtenstein is a constitutional hereditary monarchy with democratic, parliamentarian principles. Cooperation with Switzerland (customs and monetary union) is regulated by a customs treaty, which has a considerable impact on environmental and fiscal strategies. Many Swiss taxes (such as transport or environmental taxes) and regulations for special areas (for example, environmental standards) are adapted for application in Liechtenstein.

Liechtenstein has also implemented European Union legislation since joining the European Economic Area in 1995, and has participated in various European Union programmes.

Current and future emissions

The elaboration of the 1999 climate inventory has been closely coordinated with the air pollution register. Work on the inventory is still ongoing, so that only a preliminary status report is possible at this time. With the exception of transport, for which detailed information is already available, data quality is, generally speaking, average, and will be greatly improved in coming years.

In 1999 Liechtenstein's CO_2 emissions stood at 196.2 gigagrammes (Gg), virtually all of which were caused by energy-related processes: 26 per cent each in the transport sector and in trade and industry. A large proportion (approximately 45 per cent) was caused by residential heating systems. Emissions levels remained practically constant as compared to 1990 figures. In regard to forests, it is a cautious assumption that carbon fixation and emissions more or less offset each other, so that the forests do not constitute a specific sink.

Methane (CH_4) emissions levels stood at 0.71 Gg, most of which were generated in the agriculture sector (89 per cent). These emissions are down by 13 per cent as compared to 1990 levels, the result of a reorientation towards environmentally sound production methods.

Nitrous oxide (N_2O) emissions for 1999 stood at 0.023 Gg and originated in agriculture (62 per cent) and transport (27 per cent, after the introduction of catalytic converters for passenger vehicles). Owing to the more widespread use of catalytic converters with the aim of lowering specific air pollutants, emissions levels rose slightly by 13 per cent between 1990 and 1999.

Expressed in CO_2 equivalents, emissions totals stood at 218.5 Gg. The following figure shows the composition of these emissions. GHG-emissions such as HFCs, PFCs or SF_6 may play only a very limited role in Liechtenstein.

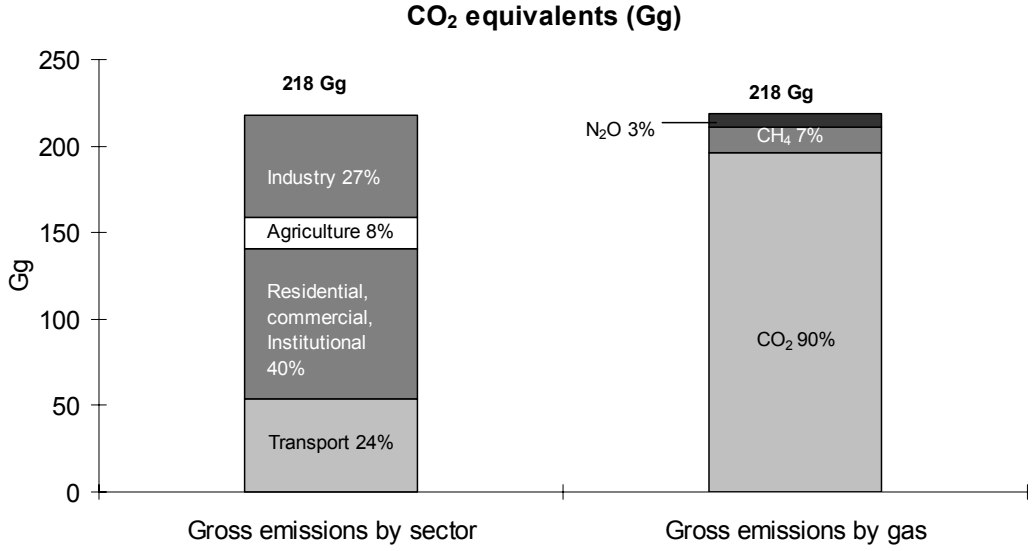

Figure 1-1: 1999 emissions in CO_2 equivalents by sector and by gas

The following changes have been predicted for 2010:

- CO_2 emissions will rise by 8 per cent as compared to 1999 levels, due in particular to the dynamics of the transport sector;
- CH_4 emissions will drop by 4 per cent as a result of further improvements in the agriculture sector;
- N_2O emissions will drop by 11 per cent compared to 1999 levels to reach 1990 levels, due to improvements in the transport sector.

The following figure shows the evolution of the situation in this area, expressed in CO_2 equivalents. Total emission levels remain almost constant. This forecast takes into account, in general terms, the effects of implemented measures in Liechtenstein, but does not consider adopted or planned measures. The projections represent, in the first instance, calculations based on predictions for Switzerland.

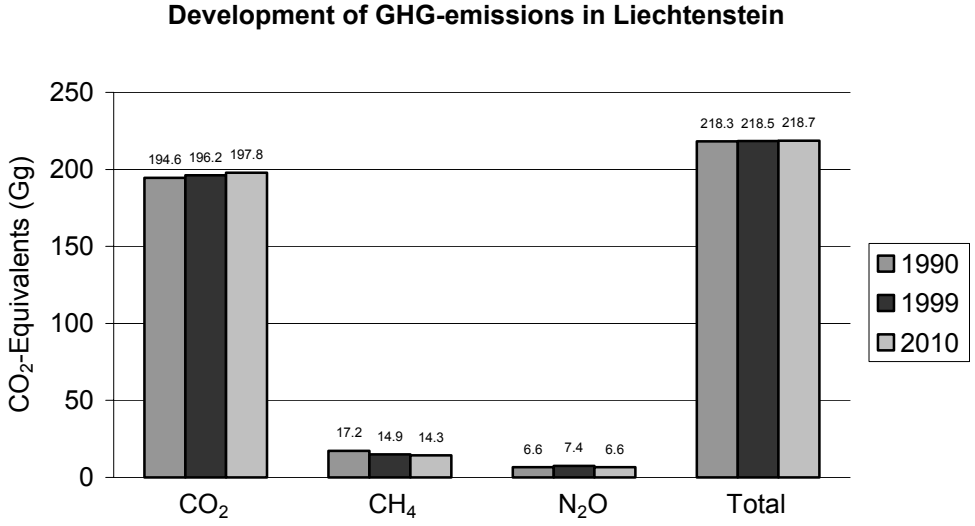

Figure 1-2: Predictions for GHG-emissions, 1990–2010

Detailed information on emissions levels for precursor substances and SO_2 up to 2010 was calculated only for the transport sector. Emissions levels for all gases have dropped markedly as a result of emissions regulations.

Policies and measures

Liechtenstein's climate policy is deeply rooted in its sectoral policies, in particular as regards energy, the environment, transport, agriculture and forestry. Policy in all these areas include measures which help to reduce the levels of GHG-emissions. Because of its small size, Liechtenstein places great emphasis on international cooperation, and its relations with Switzerland are particularly important in this regard.

The Government model (1995) calls for conservative use of resources, the preservation of the quality of life and the introduction of sustainable policy, while affirming that the Government should play a role in finding a solution to global environmental problems. In the latest government programme, climate is considered a priority area. These fundamental dictates are further consolidated through development, national and guideline planning.

- Environmental policy: The core elements of this policy are the Air Pollution Prevention Act (1985) and the Waste Prevention and Disposal Act (1988). Liechtenstein is connected to Switzerland as regards technical implementation of these provisions in several areas, for example, regulations governing various substances and VOC and SO_2 emissions. Air pollution targets are also the same as in Switzerland.
- Energy policy: Liechtenstein has introduced a modern energy savings policy which lays down guidelines, establishes financial incentives for the promotion of renewables (wood-based and solar energy) and sets out energy conservation measures. Public information activities are also conducted by an energy office.
- Transport policy: Policy in this area is determined by the principles of sustainability, and makes public transport a priority. The introduction of the distance- and weight-dependent heavy goods vehicle fee means a turnover as regards the real costs of freight transport by road.
- Agriculture: Liechtenstein's agriculture sector is devoted mainly to animal husbandry (70 per cent of revenue). Liechtenstein promotes the trend towards more eco-friendly agricultural practices. In addition to maintaining soil productivity, environmental pollution is to be kept to a minimum. Environmentally sound agriculture production methods, whether low input or organic farming, are actively promoted. Landscape protection is also considered a responsibility of agriculture which will become increasingly more significant.
- Forestry: Liechtenstein's forests are very important. Forested areas account for 43 per cent of the country's area, and this figure is rising. Therefore, forestry has been highly sustainable ever since the introduction of the forestry regulations in 1865. Sustainable forest management, the preservation of forest cover and the promotion of nature-friendly forest management are important goals of this policy. All of Liechtenstein's forests have SGS-FM/COC-0764 certification from the Forest Stewardship Council (FSC).
- International cooperation: This is a principal element of Liechtenstein's climate policy, which, given the small size and limited capabilities of the country, creates significant synergies. In addition to cooperation with Switzerland, various international treaties (air pollution prevention conventions, the International Convention for the Protection of the Alps, signature of the Kyoto Protocol, etc.) play an important role in this area.

The following table sets out the principal measures implemented, adopted and planned. Details and information on further measures are given in section 4.

Policy/Measure	Goals/Orientation	Type of instrument	Status
a) Energy			
Energy Conservation Act	Promotion of the renovation of old buildings, heating systems (wood, solar energy, heat pumps), as well as promotion of renewable energies and demonstration installations	Fiscal measure (subsidy)	In effect since 1996
Photovoltaic promotion programme	Promotion of approx. 20 photo-voltaic arrays – 8,500 CHF/kWh	Fiscal measure (subsidy)	Launched on 1 July 2001 (for a period of two years)
Heating regulations	Prohibition of electrical heating and heating of outdoor areas and ramps Heating cost deductions (dependent on consumption) Periodic monitoring of ventilation systems	Regulation	Introduced in 1993 Regulations to be tightened in late 2001
Heat insulation regulations	Planning of buildings and installations must, as far as possible, aim to conserve energy (minimum insulation value) in accordance with Ordinance/SIA Norm 380/1	Regulation	Introduced in 1993 New regulations expected in late 2001
b) Transport			
Distance- and weight-dependent heavy goods vehicle fee	Shifting of freight traffic from road to rail and reduction of road traffic in the trans-Alpine region	Fiscal measure (internalization of external costs)	In effect since 1 January 2001
Promotion of solar, electric, gas-driven and/or hybrid vehicles	Exemption of electric, gas-driven and/or hybrid vehicles from the vehicle tax	Fiscal measure	In effect since 1999
Promotion of the use of public transport	Establishment of the Liechtenstein Bus Authority and introduction of frequent-service regional trains	Institutional measure	In effect since 2000
c) Stationary installations and waste			
Emissions regulations	Emissions regulations for stationary installations (heating, industry)	Regulation	In effect since 1987 Revised in 1992
Waste disposal regulations for the construction sector	Waste: Proof of recycling and waste disposal plan required before beginning construction	Regulation	In effect since 1993 (Ordinance accompanying the Construction Act)
d) Agriculture			
Ecological incentive payments in the agriculture sector	Payment of subsidies, in accordance with production levels, to encourage switching to ecologically sound agricultural management methods	Fiscal measure (direct payments)	In effect since 1996

Policy/Measure	Goals/Orientation	Type of instrument	Status
Preservation of agricultural lands	Agriculture: Long-term protection of land used for agriculture from being used for other purposes	Regulation	In effect since 1992
Water Pollution Prevention Act	Establishment of maximum numbers of cattle and horses per given area	Regulation	Envisaged for 2002
e) Planning			
Energy register	Establishment of a national energy register	Planning measure	Envisaged for 2002
Spatial Planning Act	Reconciliation of various user interests	Planning measure, regulations	Planned (under study in Parliament)
f) Forests			
Forest management regulations contained in the Forestry Act	Sustainable forest management	Regulation	Implemented in 1991
Ordinance on forest reserves and special forest areas	Mandate	Regulation	Implemented in 2000

Table 1-1: Overview of the principal measures implemented, adopted or planned

Liechtenstein has commissioned a basic report (Factor 2000) for future climate strategy (implementation of the Kyoto Protocol), the findings of which affirm that a purely national strategy is difficult to implement and, given the already high level of climate-related measures, the marginal costs of additional reductions are relatively high. The report recommends a strategy with an international focus based on the Kyoto mechanisms (joint implementation and clean development mechanisms, emission trading and the bubble mechanism[1]), thereby allowing for considerably improved cost-effectiveness of its climate policy. Liechtenstein is currently examining its commitment and participation in these international instruments.

National measures are also the subject of further study. It is conceivable that Liechtenstein will adopt appropriate measures from Switzerland's climate policy This could, in the first instance, lead to the introduction of a CO_2 tax beginning in 2004, should the voluntary measures envisaged for Switzerland prove ineffective.

Other activities

Adaptation measures

It is difficult to translate the effects of global warming into reality in Liechtenstein using modelling principles. Available climate models are not yet able to predict detailed effects at the regional level. Generally speaking, however, the following overall effects may be expected should CO_2 concentrations double: temperatures will rise (particularly in winter) by 2 to 3 degrees, total winter precipitation levels will rise by 10 to 20 per cent, summer precipitation levels will drop, and there will be 10 to 20 fewer days of snowfall per degree Celsius temperature rise in areas over 2,500 metres above sea level.

Strategies for dealing with this new risk differ greatly from sector to sector. With its laws governing nature and landscape, forests and agriculture, Liechtenstein has laid important

1 A "bubble" is an association of States with the same climate-related goals that have come together on the basis of agreements to pursue these goals. The member States of the European Union constitute one such "bubble".

groundwork for sustainable cultivation. Important activities are also being conducted in the tourism sector, where a new law seeks to establish sustainable tourism structures.

Financial resources and technology transfer

Liechtenstein participates in a number of projects run by the United Nations and the Council of Europe as part of its international humanitarian aid programme, and also cooperates closely with aid organizations in the neighbouring countries, for example, 'Hilfswerk Österreich' in Austria.

On this basis, Liechtenstein provides support for development programmes. New guidelines and criteria for providing support to such projects were developed in 1998. Liechtenstein has a long history of involvement in social work. In this respect, its activities centre around poverty eradication, peace-building, rural development, small business promotion, training and education, health and improvement of the status of women.

International humanitarian aid is funded out of the national budget. In 2000, as part of its development cooperation activities, Liechtenstein disbursed 10.4 million Swiss francs, equivalent to 1.5 per cent of total national expenditure. It also contributes some 200,000 CHF annually to international organizations.

Research and systematic observation

Liechtenstein does not have its own institutes for basic research, and therefore provides support for research activities in other countries (Switzerland, European Union research programmes, Interreg programmes, etc.). Its government agencies are also indirectly committed to activities in the area of technology. The Liechtenstein Technical University for Technology, Economics and Design provides training in this area with a budget that totalled 4.2 million CHF in 1999.

Liechtenstein compiles various types of climate data, on the one hand through its own measuring stations, and on the other hand, through interregional cooperation, in particular with Switzerland. However, Liechtenstein does not have any large measuring stations as such which input their data into a network such as GCOS. International cooperation, in particular with Switzerland, also plays an important role in this area.

Education, training and public awareness

Liechtenstein promotes sustainable mindset and behaviour through various activities conducted in schools, among the public, in cooperation with non-governmental organizations (NGOs) and within the framework of specific programmes, such as:

- Appointment of environmental focal points in schools and organization of ‘environment days’;
- Environmental conservation calendars and various public information events at the municipal and national levels;
- Collaboration with the Liechtenstein Society for Environmental Protection and various other NGOs and regional networks.

2. National Circumstances

2.1. Geography and economy

Geographical position

The Principality of Liechtenstein covers an area of 160 km^2 and lies 47°02' to 47°16' north and 9°28' to 9°38' east in the centre of Europe, between Austria and Switzerland. The transport hubs joining Munich and Milan, and Zurich and Vienna cross each other close to Liechtenstein. Nevertheless, Liechtenstein's road system has no highways, only regional roads. The natural border with Austria is marked by the Alps, an elevated mountain range in the east, while the Rhine river marks the border with Switzerland. Two thirds of the country is mountainous terrain, while the remaining third consists of the heavily settled Rhine valley, where 9 of the country's 11 municipalities are to be found.

Climate

Liechtenstein has a continental climate, that is, it experiences considerable weather variations in the course of the year. The average temperature in the capital Vaduz, located at 433 metres above sea level, is 9.6°C. Average precipitation has not changed appreciably in the last 20 years, fluctuating by approximately 900 mm annually in Vaduz.

Population

In late 1999 the population of Liechtenstein stood at 32,400. One third were nationals of other countries (in particular, Switzerland, Austria and Germany). Population density for 1999 was 202.6 inhabitants per square kilometre, or approximately 500 inhabitants per square kilometre in the densely settled Rhine valley.

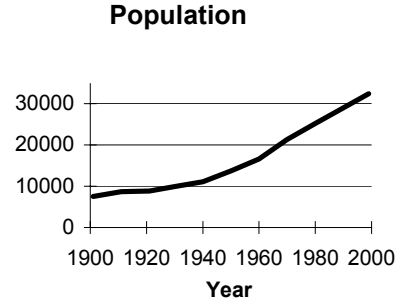

Figure 2-1: Development of population, 1900–1999 (AfV, 1999)

Land use

Liechtenstein covers an area of approximately 160 km^2, of which forested areas account for 43 per cent, meadows and farmland 32 per cent, built-up areas 13 per cent, and fallow land 12 per cent. From 1950 to 1990, built-up areas more than doubled in size. Transport infrastructure covers almost 2.5 per cent of the country's area. The percentage of land under cultivation fell by 15 per cent between 1955 and 1995.

Economy: GDP

In 1998 Liechtenstein's nominal GDP stood at 3.6 billion CHF. Before that, data was calculated using a different method, so that no direct comparison is possible. Skilled trades and industry account for 64 per cent of GDP, and banking and insurance for 20 per cent. Real GDP has risen gradually since the 1960s. Figure 2-2 shows the difference in the evolution of nominal and real GDP between 1960 and 1998.

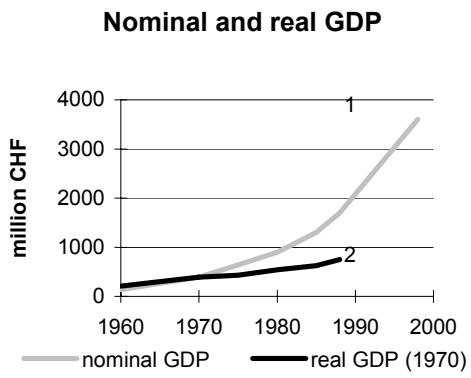

Figure 2-2: Nominal and real GDP (1970s prices), 1960–1999 (AfV, 1999)

From the 1960s to 1998, nominal GDP rose steadily per capita (full-time positions). In 1998 it exceeded 169,000 CHF per full-time position.

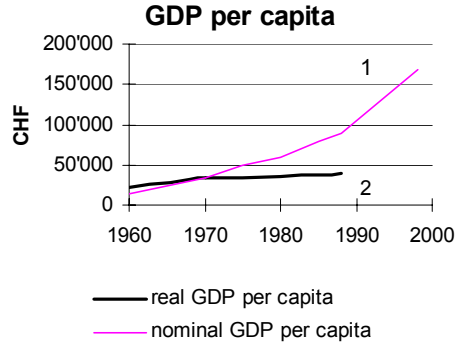

Figure 2-3: Nominal and real GDP per capita (1970s prices) from 1960 to 1998 (AfV, 1999)

Unemployment in 1998 stood at 2.6 per cent. Sixty per cent of Liechtenstein's work force are foreign nationals, two thirds of them commuters from Austria and Switzerland.

Energy supply

Liechtenstein has no fossil fuel resources of its own. It provides only 8.6 per cent of the energy it uses (AfV, 2000). From 1965 to 1998, gasoline and diesel consumption rose by a factor of 3.3, while electricity consumption rose by 5.4. Overall per capita energy use has risen by 60 per cent since 1970 and annual consumption now stands at 36.1 MWh per capita.

Energy productivity has remained constant over the last decade, that is, the per capita energy index and the per capita GDP index have both risen steadily.

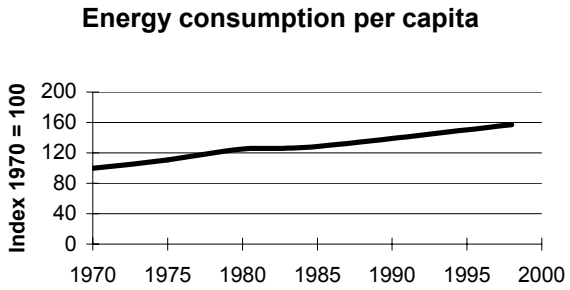

Figure 2-4: Per capita energy end-use index from 1970 to 1998 (1970 = 100) (AfV, 1999)

Energy prices

Liechtenstein does not have any statistics of its own on the evolution of energy prices. Figures for Switzerland should, however, be comparable. From 1970 to 1993, the prices of energy sources fell, generally speaking, and have now reached an all-time low. Liechtenstein has only been using natural gas since 1990.

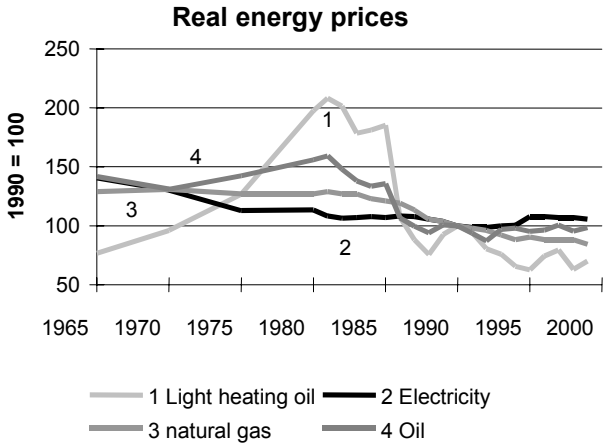

Figure 2-5: Real energy prices for the principal energy sources for the retail trade and household use (1990 =100) (BfE, 2000)

Trade in electricity

In 1999, electricity output to the country's network stood at 300 GWh. Approximately three quarters of the electricity consumed in Liechtenstein came from other countries. The country produces approximately 75 GWh on its own, of which 4 GWh are produced in its nine block heating plants, while the rest is produced in hydroelectric plants. Electricity consumption has risen by 50 per cent in the last decade (LKW, 2000).

Transport

The most important transport network in Liechtenstein is the road system. Apart from the Feldkirch–Buchs route of the Austrian railway company (ÖBB), there are no other rail networks Public transport is provided by an extensive bus network. Liechtenstein has no highway network of its own, since there is already a highway running along the Swiss side of its border with Switzerland, and there is little room for a highway within Liechtenstein itself.

Heavy goods traffic consists mainly of internal or cross border traffic (96 per cent); transit traffic accounts for only 4 per cent. Two thirds of all vehicles are foreign-made. In 1999 trucks travelled a total distance of approximately 5 million kilometres, while passenger cars covered 134 million kilometres.

The number of passenger cars has quadrupled in the last 30 years. In 1998, there were 21,000 cars in use in Liechtenstein, that is, 0.65 cars per inhabitant. There has been a trend towards larger, heavier cars.

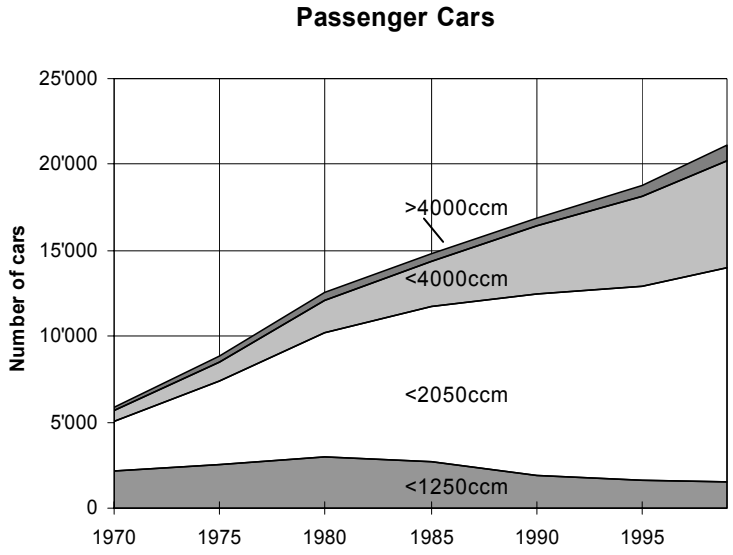

Figure 2-6: Registered passenger cars by cubic capacity (AVW, 1999) (under 1250 cm^3, 1250–2050 cm^3, 2050–4000 cm^3, over 4000 cm^3)

2.2. Political structure in Liechtenstein

2.2.1. Organization

Liechtenstein is a constitutional hereditary monarchy with democratic and parliamentary traditions. The power of the State rests in the Prince and in the people. The 25-member Diet or Parliament is elected every four years by the people. The Diet makes proposals to the Prince regarding candidates to form the Government or Cabinet. Laws tabled by the Diet must be approved by the Prince in order to be promulgated.

2.2.2. Direct democratic rights

In accordance with the Constitution of Liechtenstein, the people exercise their rights directly through elections and referendums, and may, under other democratic rights, submit initiatives and

referendums on different laws and on the Constitution. Participation in elections and referendums is compulsory. The Prince, the Diet and eligible voters are entitled to propose initiatives on laws. (Initiatives pertaining to laws require 1,000 signatures or three municipalities; initiatives pertaining to the Constitution require 1,500 signatures or four municipalities.) The Constitution of Liechtenstein provides for referendums on international treaties, laws, finances and the Constitution itself (for laws and finances, 1,000 signatures or three municipalities; for the Constitution and international treaties, 1,500 signatures or four municipalities). A system providing for optional referendums on international treaties was introduced in 1992. (www.firstlink.li)

2.2.3. Relations with Switzerland

Liechtenstein and Switzerland are partners in a customs and monetary union governed by a customs treaty. On the basis of this union, Switzerland formulates all foreign trade strategies, with few exceptions, such as trade with the European Economic Community, of which Liechtenstein is a member.

The customs treaty impacts greatly on environmental and fiscal strategies. Many Swiss taxes (for example, transport or environmental taxes) and regulations for special goods (for example, environmental standards) are also adapted and applied in Liechtenstein.

2.2.4. Liechtenstein and the European Union

Since joining the European Free Trade Association (EFTA) in 1991 and the European Economic Area (EEA) in 1995, Liechtenstein has implemented European Union (EU) legislation and has taken part in various EU programmes. Several projects and activities under the EU's former COMETT and ERASMUS training programmes have been successfully completed. Liechtenstein joined the Fifth Framework EU Programme for Research and Technical Development (1998–2002).

References:

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AVW (Amt für Volkswirtschaft), 1999, Statistisches Jahrbuch 1999, Vaduz.

BFE (Bundesamt für Energie), 2000, Statistique globale suisse de l'énergie 1999, Bulletin SEV/VSE, Nr 16/2000, Bern.

LKW (Liechtensteinische Kraftwerke), 2000, Geschäftsbericht 2000, Schaan.

www.firstlink.li (official website of the Principality of Liechtenstein).

3. GHG-inventory information

The standardized and technical inventory information, as given by the guidelines on preparing national reports by Annex 1 States parties and the revised IPCC guidelines for national greenhouse gas inventories (UNEP/WMO/IPCC, 1996), are reproduced in the annex to the present report. This section presents in detail and analyzes inventory data: principal sources (section 3.1), emissions trends since 1990 (section 3.2) and the role of CO_2, CH_4 and N_2O in Liechtenstein's current emissions situation on the basis of 100-year GWP values (section 3.3).

3.1. Overview of sources and sinks

3.1.1. Methodology

Work is currently under way to establish a climate inventory for the Principality of Liechtenstein. This involves, in particular, the elaboration of an emissions register for air pollutants. Comprehensive data is available only for individual sectors. The data below (as well as those for 1990 and 2010) is therefore based on estimates. The following tables show the main actions taken and the underlying assumptions.

Area	Procedure	Data quality
Energy-related processes (excluding transport)	Fuel sales statistics by energy sources (heating oil, natural gas, wood, liquid gas) and emissions factors as in Switzerland Assumption that distribution by sector for all fuels is similar to that for gas	For natural gas: Good For other fuels: Average
Transport	Detailed calculation of emissions by traffic link (based on results of traffic models and detailed estimates of emissions factors)	Good
Fugitive emissions	Gas loss estimates	Poor
Solvent use	Estimates of the most important activities and use of emissions factors as in Switzerland	Average
Agriculture	Data on activities (in particular, on livestock and land, and emissions factors as in Switzerland). Gross estimate of soil use	Good Soil emissions: Poor
Land use and forestry (sinks)	Gross assumption of equilibrium (CO_2 emissions for biomass estimated on the basis of figures for Switzerland)	Poor
Waste	Emissions from waste incineration by State authorities: none Emissions from illegal waste incineration (0.75% of waste generated)	Good

Table 3-1: Overview of the most important methods used in elaborating the GHG inventory

3.1.2. CO_2

In 1999, Liechtenstein produced a gross total of 196.19 Gg[2] in CO_2 emissions, or 6.05 tonnes per capita. Approximately one quarter (26 per cent) of these emissions were generated in the transport sector. Industry accounted for 20 per cent. Other sources, such as the service sector, public authorities and residences, accounted for 44 per cent of emissions, while still other sources such as agriculture and waste were insignificant.

Forests were not previously considered CO_2 sinks. This means that the balance (CO_2 fixation in the forests and emission through rotting and burning) is now increasing somewhat.

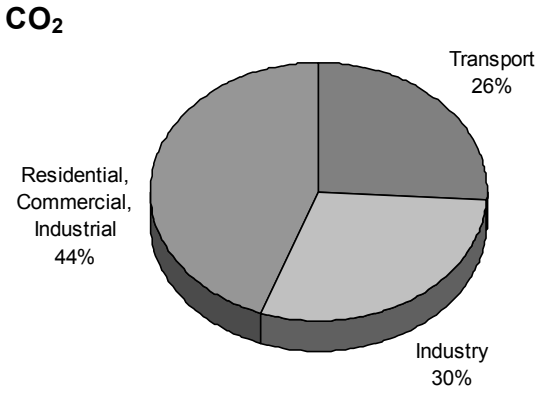

Figure 3-1: 1999 CO_2 emissions by sector

3.1.3. CH_4

Total CH_4 emissions for 1999 stood at 0.7087 Gg. Approximately 90 per cent of this was generated by agriculture, with two thirds caused by ruminants. Other sources such as the service sector, public authorities, residential and waste account for 8 per cent. The small amount of CH_4 generated through the waste sector may be explained by the fact that Liechtenstein's waste is incinerated in Switzerland (Buchs waste incineration centre) and as such is not included in the inventory.

2 1 Gg = 1,000 tonnes.

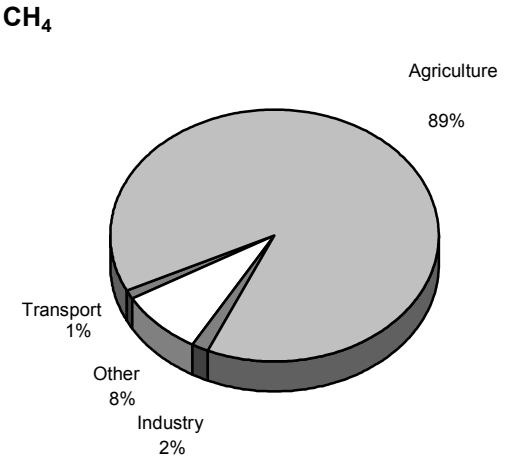

Figure 3-2: 1999 CH_4 emissions by sector

3.1.4. N_2O

About two thirds of the 0.023 Gg of N_2O emissions for 1999 came from agriculture. Another important source was transport, which accounted for 27 per cent of these emissions.

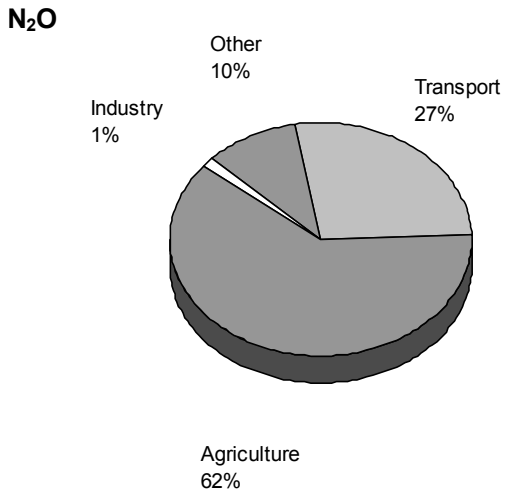

Figure 3-3: 1999 N_2O emissions by sector

3.1.5. Other greenhouse gases (HFC, PFC, SF_6)

Emissions of HFC, PFC and SF_6 have been of only marginally significance in Switzerland to date (approximately 1 per cent of total gross GHG emissions). Similar figures should apply to Liechtenstein. Work is currently under way to compile comprehensive, reliable emissions statistics. There are no estimates available.

3.1.6. Precursor gases and SO_2

Precise emissions data for NO_x, CO, NMVOCs and SO_2[3] is available only for the transport sector. The following table shows emissions for all transport-relevant gases.

Energy source	**Emissions category**	**CO_2 (Gg)**	**CH_4 (Gg)**	**N_2O (Gg)**	**CO (Gg)**	**NO_x (Gg)**	**NMVOC (Gg)**	**SO_2 (Gg)**
Gasoline	Exhaust	*37.96*	*0.0084*	*0.0060*	*1.158*	*0.091*	*0.119*	*0.0048*
	Evaporation						*0.037*	
Diesel	Exhaust	*13.25*	*0.0004*	*0.0005*	*0.034*	*0.126*	*0.017*	*0.0028*
Total		**51.21**	**0.0088**	**0.0065**	**1.192**	**0.217**	**0.173**	**0.0076**

Table 3-2: Emissions in the transport sector,1999

3.1.7. 1999 summary

IPCC	Sources/sinks Category	CO_2 (Gg)	CH_4 (Gg)	N_2O (Gg)	HFC/ PFC/ SF_6	NO_X 2) (Gg)	CO2) (Gg)	NMVOC2) (Gg)	SO_2 2) (Gg)
1	All energy Fuel combustion 1) Fugitive emissions	196.11 (196.11) (NE)	0.0669 (0.038) (0.029)	0.0074 (0.0074) (NO)	NE	0.091 (0.091) (NO)	1.158 (1.158) (NO)	0.173 (0.136) (0.037)	0.0076 (0.0076) (NO)
2	Industrial processes	NO	NO	NO	NE	NE	NE	NE	NE
3	Solvent use	NO	NO	0.0015	NE	NE	NE	NE	NE
4	Agriculture	NO	0.6403	0.0147	NE	NO	NO	NO	NO
6	Waste	0.08	0.0015	0.0004	NE	NE	NE	NE	NE
	Gross total emissions	**196.19**	**0.7087**	**0.0239**	**NE**	**0.091**	**1.158**	**0.173**	**0.0076**
5	Land use and forestry	0.00	NE	NE	NE	NE	NE	NE	NE
	Net total emissions	**196.19**	**0.7087**	**0.0239**	**NE**	**0.091**	**1.158**	**0.173**	**0.0076**
	International bunkers	NO	NO	NO	NE	NO	NO	NO	NO

1) including transport
2) transport only
NE not estimated
NO not occurring

Table 3-3: Overview of emissions and sinks for 1999 (categories based on the IPCC short summary table)

3 Unlike the precursor gases, SO_2 is not a climate-altering gas. SO_2 emissions even have the opposite effect.

3.2. Recent emissions trends

Figure 3-4 shows emissions trends for the three major GHG-emissions for the period from 1990 to 1999.

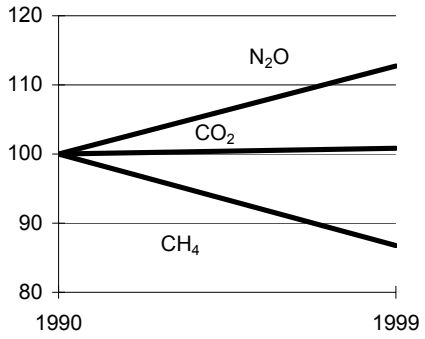

Table 3-4: Index of total CO_2, CH_4 and N_2O emissions for the period from 1990 to 1999 (1990=100)

3.2.1. CO_2

CO_2 emissions stood at 194.56 Gg in 1990, and have risen only slightly (0.8 per cent) since then. The fluctuation of these levels from year to year may be explained, for the most part, by changing weather conditions (changes in the number of degree days per year) and inaccuracies in calculating fuel sales figures. These factors that are due to nature or are beyond researchers' control must be taken into account in comparing agreed targets and results.

At 196.19 Gg, CO_2 figures for 1999 were very close to 1990 levels. Liechtenstein has therefore reached its goal of stabilizing CO_2 emissions levels for the period 1990–2000. This success is due to two factors: climate-related policy measures and implementation measures (see section 4).

3.2.2. CH_4

Calculations show that CH_4 emissions fell from 0.82 Gg in 1990 to 0.71 Gg in 1999, that is, a drop of over 13 per cent. This trend was due mainly to changes introduced in the agriculture sector, where there is a strong correlation between livestock numbers and CH_4 emissions.

3.2.3. N_2O

Emissions of N_2O have risen slightly from 0.021 Gg in 1990 to 0.024 Gg in 1999. This relative stability is the result of two contrasting trends. Whereas emissions from the agriculture sector are decreasing, emissions caused by transport are on the rise, owing to the use of catalytic converters in passenger vehicles.

3.2.4. Precursor gases and SO_2

Comparison data is only available for the transport sector. Improved exhaust gas technologies (in particular, catalytic converters) and reduced fuel sulphur content have brought about a drop in emissions levels during the period 1990–1999 as follows:

CO	down 45 per cent
NO_x	down 37 per cent
NMVOCs	down 62 per cent
SO_2	down 53 per cent

3.3. Overall emissions

3.3.1. CO_2 equivalents by gas

Gross total emissions of GHGs in Liechtenstein for 1999 stood at 218.47 Gg in CO_2 equivalents, based on 1995 GWP values with a 100-year perspective (UNEP/WMO/IPCC, 1996).

There were no significant differences in the proportion of the various greenhouse gases in total emissions levels as compared to 1990 figures.

Gg CO_2 equivalents	CO_2	CH_4	N_2O	Total
Gross emissions 1990	194.56	17.14	6.55	218.26
Percentage	*89.14%*	*7.86%*	*3.01%*	*100*
Gross emissions 1999	196.19	14.882	7.395	218.47
Percentage	*89.80*	*6.81*	*3.38*	*100*

Table 3-5: 1999 emissions by gas in CO_2 equivalents

3.3.2. CO_2 equivalents by sector

The following sectors are important for total emissions in CO_2 equivalents: transport (24 per cent), industry (27 per cent) and agriculture (8 per cent). Waste and solvents are not relevant. The remaining sectors (public authorities, services and residences) are not treated individually.

The energy sector (fuels) accounts for 91 per cent of emissions in CO_2 equivalents.

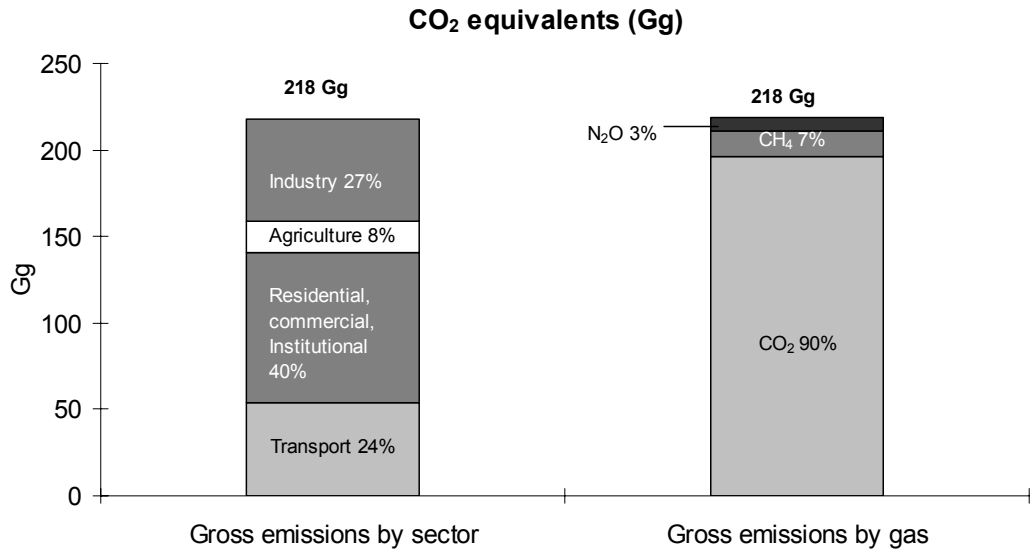

Figure 3-4: 1999 Emissions in CO_2 equivalents by sector and by gas

References:

1999 National Greenhouse Gas Inventory for Switzerland.

UNEP/WMO/IPCC, 1996, IPCC Guidelines for National Greenhouse Gas Inventories, vols. 1–3.

UNEP/WMO/IPCC, 1996, Climate Change 1995, The Science of Climate Change.

4. Policies and measures

4.1. Climate-related policy areas in Liechtenstein

Liechtenstein's climate policy is heavily entrenched in its other sectoral policies, with the main focus on its policies in the areas of energy, the environment, transport, agriculture and forestry. In all of these areas, measures have been taken which help to reduce the levels of GHG-emissions.

International cooperation is of great importance, given the small size of the country. Relations with Switzerland are particularly important. Liechtenstein's customs treaty with that country facilitates cross-border activities and bilateral operations in several areas, so that Liechtenstein has in many cases implementation regulations that are similar to those applicable in a Swiss canton (e.g., mineral oil taxes, regulations governing ecologically relevant substances). Accordingly, most policy areas are closely linked to Swiss policy in terms of both content and implementation.

Liechtenstein has set itself the goal of sustainability for its policies. The Government model (1995) calls for conservative use of resources, preservation of the quality of life and the introduction of sustainable policy, while affirming that the Government should contribute towards finding a solution to global environment problems. The most recent government programme makes climate a priority policy area. These fundamental issues are explored in greater depth in the new development, national and guideline planning schemes.

A proposal currently before the Parliament calls for the elaboration of CO_2 legislation. In practical terms, there is a tendency towards Swiss practice (the Swiss CO_2 Act). Because of its close economic ties with Switzerland, it is envisaged that Liechtenstein will probably introduce a CO_2 tax in 2004 similar to that planned in Switzerland.

4.1.1. Environmental policy

Liechtenstein has deliberately avoided introducing specific legislation on the environment. Appropriate provisions are to be found in the policies governing the various sectors. As regards the technical implementation of those provisions, Liechtenstein is often bound by the terms of its customs treaty with Switzerland (e.g., substances regulations, VOC taxes, SO_2 taxes – see section 4.3). Air pollution targets are also the same as in Switzerland.

Two pieces of legislation govern environmental and climate policy in Liechtenstein:

The **Air Pollution Prevention Act (1985)** regulates, inter alia, emission targets for stationary installations, maximum air pollution levels, measures to be taken if emission targets are surpassed, as well as fuel requirements. Important factors are the polluter pays principle and an obligation to create public awareness in this area. The Ordinance accompanying the Air pollution Prevention Act was amended in 1999 to establish new requirements for gasoline and diesel oil and to set a new target for fine airborne dust particles. The average annual value for sulphur dioxide (threshold value) was reduced from 30 mcg/m^3 to 20 mcg/m^3. Under the terms of this Ordinance, leaded gasoline is no longer permitted as of 1 January 2000, the allowable lead content for unleaded gasoline has been reduced from 0.013 g/l to 0.005 g/l, and the proportion of carcinogenic benzol in gasoline has been reduced from 5 per cent to 1 per cent. The sulphur content for diesel has been reduced from 0.5 g/kg to 0.35 g/kg.

The **Waste Prevention and Removal Act (1998)** establishes a sorting requirement for different types of waste. The Government is empowered to pass ordinances on recycling certain categories of waste if such recycling will serve to improve the ecological balance. This law is also based on the polluter pays principle. Generally, almost none of the waste generated is deposited in reactor dumps. All garbage is incinerated in the waste incineration plant in Buchs, in neighbouring Switzerland.

4.1.2. Energy policy

The legal foundation for the goal of conserving energy was laid within the energy regulations in 1993 and expanded in 1996. The following are the key elements in this area:

1) Guidelines for installations such as heating systems (heat insulation regulations), air conditioning systems, ventilation systems, as well as the maintenance of such systems. These measures are set out in the revised Construction Act and its Ordinances.
2) An energy commission advises the Government on energy policy issues, providing its opinion on all basic energy policy issues. The commission brings together experts from all relevant fields (architecture, energy management, industry, trade, government offices, environmental organizations).
3) An energy division has been set up at the Office of the Economy to advise the municipalities and the private sector on all aspects of energy conservation. The division also provides technical and organizational processing of subsidy applications, and develops and implements energy policy models, as well as providing public information through lectures, radio discussions and face-to-face encounters.
4) The promotion of energy conservation is a central pillar of Liechtenstein's energy policy. Financial support is provided to facilitate energy saving in buildings, particularly as regards the renovation of old buildings, residential technical installations, block heating plants (natural gas and wood) and solar collectors. Liechtenstein is almost at full capacity as regards wood-chip heating systems.

4.1.3. Transport policy

Liechtenstein's transport policy is driven by the principles of sustainability. In signing the Transport Protocol to the Alpine Convention, to be ratified in 2001, Liechtenstein has established a legally binding basis for action in this area. To reverse the trend towards increasing traffic, the Government has developed or implemented a number of projects (development of the Liechtenstein Bus Authority and the 'Liechtenstein-Takt' train service, priority for buses at traffic signals, tax exemptions for solar-, hybrid-, electric- or natural-gas-driven vehicles, safety measures at school crossings, the 'Aktion Mobilität' initiative, studies aimed at ensuring the sustainable evolution of the transport sector).

Freight transport policy has a pivotal role to play, in that Liechtenstein, following Switzerland's example, has introduced, as of 1 January 2001, a system of charges on heavy goods vehicles depending on their service category. These charges are based on the polluter pays principle and are determined by the distance travelled and the gross weight of the vehicle. This serves to increase productivity as regards road traffic and also helps to divert freight traffic from the roads to the railways, thereby easing the burden on Liechtenstein's roads.

Under the terms of the customs treaty with Switzerland, Liechtenstein also contributes to importers' efforts, in accordance with Swiss regulations, to reduce use of specific fuels, and is obligated to declare the use of such fuels under EU guidelines.

4.1.4. Agriculture

Agriculture in Liechtenstein is devoted mainly to animal husbandry (70 per cent of revenue). Liechtenstein promotes the trend towards more eco-friendly agriculture with the aim of maintaining the productive capacity of the soil, as well as keeping pollution at a minimum. Environmentally sound agriculture production systems, be they low input or organic farming, are specifically targeted and promoted. Preservation of the landscape is also considered as a responsibility of the agriculture sector which will become more and more significant in future.

The Act on direct subsidies and the Act on ecological incentives for eco- and animal-friendly agricultural production (Compensation Act) and its accompanying Ordinance provide the framework for promoting the management of nature-friendly living spaces, of fields on moors and mixed soils, and of environment-and animal-friendly industry. As regards infertile lands, which it is particularly important to preserve from the point of view of nature conservation, require even greater efforts for ecological management. Parallel to Switzerland's efforts (2002 agricultural policy), new guidelines for environmentally sound and animal-friendly industry have been introduced. About four fifths of Liechtenstein's agricultural producers follow low input or organic farming guidelines. Direct subsidies are therefore paid only when production conditions conform to animal and environmental protection provisions. The use of agricultural aids (fertilizers, pesticides) is strictly regulated; use of these substances (with the exception of manure) in forested or Alpine areas is prohibited.

A new law providing for the prevention of water pollution (comparable to Switzerland's provisions in this area) will determine threshold livestock numbers (GVE) per surface area unit when it is introduced in 2002.

4.1.5. Forestry

Liechtenstein's forested area is of great significance to the country. Forests cover 43 per cent of the country's area, and this proportion is increasing. Sustainable forest management has therefore been afforded a high level of priority since as far back as the forestry regulations of 1865. Efforts in this area are aimed at sustainable forest management, conservation of existing forest stands and the promotion of nature-friendly forest management, on the basis of the current Forests Act (1991) and international conventions, inter alia, the 1993 Ministerial Conference on the Protection of Forests in Europe. For example, felling of timber is not permitted, and, if an exception is made, an area equivalent to that cleared must be afforested in the same place. Such efforts have made it possible in recent years to improve biological diversity in forest areas. Liechtenstein has an increasingly large area of forest reserves: one quarter of all its forested areas are reserves.

In June 2001 a national forests programme was announced, which represents Liechtenstein's response to its international obligations to promote sustainable forest management. With a view to meeting Liechtenstein's sustainable development goals, the National Forests Programme provides the conceptual framework for the implementation of forest management measures. In particular, the National Forests Programme encompasses the following principles: respect for national sovereignty and responsibility for its own use of resources, compliance with domestic legislative provisions, compliance with obligations under international conventions and agreements, establishment of partnerships and participation by all interested groups, a global approach to forest conservation and management and choice of a long-term, iterative planning, implementation and monitoring process.

All of Liechtenstein's forested areas have met the criteria established by the Forest Stewardship Council (FSC) and have therefore received FSC certification (SGS-FM/COC-0764).

4.1.6. International cooperation

International cooperation is a key element of Liechtenstein's climate policy, since it creates synergies important for the country, given its small size and limited capabilities. Mention has already been made of Liechtenstein's commitment in the area of international climate policy and

its relations with Switzerland. As regards environmental policy, the following cooperation measures also play a crucial role:

- In 1983, Liechtenstein ratified the Convention on Long-range Transboundary Air Pollution, and between 1986 and 1998 it ratified five of the eight Protocols thereto: the Protocol on the Reduction of Sulphur Emissions or Their Transboundary Fluxes by at least 30 per cent in 1986, the Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) in 1987, the Protocol concerning the Control of Nitrogen Oxides or Their Transboundary Fluxes and the Protocol concerning the Control of Emissions of Volatile Organic Compounds or Their Transboundary Fluxes in 1994, and the Protocol on Further Reduction of Sulphur Emissions in 1997. It also signed the Protocol on Heavy Metals and the Protocol on Persistent Organic Pollutants in 1998, and the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone in 1999.
- In 1989 Liechtenstein became a party to the Vienna Convention, and also ratified the Montreal Protocol. Subsequently it ratified the London Amendment in 1994 and the Copenhagen Amendment in 1996. It also expects to ratify the Montreal Amendment and the Beijing Amendment.
- Liechtenstein is a party to the Alpine Convention, which is a framework convention for the protection and sustainable, environmentally sound development of the Alpine region. The Convention was signed in Salzburg on 7 November 1991 by the seven States in the Alpine area (Austria, France, Germany, Italy, the former Yugoslavia, Liechtenstein and Switzerland) as well as the European Community. Monaco acceded to the Convention by means of an Additional Protocol. The Alpine Convention entered into force on 9 March 1995.
- In 1998, Liechtenstein ratified the Convention on Environmental Impact Assessment in a Transboundary Context.
- In May 2001 Liechtenstein signed the convention providing for the reduction and elimination of 12 persistent organic pollutants (POPs Convention).

4.2. Summary tables of measures

The following tables provide an overview of the principal measures, implemented and planned, in Liechtenstein.

The following sections will deal in greater detail with the most important measures.

Policy/Measure	Goals/Orientation	GHG's affected	Type of Instrument	Status	Implementing Agency	Implementation Indicators
a) Energy						
Energy Conservation Act	Promotion of the renovation of old buildings, heating systems (wood, solar energy, heat pumps), renewable energies and demonstration installations	CO_2	Fiscal measure (subsidy)	In effect since 1996	Office of the Economy	Replacement of approx. 850,000 litres of heating oil annually
Photovoltaic promotion programme	Promotion of approx. 20 photovoltaic installations – 8,500 CHF/kWh	CO_2	Fiscal measure (subsidy)	Introduced on 1.7.2001 (for a two-year period)	Office of the Economy	Demonstration effect: approx. 55,000 kWh of electricity annually
Heating regulations	Ban on electrical heating systems and heating of outdoor areas and ramps Heating cost deductions (determined by consumption) Periodic monitoring of ventilation systems	CO_2	Regulation	In effect since 1993 Provisions to be tightened in late 2001	Building Surveyor's Office	
Heat insulation regulations	Planning of buildings and installations must, as far as possible, aim to conserve energy (minimum insulation value) in accordance with Ordinance/SIA Norm 380/1	CO_2	Regulation	Introduced in 1993; new provisions to be introduced in late 2001	Building Surveyor's Office	
The Minergie standard for government buildings	Obligation to undertake all future construction of government buildings in accordance with the Minergie standard	CO_2	Regulation	Foundation in place; to be implemented in 2002	Building Surveyor's Office	Energy savings of 30% per building

Policy/Measure	**Goals/Orientation**	**GHG's affected**	**Type of Instrument**	**Status**	**Implementing Agency**	**Implementation Indicators**
Connection obligations	Establishment of energy supply areas with mandatory connection to a long-distance heating system	CO_2	Planning measure	In effect since 1995 (Energy Act)	Building Surveyor's Office	
b) Transport						
Distance- and weight-dependent heavy goods vehicle fee	Transfer of freight traffic from road to rail and reduction of trans-Alpine road traffic	CO_2 , precursor gases	Fiscal measure (Internalisation of external costs)	Introduced on 1.1.2001	Finance Division	13.6–17.2% expected reduction of truck-kilometres One third of revenue earmarked for the environment and the transport sector
Promotion of solar, electric, gas-driven and/or hybrid vehicles	Exemption of electric, gas-driven and/or hybrid vehicles from the motor vehicle tax	CO_2 , precursor gases	Fiscal measure	In effect since 1999	Office of Motor Vehicles	
Conversion of diesel public buses to natural gas	Introduction of new, natural-gas-driven buses	Precursor gases, CO_2	Investment measure Subsidy (funded through revenue generated through heavy vehicles fee)	Introduced in 2001	Energy Division of the Office of the Economy	Emissions generated by the fleet of buses: (in particular, NO_x, VOCs, PM_{10}, by approx. 40%
Promotion of the use of public transport	Establishment of the Liechtenstein Bus Authority and introduction of the 'Liechtenstein Takt' regional train service	CO_2 , precursor gases	Institutional measure	In effect since 2000	Finance Division	
Emissions regulations	Adoption of European emissions regulations (EURO standards) Fuel regulations	Precursor substances	Regulation	In effect since 1993	Office of Motor Vehicles	Ongoing emissions reduction in road traffic

Policy/Measure	Goals/Orientation	GHG's affected	Type of Instrument	Status	Implementing Agency	Implementation Indicators
Development regulations	Cap on the number of parking places in construction planning if required from a planning perspective	CO_2 , precursor gases	Regulation	Envisaged (beginning 2002)	Building Surveyor's Office	
c) Stationary installations and waste						
Emissions regulations	Emissions regulations for stationary installations (heating, industry)	Precursor gases, CO_2	Regulation	In effect since 1987 Revised in 1992	Office of the Economy	
Waste disposal regulations for the construction sector	Waste: proof of recycling and waste removal plan required before beginning construction	CH_4, CO_2	Regulation	Introduced in 1993 (Ordinance accompanying the Construction Act)	Building Surveyor's Office	
d) Agriculture						
Incentive payments for eco-friendly agricultural practices	Payments to producers, independent of their products, with the aim of inciting them to espouse eco-friendly management methods	CH_4 , N_2O	Fiscal measure (direct payments)	In effect since 1996	Office of Agriculture	
Preservation of agricultural lands	Agriculture: long-term protection of agricultural lands from being used for other purposes	CH_4 , N_2O	Regulation	In effect since 1992	Office of Agriculture	
Water Pollution Prevention Act	Establishment of maximum livestock numbers per unit of area	CH_4 , N_2O	Regulation	Envisaged for 2002	Office of the Environment	
e) Planning						
Energy register	Elaboration of a country-wide energy register	CO_2	Planning measure	Envisaged (beginning 2002)	Building Surveyor's Office	

Policy/Measure	Goals/Orientation	GHG's affected	Type of Instrument	Status	Implementing Agency	Implementation Indicators
Spatial Planning Act	Reconciliation of various user interests	All	Planning measure, regulation	Envisaged (under consideration by Parliament)	National planning	
f) Forestry						
Regulations governing forest management in the Forests Act	Sustainable forest management	CO_2 (sinks)	Regulation	In effect since 1991	Office of Forestry, Nature and Landscape	National forest inventory, 1998
Ordinance regulating the scope and granting of compensation and financial assistance under the Forests Act	Mandated activity	CO_2 (sinks)	Regulation	In effect since 1995	Office of Forestry, Nature and Landscape	National forest inventory, 1998
Ordinance on forest reserves and special areas	Mandated activity	CO_2 (sinks)	Regulation	In effect since 2000	Office of Forestry, Nature and Landscape	National forest inventory, 1998
Forest inventory, 1998, and National Forest Programme (2002–2012)	Binding specifications for future forest exploitation Elaboration of a forest inventory for 2000	CO_2 (sinks)	Planning measure, regulations	Introduced in 2001	Office of Forestry, Nature and Landscape	
FSC certification for all forest areas	Mandated activity	CO_2 (sinks)	Industry planning	Introduced in 2001	Office of Forestry, Nature and Landscape; Forestry industry concerns	Certification report

4.3. Measures implemented

The major, most relevant measures are described below.

4.3.1. Energy

The following measures are at the core of efforts to promote energy conservation:

- Renovation of old buildings:
  Many older buildings have inadequate insulation. Incentive payments of up to 75,000 CHF may be obtained for provision of sustainable heat insulation.
- Residential technical installations:
  For buildings with walls that meet modern insulation requirements, low-consumption or renewable-energy technical installations can lead to better energy savings. State incentives may amount to as much as 20,000 CHF.
- Solar collectors:
  Thermal solar collectors may serve to meet a large part of hot water needs, thereby reducing consumption of heating oil and electricity. The State promotes such installations through contributions of 350 CHF per square metre of such collectors.
- Photovoltaic promotion programme:
  Incentives are provided for electricity-generating installations through contributions of 8,500 CHF per installed output (kW), up to 30,000 CHF. The electricity generated must be stored in the public network. This programme, for the time being, has a limited duration of two years and is run through the Solar Energy Society of Liechtenstein.
- Demonstration installations:
  The Act also provides for the promotion of so-called demonstration installations to promote understanding of energy conservation and the use of new technologies and showcase new technological capabilities.

In 1999, Liechtenstein expended 160,000 CHF on renovations of old buildings, 150,000 CHF on residential technical installations, 165,000 CHF for solar collectors/photovoltaic arrays and 140,000 CHF for demonstration installations. The municipalities make voluntary contributions amounting to half of the State's contribution. Annual expenditure in this area at the national level is approximately 700,000 CHF.

4.3.2. Transport

Distance- and weight-dependent heavy goods vehicle fee

The distance- and weight-dependent heavy goods vehicle fee was introduced on 1 January 2001 at the same time as in Switzerland with the aim of internalizing external costs. The number of kilometres covered is determined using the latest data compilation techniques. The fee applies to vehicles with a gross weight of 3.5 tonnes and over. In the first stage (2001–2005), the fee is 1.6 centimes per kilometre and tonne of gross weight, and will increase to 2.5 centimes in the second stage (beginning 2005). The fee is also determined on the basis of emissions regulations (EURO standards), so that freight companies are encouraged to acquire the most modern vehicles and make full, efficient use of them. This measure also makes goods transport by road more expensive, and therefore leads freight carriers to utilize the railway system more. One third of the revenue generated through this measure – some CHF 1.5 million (expected to double beginning in 2005 when the rates are increased) – is earmarked for environment- and transport-related activities.

Promotion of eco-friendly vehicles

Vehicles with environmentally sound propulsion systems (solar, electric, gas-driven and/or hybrid vehicles) are exempt from the motor vehicles tax. This relatively privileged treatment provides stronger incentives to purchase and use such vehicles.

As a member of the European Economic Area, Liechtenstein has also adopted the European Union transport guidelines. Important elements in this area are the EURO standards (emissions regulations) and the measures aimed at promoting energy-efficient vehicles, in particular the introduction of a labelling system to reduce emissions of CO_2, precursor gases and N_2O.

Promotion of the use of public transport

Public transport is a high priority in Liechtenstein. The schedules have been greatly improved in recent times, in particular as regards cross-border transport (known as the'Liechtenstein Takt'system). A report on transport in Liechtenstein was prepared in 1997 which provided the basis for further improvements in future. Liechtenstein also participates in major long-term planning studies aimed at achieving sustainable development of the transport sector, for example, the studies on "Bodanrail 2020" (Improvement of train service in the greater Lake Constance area) and "Sustainable transport in the upper Rhine valley" (Optimization of cross-border traffic between Liechtenstein, Austria and Switzerland and recommendations for reducing pollution caused by traffic in accordance with the basic principles of sustainability).

4.3.3. Industry and waste

Liechtenstein has no heavy industry of its own and has, in the main, adopted Swiss measures in this area. The following are the principal measures applicable:

- VOC tax: This tax was introduced in 1999 in conjunction with Switzerland. As of 1 January 2000, products containing more than 3 per cent of NMVOCs are subject to a tax of 2 CHF per kilogram. This rate is expected to increase in 2003.
- SO_2 policy: Liechtenstein has adopted Swiss regulations to reduce the sulphur content of fuels (from 0.2 per cent to 0.05 per cent for diesel as of 1994, and from 1.5 per cent to 1 per cent for heavy heating oil as of 1991). Beginning in 1998, it has also been levying an SO_2 tax on light heating oil (with a sulphur content of over 1 per cent).
- Regulations governing hazardous substances: The 1995 Ordinance governs hazardous substances (mainly HFCs, PFCs and SF_6 are climate-relevant). Under these provisions, various substances (in particular in fire extinguishing systems and spray cans) are not permitted. HFC 125 is the only allowed substitute which may be used in spray cans.

4.3.4. Agriculture and forestry

Liechtenstein places great emphasis on nature-friendly forest and soil management. The principal measures adopted in recent years have provided the legal foundation for nature-friendly management (the Forests Act, FSC certification) or have promoted such management through a direct payments system (ecological incentive payments). In addition, information on the status of the forests and areas under cultivation is required. Where land is used for a purpose other than originally intended, an equivalent area of forest or arable land must be made available.

4.4. Measures adopted and planned

The following orientations are especially relevant for future climate policy:

4.4.1. Climate policy

Liechtenstein has commissioned a report (Factor 2000) on its future climate strategy (implementation of the Kyoto Protocol). The findings show that a purely national strategy in this area would be difficult to implement and, given the already high level of climate-relevant measures, the marginal costs for additional reductions are relatively high. The report recommends

an international oriented strategy based on the Kyoto mechanisms (joint implementation and clean development mechanisms, emission trading and the "bubble" mechanism[4]) to greatly improve the cost-effectiveness of Liechtenstein's climate policy. Liechtenstein is currently assessing its commitment and participation in these international instruments.

Measures at the national level are also under study. As mentioned before, it is envisaged that Liechtenstein would implement those climate policy measures in Switzerland that are appropriate to its own context. This could, in the first instance, mean the introduction of a CO_2 tax, should Switzerland's voluntary measures prove to be inadequate.

4.4.2. Energy

Reinforcement of the Construction Act

The implementation provisions of the Construction Act are to be tightened in late 2001. This entails mainly the adoption of Swiss energy regulations. The key element is a ban on electrical heating systems and the heating of outdoor installations, as well as the introduction of heating cost deductions, dependent on consumption, for five or more occupants. These measures allow for considerable improvement in the efficiency of heating systems.

At the same time, a decision is awaited as to whether the Minergie standard (reduction of energy needs by 50 per cent compared to the stated norm) will be introduced for government buildings. Promotion of compliance with the Minergie standard for private buildings is expected in the near future.

The Minergie standard
This standard requires buildings to provide a high degree of comfort, be economically efficient and use little energy. Optimal air quality may be attained by using monitored ventilation systems.

The Minergie standard was developed in conjunction with Switzerland. There are currently regulations in place governing residential properties, hotels and public-sector service buildings. Other areas are expected to be included as of 2001. Liechtenstein will introduce the standard for all new government buildings in the first instance.

Energy Market Act

In 2002 an Energy Market Act will be introduced to liberalize the electricity market. This legislation takes ecological factors into account, providing for exemptions from distribution charges for renewable energies and heat-power coupling systems.

4.4.3. Further measures

The following measures are currently under consideration in Liechtenstein:

- The Spatial Planning Act is currently being examined by the Parliament. The main focus of this new law is to secure sustainable use of the land and communication links. The Spatial Planning Act places much emphasis on and points the way towards the future sustainable development of Liechtenstein.
- A law on the prevention of water pollution is expected to be introduced in 2002 which will establish thresholds for livestock numbers in agriculture, thereby contributing to the reduction of N_2O and CH_4 emissions.

4 A "bubble" is an association of States with the same climate-related goals that have come together on the basis of agreements to pursue these goals. The member States of the European Union constitute one such "bubble".

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5. Projections and total effect of measures

5.1. Methodology

Because of its small size, Liechtenstein does not have a comprehensive system for predicting emissions of GHG-emissions. The projections set out below are therefore based mainly on cross-references and analogous conclusions drawn from Swiss data. Transport is an exception, since an independent, detailed transport forecast is available for this sector. All values refer to the year 2010.

a) Switzerland: basic information for energy-related sectors (excluding transport)

Through its Federal Office of Energy, Switzerland establishes on a periodic basis what are known as energy scenarios, based on detailed values and a "bottom-up" approach introducing new structural projections at intervals. These models are compared to macroeconomic models. The following general assumptions regarding the evolution of major structural parameters are key in this respect.

	1998	2005	2010
World oil prices (US$/bbl)			
real	12.7	16.5	17.0
nominal	112.9	19.0	21.5
Energy prices, Switzerland (real)	(1992)		
Fuel for heating systems (CHF/t)	441	341	351
Fuel for industrial processes (CHF/t)	404	330	339
Electricity (CHF/kWh)	0.159	0.135	0.123
GDP CHF (billions), 1990 prices	329	381	425
Population (millions)	7.1	7.4	7.5

Table 5-1: Key variables for energy scenarios in Switzerland (Source: FOE/Prognos, 2001)

b) Switzerland: basic information for non-energy-related sectors

The remaining projections place emphasis on the Federal Office of Environment, Forestry and Landscape (SAEFL). These emissions projections are based on structural models and forecasts for emissions factors, and are regularly updated. The main findings are based on the related report (1995).

c) Liechtenstein: transport projection

The projections for the transport sector in Liechtenstein are based on a detailed transport model which determines the traffic volumes per road link. For each road link, projection factors were arrived at by means of general structural forecasts. The resulting transport loads were converted into greenhouse gas emission figures using specifically projected emissions factors. The following table shows the main assumptions:

	Growth 1999–2010
Population growth	+ 9.2%
Work force growth	+ 9.2%
GDP growth (real)	+ 21%
Projection factors for different modes of transport	
Passenger cars	+20%
Delivery vans (<3.5 t), Light duty vehicles	+20%
Coaches	+20%
Scheduled buses (public transport)	+5%
Motorcycles	+20%
Heavy duty vehicles (LW, LZ, SZ)	+27%

Table 5-2: Transport projection for Liechtenstein: basic assumptions

5.2. CO_2

a) CO_2 projections

Table 5-3 gives an overview of CO_2 projections for the period 1990–2010. Total emissions are expected to increase by 1.6 per cent between 1990 and 2010, due mainly to a strong increase in transport. During the same period, CO_2 emissions from transport will increase by some 9 per cent.

CO_2 (Gg)	**1990**	**1999**	**2010**
Energy	194.49	196.11	197.67
Transport	*51.90*	*51.21*	*56.51*
Industrial processes	NO	NO	NO
Solvent use	NO	NO	NO
Agriculture	NO	NO	NO
Land use and forestry	0.00	0.00	0.00
Waste	0.07	0.08	0.09
Total emissions	**194.56**	**196.19**	**197.76**

Table 5-3: CO_2 projections, 1990–2010

b) Overall effects of measures

The results set out above reflect the evolution under the assumption that the measures implemented (see section 4) prove to be effective (Implemented Measures scenario). If the planned measures (in

particular the introduction of a CO_2 tax) were also taken into account, emissions could indeed be reduced to 1990 levels. However, detailed calculations for the quantitative aggregate impact of the various measures are not available.

5.3. CH_4

Methane emissions in Liechtenstein are caused mainly by the agriculture sector, which has constantly accounted for approximately 90 per cent of emissions during the period 1990–2010. Fugitive emissions, the second largest source of emissions, are included in the table below under Energy. These emissions have to do with gas loss through the natural gas distribution network.

Table 5-4 shows the changes in methane emissions in the various sectors from 1990 to 2010. Overall, emissions have dropped by 16.5 per cent over the 20 years, largely due to the agriculture sector (down 19 per cent). Reduction of methane emissions from agriculture is linked to the reduction in livestock numbers. The largest drop has been in the transport sector (79 per cent). However, given the fact that emissions in this sector account for only a small proportion of total emissions (1.3 per cent in 1999), this considerable drop has little effect. Energy, and in particular fugitive emissions, account for 15 per cent more of total emissions during the period 1990–2010, due to increased use of natural gas (approximately 9 per cent for 1999–2010).

CH_4 (Gg)	**1990**	**1999**	**2010**
Energy	0.052	0.067	0.062
Transport	*0.019*	*0.009*	*0.004*
Industrial processes	NO	NO	NO
Solvent use	NO	NO	NO
Agriculture	0.763	0.640	0.618
Land use and forestry	0.000	0.000	0.000
Waste	0.001	0.001	0.002
Total emissions	**0.817**	**0.709**	**0.682**

Table 5-4: CH_4 projections, 1990–2010

5.4. N_2O

Table 5-5 shows a steady pattern of total N_2O emissions for 1990 and 2010. In 1999, levels surpassed peak levels to reach 0.0239 Gg. The principal source of N_2O emissions is agriculture (61.5 per cent in 1999), where the levels have remained more or less constant over the years. Changes in total emissions have been due mainly to transport. The increase seen up until 1999 (a 65 per cent increase between 1990 and 1999) may be explained by the mandatory use of catalytic converters in passenger vehicles.

N_2O (Gg)	1990	1999	2010
Energy	0.0049	0.0073	0.0050
Transport	*0.0038*	*0.0063*	*0.0039*
Industrial processes	NO	NO	NO
Solvent use	0.0013	0.0014	0.0015
Agriculture	0.0147	0.0147	0.0143
Land use and forestry	0.0000	0.0000	0.0000
Waste	0.0004	0.0004	0.0006
Total emissions	**0.0212**	**0.0239**	**0.0214**

Table 5-5: N_2O projections, 1990–2010

5.5. Aggregate projections

Figure 5-1 and table 5-6 represent the aggregate effect of GHGs. Values for CO_2, CH_4 and N_2O emissions are expressed in CO_2 equivalents. Generally speaking, GHG emissions have remained constant (an increase of 0.43 Gg or 0.2 per cent over a 20-year period). The 1 per cent increase in CO_2 emissions has been offset by the 20 per cent decrease in CH_4 emissions.

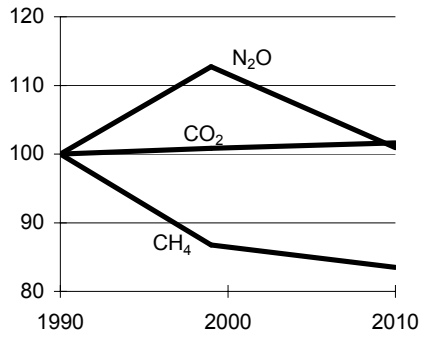

Figure 5-1: Evolution of various GHG-emissions (Indexed: 1990 = 100)

Sectors	CO_2 (Gg)			CH_4 in CO_2 equivalents (Gg)			N_2O in CO_2 equivalents (Gg)			Total emissions in CO_2 equivalents (Gg)		
	1990	**1999**	**2010**	**1990**	**1999**	**2010**	**1990**	**1999**	**2010**	**1990**	**1999**	**2010**
Energy	194.5	196.1	197.7	1.10	1.40	1.31	1.51	2.28	1.54	197.1	199.8	200.5
Energy (excluding transport)	*142.6*	*144.9*	*141.2*	*0.71*	*1.22*	*1.23*	*0.32*	*0.33*	*0.34*	*143.6*	*146.4*	*142.7*
Transport	*51.9*	*51.2*	*56.5*	*0.39*	*0.19*	*0.08*	*1.19*	*1.95*	*1.20*	*53.5*	*53.3*	*57.8*
Industrial processes	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Solvent use	NO	NO	NO	NO	NO	NO	0.40	0.45	0.47	0.40	0.45	0.47
Agriculture	NO	NO	NO	16.03	13.45	12.97	4.54	4.54	4.43	20.55	17.97	17.38
Forestry	0	0	0	0	0	0	0	0	0	0	0	0
Waste	0.07	0.08	0.09	0.03	0.03	0.04	0.11	0.12	0.19	0.20	0.24	0.32
Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total	**194.6**	**196.2**	**197.8**	**17.15**	**14.88**	**14.32**	**6.56**	**7.40**	**6.62**	**218.2**	**218.4**	**218.7**

Table 5-6: Greenhouse gas projection, 1990–2010, expressed in CO_2 equivalents

5.6. Precursor gases and SO_2

As with the inventory, these figures have been calculated for the transport sector alone.

Table 5-7 shows the trends in the evolution of precursor gases and SO_2 for the period 1990–2010. Levels of all emissions are dropping, due to the emissions regulations and air pollution prevention measures, as seen in the following:

- NO_X emissions: down 70 per cent
- CO emissions: down 74 per cent
- NMVOC emissions: down 88 per cent
- SO_2 emissions: down 90 per cent

Gas (Gg)	1990	1999	2010
NO_x	0.354	0.217	0.104
CO	2.146	1.192	0.560
NMVOCs	0.448	0.173	0.056
SO_2	0.0161	0.0076	0.0016

Table 5-7: Projection for precursor gases and SO_2 in the transport sector (1990–2010)

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6. Vulnerability assessment, impact and adaptation

6.1. Expected impact of global warming

There have been several research programmes conducted in recent times on the impact of global warming in the Alpine region. Trends and projections so far show that tangible effects may be expected. Changes in the permafrost border have a central role to play in this respect. Liechtenstein will also be affected. Most of the work on this phenomenon is being done in Switzerland as part of a national research project. Several recent natural events (e.g., the "Lothar" storm) have also impacted Liechtenstein's forests, in that roughly the equivalent of one year's worth of timber consumption was destroyed.

It is difficult to transpose the effects of global warming onto Liechtenstein using models. The available climate models are not yet capable of predicting in detail impacts on a regional level. However, the following overall effects may be expected if CO_2 levels were to double: temperatures would rise by 2 to 3 degrees, particularly in winter, winter precipitation would rise by 10 to 20 per cent, summer precipitation levels would fall and there would be 10 to 20 fewer days of snow cover per degree Celsius warming in areas over 2,500 metres above sea level.

The following effects are of particular importance:

- Ecosystem: Warming would change the composition of forest vegetation. Deciduous trees could become more important. Other weather-related instabilities (storms, avalanches) could have a further negative influence on vegetation.
- Water and soils: Growing weather-related instabilities could lead to flooding. This is a great danger in the narrow Alpine valleys (mountain streams), where various precautionary measures, such as rockfall constructions and water course corrections, are needed. Another source of danger is the Rhine river, which is regulated but which could pose a threat to the heavily utilized Rhine valley should flooding occur.
- Individual sectors of the economy: Global warming would impact the various sectors of Liechtenstein's economy. Agriculture and forestry would be directly affected due to the processes outlined above. The expected rise in the snow line and increased weather-related instabilities would also impact the nearby recreation and tourism area of Malbun. The insurance sector's international commitments may be the most heavily hit by an increase in the possibility of risk occurrences.

Generally speaking, Liechtenstein, as a mountainous country, is dependent on the stability of the ecosystem. This has been a strong motivating factor for the introduction of an active national climate policy and the participation of the country in international networks, such as the Alpine Convention.

6.2. Adaptation policy

Strategies for dealing with this new risk are heavily sector-specific. Section 4 showed how agriculture and forestry are moving towards sustainability and becoming less vulnerable to

climate-related problems through a modern, ecologically sound policy, the basis for which is provided by the following:
- the Nature and Landscape Protection Act (1996);
- the Forests Act (1991);
- the Preservation and Protection of Agricultural Lands Act (1992);
- the Ordinance on the integrated rehabilitation of the Alpine and mountain regions (1968).

Liechtenstein has always placed great emphasis on the protection of its infrastructure and on flood protection. Such constructions are particularly important for the protection of traffic links.

The potential threat to individual economic sectors has given rise to various activities. The municipalities and various institutions have introduced new winter and summer tourism offerings to offset the threat of a drop in revenue. A principal component of this may be seen in strategies aimed at promoting "soft tourism".

The revised Tourism Act, which took effect in May 2000, is based on the principles of sustainability and takes into account the interests of the natural and social environment. In recent years, a tourism model was developed for Liechtenstein which focuses heavily on marketing and on overall tourism conditions. With the exception of the Alpine and mountain region, however, the model does not devote sufficient attention to the landscape and, in particular, its ability to meet all of the demands placed on it. In the Alpine and mountain region, the integrated consideration of all user interests is governed by the Ordinance on the integrated rehabilitation of the Alpine and mountain areas (1968). Work on this model is continuing, in that tourism will be addressed in detail through the elaboration of a separate model for the mountain region. It will be determined which forms of tourism are economically desirable in Liechtenstein's mountain region, as well as feasible from an ecological and socio-cultural and, generally, sustainable point of view. This is to serve as the basis for the development of a specific approach that will include a series of measures to be taken.

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7. Financial resources and transfer of technology

7.1. Competent bodies and legislative frameworks

The Ministry for Foreign Affairs has responsibility for coordination in the area of development cooperation.

The legal framework is provided by the Promotion of Development Aid and Disaster Relief Act.

Under the provisions of this Act, "Liechtensteiner Entwicklungsdienst", an autonomous foundation established in 1965, is responsible for work relating to Liechtenstein's development cooperation activities.

Liechtenstein's foreign policy must meet the demands of the international community in terms of international solidarity, in particular as regards participation in international assistance programmes by providing aid to refugees and disaster relief through its programmes on development aid and assistance to Eastern Europe.

As part of its international humanitarian aid, Liechtenstein participates in many projects run by the United Nations and the Council of Europe, and also collaborates closely with aid organizations in neighbouring countries, such as "Österreichisches Hilfswerk" in Austria.

In accordance with these principles, Liechtenstein generally provides support to development programmes. In 1998, it established new guidelines and criteria for providing support to projects. Liechtenstein has long been involved in activities in the social sphere, where its main focus has been on poverty alleviation, peace-building, rural development, support for small business, education, health and improvement of the status of women. The sub-Saharan region is among those that are given particular attention. Cooperation with local NGOs plays a major role, and recent projects have tended to place more emphasis on awareness-raising on environmental issues.

There is an indirect relation between activities in this area and climate. Liechtenstein is convinced that improving social conditions is an essential condition for ensuring more environment- and climate-conscious conduct.

7.2. Overview of financial contributions

International humanitarian assistance is funded from the national budget. In 2000 Liechtenstein's expenditure for development cooperation activities amounted to 10.4 million Swiss francs, that is, 1.5 per cent of its total expenditure.

The following table shows an overview of Liechtenstein's principal contributions to international organizations.

Contributions (CHF) to:	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Vienna Convention for the Protection of the Ozone Layer/Montreal Protocol	11,000	8,000	23,000	20,000	21,000	27,000	26,000	28,000	28,000
Climate Convention					1,000	1,000	2,000	2,000	1,000
IAEA Technical Cooperation Fund	5,000	8,000	9,000	9,000	8,000	10,000	11,000	12,000	17,000
Convention on Biological Diversity [1)]								1,000	20,000
Other international social contributions	98,000	76,000	113,000	83,000	117,000	138,000	158,000	145,000	107,000
Total	115,000	119,000	145,000	112,000	146,000	175,000	197,000	187,000	174,000

1) Additional costs for technology transfer in the area of biotechnology in the Third World

Table 7-1: Overview of Liechtenstein's international financial commitment

The strategy report (Factor 2000) mentioned in section 4 above provides an important pillar for Liechtenstein's international climate policy. The various possibilities for expanding Liechtenstein's international commitment in this area are currently being closely studied.

8. Research and systematic observation

8.1. Research

Basic research

Liechtenstein does not have any university or research institute devoted primarily to sustainable development activities. However, as part of the country's biological research activities, authorities and private organizations in Liechtenstein cooperate with university research institutes in other countries to acquire ecological scientific know-how, which combines with the results of economic and sociocultural evaluations and research activities to help to shape sustainable development policy.

Liechtenstein therefore supports research activities abroad with annual contributions of 250,000 Swiss francs each to the Swiss national research fund (Schweizerischer Nationalfonds) and the Austrian scientific research fund (Fonds für wissenschaftliche Forschung). As a member of the European Economic Area, Liechtenstein also participates in European research programmes, and is currently involved in the Fifth Framework Programme for research and development. The current framework programme focuses on sustainability (Sustainable Management and Quality of Water, Global Change, Climate and Biodiversity and Cleaner Energy Systems).

Technological research

Public institutions in Liechtenstein also have indirect commitments in the area of technology. The "Fachhochschule Liechtenstein für Technik, Wirtschaft und Gestalten" technical university, with a budget of 4.2 million Swiss francs (1999), is involved in providing technical training. Liechtenstein also provides support, in the form of an annual contribution of 560,000 Swiss francs, to the Swiss "Neutechnikum Buchs" technical university.

Direct international commitment

Liechtenstein has a keen interest in cooperating with its neighbours and with international bodies and is committed to a coordinated transboundary spatial planning system. It participates in the Interreg III B programme Alpine Space, and provides support, through the various Interreg projects, to the priority areas of water pollution prevention, including measures to be taken in the agriculture sector, and joint monitoring of air pollutant emissions in the Lake Constance area. Because Liechtenstein is a small country, its main focus is on its regional ties. It therefore maintains contacts with Switzerland, Austria and Germany under the terms of various agreements.

Various research projects aimed at achieving a sustainable transport sector have been discussed in section 4 above.

8.2. Systematic observation

Liechtenstein gathers various types of climate data through its own measuring stations and through supraregional cooperation, in particular with Switzerland. However, there are no large measuring stations as such in Liechtenstein capable of storing data in a network such as GCOS. The largest measuring station in the country has been in operation in Vaduz since 1974, and collects current meteorological data such as air pressure, temperature, relative humidity, wind direction, wind speed, precipitation and sunshine total. In addition, a private company has been conducting data

collection operations at several stations since 1997. The Office of Civil Engineering has 10 locations for measuring snowfall levels which have been in operation since 1970. Since the 1960s, the Office of Environmental Protection has been collecting water samples from various sources for water quality control and development of ground water profiles.

In 2000, Liechtenstein signed an agreement with the cantons of eastern Switzerland to provide for joint monitoring of air pollutant emissions. Under the terms of this agreement, air pollution is monitored jointly in Liechtenstein and in eastern Switzerland as of 1 January 2001.

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9. Education, training and public awareness

Education in schools

The Ministry of Education is responsible for coordinating action in the area of education and training. The regulatory framework is provided by the Education Act and the Occupational Training Act and their accompanying ordinances. Of particular importance is the fact that the various relevant sectoral laws, in particular the more recent ones such as the Forests Act and the Nature Protection Act, establish the obligation for implementing authorities, in addition to providing for a comprehensive monitoring system, to promote regular further training and continuing education for the agencies involved in the various areas, to ensure the dissemination of information to the public and, in general, to promote greater awareness of sustainable development issues.

After the 1992 Rio Conference, as before, schools in Liechtenstein have been conducting projects on environmental education, for example:

- Provision of environmental education services in some schools: faculty members are exempted from one teaching period in exchange for assuming responsibility for instruction on environmental issues. These environmental focal points either launch or provide support for specific environment projects in their schools. This has given rise to "forest days", school gardens, environmentally sound recreation areas, field trips and much more.
- Environment days: special "environment days" have been organized in all of Liechtenstein's schools. For example, a secondary school class visited a hydroelectric power station on "Water Day", and another class built water wheels or created a small biotope.
- Eco-friendly office and school supplies: there is a catalogue in which teachers can find recommendations on eco-friendly office and school supplies (paper, notebooks, writing implements, etc.).
- Miscellaneous other support activities: Liechtenstein's schools supervisory office promotes environmental awareness that is in line with the goals of the new curriculum by, inter alia, publishing various teaching and learning aids (for example, "School on the Farm"), and organizing further training courses for teaching staff.

After a two-year pilot, testing and evaluation phase (1999–2001) and a subsequent revision phase, the new curriculum will take effect in the 2002/03 academic year for the entire compulsory school system. This instructional model, which applies to all types of educational establishments, includes "Man and the Environment" as a specific subject area, alongside Languages, Design, Music and Sports and Mathematics. The new subject area covers Religion, Biology, Physics and Chemistry, History, Geography, Home Economics and Computer Science. This curriculum model facilitates interlinking education on environmental issues with other subjects.

Public awareness activities

The various sectoral offices have responsibility for activities in this area. In addition, external institutions are charged with conducting certain activities and NGOs also provide support in this respect. Local authorities also conduct public lectures.

Information on environmental issues is also provided to the public by way of newspaper reports. Research findings or results of studies on the status of the mountain region or information on

changes and developments are also made available to the public on a regular basis through publications, brochures and posters, or through newspaper reports. Various government offices organize field trips for schoolchildren, groups and professional associations, and this constitutes an important part of Liechtenstein's efforts in the area of public information. Efforts are currently underway to develop an auditing procedure with a view to making winter sports installations less damaging to the landscape and the environment.

Every year, the Office of Environmental Protection distributes an environment calendar to the public. This calendar deals with a different environment-related theme each year. Schoolchildren are asked to participate in its development by submitting drawings on the current theme, so that their environmental awareness is developed at an early age.

The public is afforded access to specific information on pollutant emission levels at individual installations through the elaboration of an emissions register and the network of measuring stations mentioned in section 8. This data is to be published in an annual report.

Finally, local authorities conduct public awareness activities relating to their area of competence on an ongoing basis.

Cooperation with private institutions and NGOs

There are several institutions that are actively involved in information and training activities, in particular, the Liechtenstein Society for Environmental Protection (www.lgu.li), the Solar Energy Society and the Travel Club of Liechtenstein (VCL).

Since 1998, the International Commission for the Protection of the Alps (CIPRA), which has its headquarters in Liechtenstein, has been conducting an annual "summer programme" focusing on the Alps in Liechtenstein. This is a valuable training exercise for young university or technical university graduates interested in studying Alpine issues from an interdisciplinary and transnational perspective. The programme consists of a three-week basic course on the Alps and an elective four-week, practical-oriented project component. Instruction is provided by experts from all the countries in the Alpine region. Funding is provided by Liechtenstein.

An important part of the work of "Lake Constance – Agenda 21" of the International Conference of Lake Constance, in which Liechtenstein has been actively involved since 2000, concerns the atmosphere. In this connection, the Office of Environmental Protection has established an advisory office for the municipalities, sectors of the economy or NGOs which deals with sustainable development issues. The office will continue to function until 2002, at which time it will be expanded, possibly to a central government office.

Annex

National greenhouse gas inventory for Liechtenstein: summary tables

Inventory tables, 1999

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2 emissions	CO_2 removals	CH_4	N_2O	HFCs(1)		PFCs(1)		SF_6		NO_x	CO	NMVOC	SO_2
						P	A	P	A	P	A				
		(Gg)				CO_2 equivalent (Gg)						(Gg)			
Total National Emissions and Removals		**196.19**	**0.00**	**0.7087**	**0.02385**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
1. Energy		**196.11**		**0.0669**	**0.00735**							**NE**	**NE**	**NE**	**NE**
A. Fuel Combustion	Reference Approach (2)														
	Sectoral Approach (2)	196.11		0.0381	0.00735							NE	NE	NE	NE
1. Energy Industries		7.25		0.0015	0.00004							NE	NE	NE	NE
2. Manufacturing Industries and Construction		50.72		0.0103	0.00031							NE	NE	NE	NE
3. Transport		51.21		0.0088	0.00646							0.217	0.009	0.172	0.008
4. Other Sectors		86.94		0.0176	0.00053							NE	NE	NE	NE
5. Other		0.00		0.0000	0.00000							NE	NE	NE	NE
B. Fugitive Emissions from Fuels		NE	NO	0.0288	NO							NE	NE	NE	NO
1. Solid Fuels		NO		NO	NO							NO	NO	NO	NO
2. Oil and Natural Gas		NE		0.0288	NO							NE	NE	NE	NO

P = Potential emissions based on Tier 1 approach of the IPCC Guidelines. A = Actual emissions based on Tier 2 approach of the IPCC Guidelines.

(1) The emissions of HFCs and PFCs are to be expressed as CO_2 equivalent emissions. Data on disaggregated emissions of HFCs and PFCs are to be provided in Table 2(II) of this common reporting format.

(2) For verification purposes, countries are asked to report the results of their calculations using the Reference approach and to explain any differences with the Sectoral approach. Where possible, the calculations using the Sectoral approach should be used for estimating national totals. Do not include the results of both the Reference approach and the Sectoral approach in national totals.

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 emissions	CO_2 removals	CH_4	N_2O	HFCs[1]		PFCs[1]		SF_6		NO_x	CO	NMVOC	SO_2
					P	A	P	A	P	A				
	(Gg)				CO_2 equivalent (Gg)						(Gg)			
2. Industrial Processes	**NO**	**NO**	**NO**	**NO**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
A. Mineral Products	NO		NO	NO							NE	NE	NE	NE
B. Chemical Industry	NO		NO	NO	NO	NO	NO	NO	NO	NO	NE	NE	NE	NE
C. Metal Production	NO		NO	NO				NO		NO	NE	NE	NE	NE
D. Other Production [3]	NO										NO	NO	NO	NO
E. Production of Halocarbons and SF_6						NO		NO		NO				
F. Consumption of Halocarbons and SF_6					NE	NE	NE	NE	NE	NE				
G. Other	NE		NE	NE	NO	NO	NO	NO	NO	NO	NE	NE	NE	NE
3. Solvent and Other Product Use	**NO**			**0.00145**							**NE**	**NE**	**NE**	**NE**
4. Agriculture	**NO**	**NO**	**0.6403**	**0.01466**							**NO**	**NO**	**NO**	**NO**
A. Enteric Fermentation			0.4161											
B. Manure Management			0.1902	NO									NO	
C. Rice Cultivation			NO										NO	
D. Agricultural Soils	[4] NO	[4] NO	0.0339	0.01466									NO	
E. Prescribed Burning of Savannas			NO	NO							NO	NO	NO	
F. Field Burning of Agricultural Residues			NO	NO							NO	NO	NO	
G. Other			NO	NO							NO	NO	NO	

[3] Other Production includes Pulp and Paper and Food and Drink Production.

[4] According to the IPCC Guidelines (Volume 3. Reference Manual, pp. 4.2, 4.87), CO_2 emissions from agricultural soils are to be included under Land use Change and Forestry (LUCF). At the same time, the Summary Report 7A (Volume 1. Reporting Instructions, Tables.27) allows for reporting CO_2 emissions or removals from agricultural soils, either in the Agriculture sector, under D. Agricultural Soils or in the Land use Change and Forestry sector under D. Emissions and Removals from Soil. Parties may choose either way to report emissions or removals from this source in the common reporting format, but the way they have chosen to report should be clearly indicated, by inserting explanatory comments to the corresponding cells of Summary 1.A and Summary 1.B. Double-counting of these emissions or removals should be avoided. Parties should include these emissions or removals consistently in Table8(a) (Recalculation - Recalculated data) and Table10 (Emission trends).

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 emissions	CO_2 removals	CH_4	N_2O	HFCs[1]		PFCs[1]		SF_6		NO_x	CO	NMVOC	SO_2
					P	A	P	A	P	A				
	(Gg)				CO_2 equivalent (Gg)						(Gg)			
5. Land use Change and Forestry	[5] **0.00**	[5] **0.00**	**NE**	**NE**							**NE**	**NE**	**NE**	**NE**
A. Changes in Forest and Other Woody Biomass Stocks	[5] 0.00	[5] 0.00												
B. Forest and Grassland Conversion	NO		NO	NO							NO	NO		
C. Abandonment of Managed Lands	[5] NE	[5] NE												
D. CO_2 Emissions and Removals from Soil	[5] NE	[5] NE												
E. Other	[5] NO	[5] NO	NO	NO							NO	NO		
6. Waste	**0.08**		**0.0015**	**0.0004**							**NE**	**NE**	**NE**	**NE**
A. Solid Waste Disposal on Land	[6] NO		NO								NO	NO	NO	NO
B. Wastewater Handling			0.0009	0.0004							NE	NE	NE	NE
C. Waste Incineration	[6] 0.08		0.0006	0.0000							NE	NE	NE	NE
D. Other	NO		NO	NO							NO	NO	NO	NO
7. Other *(please specify)*	**0.00**	**0.00**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo Items: [7]														
International Bunkers	**NO**		**NO**	**NO**							**NO**	**NO**	**NO**	**NO**
Aviation	NO		NO	NO							NO	NO	NO	NO
Marine	NO		NO	NO							NO	NO	NO	NO
Multilateral Operations	**NO**		**NO**	**NO**							**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass	**8.65**													

[5] Please do not provide an estimate of both CO_2 emissions and CO_2 removals. "Net" emissions (emissions - removals) of CO_2 should be estimated and a single number placed in either the CO_2 emissions or CO_2 removals column, as appropriate. Please note that, for the purposes of reporting, the signs for uptake are always (-) and for emissions (+).

[6] Note that CO_2 from Waste Disposal and Incineration source categories should only be included if it stems from non-biogenic or inorganic waste streams.

[7] Memo Items are not included in the national totals.

SUMMARY 1.B SHORT SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7B)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2 emissions	CO_2 removals	CH_4	N_2O	HFCs[1]		PFCs[1]		SF_6		NO_x	CO	NMVOC	SO_2
						P	A	P	A	P	A				
		(Gg)				CO_2 equivalent (Gg)				(Gg)					
Total National Emissions and Removals		**196.19**	**0.00**	**0.7087**	**0.02385**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
1. Energy		**196.11**		**0.0669**	**0.00735**							**NE**	**NE**	**NE**	**NE**
A. Fuel Combustion	Reference Approach[2]														
	Sectoral Approach[2]	*196.11*		*0.0381*	*0.00735*							*0.217[5]*	*0.009[5]*	*0.172[5]*	*0.008[5]*
B. Fugitive Emissions from Fuels		*NE*		*0.0288*	*NO*							*NE*	*NE*	*NE*	*NO*
2. Industrial Processes		**NO**		**NO**	**NO**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
3. Solvent and Other Product Use		**NO**			**0.00145**							**NE**	**NE**	**NE**	**NE**
4. Agriculture [3]		**NO**	**NO**	**0.6403**	**0.01466**							**NO**	**NO**	**NO**	**NO**
5. Land use Change and Forestry		[4] **0.00**	[4] **0.00**	**NE**	**NE**							**NE**	**NE**	**NE**	**NE**
6. Waste		**0.08**		**0.0015**	**0.00040**							**NE**	**NE**	**NE**	**NE**
7. Other		**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo Items:															
International Bunkers		**NO**		**NO**	**NO**							**NO**	**NO**	**NO**	**NO**
Aviation		*NO*		*NO*	*NO*							*NO*	*NO*	*NO*	*NO*
Marine		*NO*		*NO*	*NO*							*NO*	*NO*	*NO*	*NO*
Multilateral Operations		**NO**		**NO**	**NO**							**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass		**8.65**													

P = Potential emissions based on Tier 1 approach of the IPCC Guidelines. A = Actual emissions based on Tier 2 approach of the IPCC Guidelines.

[1] The emissions of HFCs and PFCs are to be expressed as CO_2 equivalent emissions. Data on disaggregated emissions of HFCs and PFCs are to be provided in Table 2(II) of this common reporting format.

[2] For verification purposes, countries are asked to report the results of their calculations using the Reference approach and to explain any differences with the Sectoral approach in document box of Table1.A(c). Where possible, the calculations using the Sectoral approach should be used for estimating national totals. Do not include the results of both the Reference approach and the Sectoral approach in national totals.

[3] See footnote 4 to Summary 1.A.

[4] Please do not provide an estimate of both CO_2 emissions and CO_2 removals. "Net" emissions (emissions - removals) of CO_2 should be estimated and a single number placed in either the CO_2 emissions or CO_2 removals column, as appropriate. Please note that, for the purposes of reporting, the signs for uptake are always (-) and for emissions (+).

[5] Only transport emissions.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs	PFCs	SF_6	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**196.19**	**14.882**	**7.395**	**NE**	**NE**	**NE**	**218.47**
1. Energy	**196.11**	**1.405**	**2.278**				**199.80**
A. Fuel Combustion (Sectoral Approach)	196.11	0.800	2.278				199.19
1. Energy Industries	7.25	0.031	0.014				7.29
2. Manufacturing Industries and Construction	50.72	0.215	0.097				51.03
3. Transport	51.21	0.185	2.003				53.40
4. Other Sectors	86.94	0.369	0.165				87.48
5. Other	0.00	0.000	0.000				0.00
B. Fugitive Emissions from Fuels	NE	0.604	NO				0.60
1. Solid Fuels	NO	NO	NO				NO
2. Oil and Natural Gas	NE	0.604	NO				0.60
2. Industrial Processes	**NO**	**NO**	**NO**	**NE**	**NE**	**NE**	**NE**
A. Mineral Products	NO	NO	NO				NO
B. Chemical Industry	NO	NO	NO	NO	NO	NO	NO
C. Metal Production	NO	NO	NO		NO	NO	NO
D. Other Production	NO						NO
E. Production of Halocarbons and SF_6				NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6				NE	NE	NE	NE
G. Other	NE	NE	NE	NO	NO	NO	NE

[1] For CO_2 emissions from Land use Change and Forestry the net emissions are to be reported. Please note that, for the purposes of reporting, the signs for uptake are always (-) and for emissions (+).

[2] See footnote 4 to Summary 1.A of this common reporting format.

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	SF_6	Total
	CO_2 equivalent (Gg)						
3. Solvent And Other Product Use	**NO**		**0.448**				**0.45**
4. Agriculture (no 3 years average!)	**NO**	**13.446**	**4.544**				**17.99**
A. Enteric Fermentation		8.739					8.74
B. Manure Management		3.994	NO				3.99
C. Rice Cultivation		NO					NO
D. Agricultural Soils (2)	NO	0.713	4.544				5.26
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		NO	NO				NO
G. Other		NO	NO				NO
5. Land use Change and Forestry (1)	**0.00**	**NE**	**NE**				**NE**
6. Waste	**0.08**	**0.031**	**0.124**				**0.24**
A. Solid Waste Disposal on Land	NO	NO					NO
B. Wastewater Handling		0.018	0.124				56.13
C. Waste Incineration	0.08	0.013	0.000				0.09
D. Other	NO	NO	NO				NO
7. Other *(please specify)*	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
							0.00
Memo Items:							
International Bunkers	**NO**	**NO**	**NO**				**NO**
Aviation	NO	NO	NO				NO
Marine	NO	NO	NO				NO
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**8.65**						**8.65**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	**CO_2 emissions**	**CO_2 removals**	**Net CO_2 emissions / removals**	**CH_4**	**N_2O**	**Total emissions**
Land use Change and Forestry	**CO_2 equivalent (Gg)**					
A. Changes in Forest and Other Woody Biomass Stocks	0.00	0.00	0.00			0.00
B. Forest and Grassland Conversion	NO		NO	NO	NO	NO
C. Abandonment of Managed Lands	IE	IE	IE			IE
D. CO_2 Emissions and Removals from Soil	NE	NE	NE			NE
E. Other	NO	NO	NO	NO	NO	NO
Total CO_2 Equivalent Emissions from Land use Change and Forestry	0.00	0.00	0.00	NO	NO	0.00

Total CO_2 Equivalent Emissions without Land use Change and Forestry [(a)]	218.47
Total CO_2 Equivalent Emissions with Land use Change and Forestry [(a)]	218.47

[(a)] The information in these rows is requested to facilitate comparison of data, since Parties differ in the way they report emissions and removals from Land use Change and Forestry.

Abbreviations

AVW	Amt für Volkswirtschaft (Office of the Economy)
BfE	Bundesamt für Energie (Federal Office of Energy)
BfS	Bundesamt für Statistik (Federal Office of Statistics)
BUWAL	Bundesamt für Umwelt, Wald und Landschaft (Federal Office of Environment, Forestry and Landscape)
BWG	Bundesamt für Wasser und Geologie (Federal Office of Water and Geology)
CH_4	Methane
CHF	Swiss francs
CIPRA	Commission internationale pour la protection des Alpes (International Commission for the Protection of the Alps)
CO	Carbon monoxide
CO_2	Carbon dioxide
COP	Conference of the Parties
CORINAIR	Coordination d'information environnementale projet partiel air (CORINE air emission inventory)
COST	European Cooperation in the Area of Scientific and Technical Research
DEZA	Departement für Entwicklungszusammenarbeit (Department for Development Cooperation)
ETH/ETHZ	Eidgenössische Technische Hochschule Zürich (Swiss Technical University at Zurich)
EUREKA	European Research Coordination Agency
FL	Fürstentum Liechtenstein (Principality of Liechtenstein)
FOE	Federal Office of Energy (Bundesamt für Energie)
GATT	General Agreement on Tariffs and Trade
GCOS	Global Climate Observing System
GDP	Gross domestic product
GHG	Greenhouse gases
GNP	Gross national product
Gg	Gigagramm (1,000 Tonnes)
GWP	Global Warming Potential (CO_2 equivalent)
HFC	Hydrofluorocarbons
IBK	Internationale Bodenseekonferenz (International Conference for Lake Constance)
IPCC	Intergovernmental Panel on Climate Change
LSVA	Leistungsabhängige Schwerverkehrsabgabe (Distance- and weight-dependent heavy goods vehicle fee)
NGO	Non-governmental organization
NMVOC	Non-methane volatile organic compounds
N.E.	Not estimated
N.O.	Not occurring

NO_X	Nitrogen oxide
N_2O	Nitrous oxide
OECD	Organisation for Economic Cooperation and Development
PFC	Perfluorocarbons
SF_6	Sulphur hexafluoride
SO_2	Sulphur dioxide
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
WMO	World Meteorological Organization
www	World Wide Web