REGIERUNG
DES FÜRSTEMTUMS LIECHTENSTEIN

Liechtenstein's Sixth National Communication under the UNFCCC and the Kyoto Protocol

January 2014

Imprint

Office of Environment (project management)
P.O. Box 684
9490 Vaduz
Liechtenstein

INFRAS Consulting Group
8045 Zurich
Switzerland

For further information

Mr. Sven Braden, Office of Environment
sven.braden@llv.li

Foreword

In October 2013 the Intergovernmental Panel on Climate Change (IPCC) issued the results of its Fifth Assessment Report about the state of scientific, technical and socio-economic knowledge on climate change, its causes, potential impacts and response strategies. This report is the most comprehensive assessment of scientific knowledge on climate change since 2007.

Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased. Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850. The Fifth Assessment report concludes that it is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century. The evidence for this has grown, thanks to an increase in quantity and quality of observations, an improved understanding of the climate system response and enhanced climate models.

These findings have also been taken into account when finalizing Liechtenstein's Sixth National Communication as well as Liechtenstein's First Biennial Report – which is to be found as an Annex to the Sixth National Communication. In this regard I am grateful that the 19. Conference of the Parties to the United Nations Framework Convention on Climate Change, which took place from 11th to 23rd November 2013 in Warsaw, delivered an important outcome with respect to the guidelines for the review processes of the abovementioned reports. These guidelines mandate the UNFCCC Secretariat to address the need for a cost-effective review process that respects national circumstances when coordinating reviews of national reports. In times where the development of an increasing amount of tasks is faster than the corresponding increase in budget, especially on the UNFCCC Secretariat's side, we are convinced that the agreed flexibility within the upcoming review processes will serve as a key element to maintain the high quality of climate reporting the international community has achieved so far.

The Liechtenstein Government is convinced that the global threat of climate change needs a global answer in the form of a legally binding climate change agreement in 2015. Since the release of the Fifth National Communication in 2010 Liechtenstein's national climate protection framework has been further developed throughout all political areas – which is one of the major achievements of the National Climate Strategy launched by the Government in 2007. The Liechtenstein Government will revise its strategy in the course of 2014 with the aim to widen its scope with a focus on the 2015 agreement in order to further achieve domestic GHG reductions and strengthen public awareness.

The first step towards the Government's aim of strengthening public awareness for climate change has been taken by conducting a photo competition in order to find an appropriate cover image for the Sixth National Communication. The rewarded cover image of this report shows the Alpspitz-Mountain and the Rhine valley at Full moon and was taken by Severin Wachter from Triesen, Liechtenstein.

Marlies Amann-Marxer

Minister of the Environment

Vaduz, December 2013

Table of contents

1. Executive Summary 7

1.1 Introduction 7

1.2 GHG Inventory information, including information on National Systems and National Registries 7

1.3 Policies and measures 11

1.4 Impacts, vulnerability assessment and adaptation 16

1.5 Financial resources and transfer of technology 18

1.6 Research and systematic observation 19

1.7 Education, training and public awareness 20

2. National circumstances relevant to greenhouse gas emissions and removals 23

2.2 Population 25

2.3 Climate 26

2.4 Geography 26

2.6 Energy 28

2.7 Transport 30

2.8 Industry 32

2.9 Waste 33

2.10 Building stock and urban structure 34

2.11 Agriculture and Forestry 34

3. GHG Inventory information, including information on National Systems and National Registries 36

3.1 Summary tables 36

3.2 Trends in greenhouse gas emissions and removals (1990-2011) 36

3.2.1 Aggregated greenhouse gas emissions 2011 36
3.2.2 Other greenhouse gases (HFC, PFC, SF_6, precursors) 40
3.2.3 Emission trends by gas 40
3.2.4 Emission trends by sources and sinks 44
3.2.5 Emission trends for indirect greenhouse gases and SO_2 48

3.3 Data for activities under Article 3, Paragraph 3 and 4 of the Kyoto Protocol (KP-LULUCF) 50

3.4 Status of the National Inventory System 51

3.4.1 National entity 51
3.4.2 Institutional, legal and procedural arrangements 51
3.4.3 Methodology 53
3.4.4 Key source identification 55
3.4.5 Recalculations 58
3.4.6 QA / QC activities 60

3.5 National Registry 64

3.5.1 Registry administrator 64
3.5.2 Consolidated system 64

3.5.3 Database structure and capacity 65
3.5.4 Conformity with Data Exchange Standards (DES) 65
3.5.5 Prevention of discrepancies 66
3.5.6 Determination of unauthorized manipulations 66
3.5.7 Public Reports 68
3.5.8 Internet address 70
3.5.9 Safeguard and Recovery Plan 70
3.5.10 Test procedures 70
3.5.11 Commitment period reserve (CPR) 71

4. Policies and measures 73

4.1 Policy making process – general policy context 73

4.2 Domestic and regional programmes and/or legislative arrangements and enforcement and administrative procedures 74

4.3 Policies and measures and their effects 74

4.3.1 Cross Sectoral Policies 74
4.3.2 Environmental policy 75
4.3.3 Climate policy 76
4.3.4 Energy policy 79
4.3.5 Transport policy 83
4.3.6 Agriculture 86
4.3.7 Forestry 87
4.3.8 Waste Management 88
4.3.9 International cooperation 89

4.4 Policies and measures no longer in place 90

5. Projections and the total effect of policies and measures 93

5.1 Projections 93

5.1.1 Baseline scenario “Without Measures” (WOM) 93
5.1.2 Scenario “With Measures” (WM) 93
5.1.3 Projections with additional measures (WAM) 101

5.2 Aggregated projection 106

5.3 Supplementary relating to mechanisms under Article 6, 12 and 17, of the Kyoto Protocol ... 109

Methodology for GHG emission projections 111

5.3.1 Emissions from energy related sectors 111
5.3.2 Emissions from non-energy related sectors 113

6. Vulnerability assessment, climate change impacts and adaptation measures ..117

6.1 Observed and expected impacts of climate change 117

6.1.1 Climate Change scenarios 117
6.1.2 Observed and expected temperature changes 118
6.1.3 Observed and expected precipitation changes 119
6.1.4 Impacts on the cryosphere 120
6.1.5 Impacts on the hydrological cycle and water resources 122
6.1.6 Impacts on extreme events and natural hazards 123
6.1.7 Natural hazards 125
6.1.8 Biodiversity 126
6.1.9 Forest and Forestry 127
6.1.10 Agriculture 128
6.1.11 Energy 129
6.1.12 Health 130

6.2 Vulnerability Assessment 130

6.3 Adaptation measures 131

7. Financial resources and transfer of technology 138

7.1 Assistance to developing country Parties that are particularly vulnerable to climate change 138

7.2 Provision of financial resources, including financial resources under Article 11 of the Kyoto Protocol 139

7.3 Activities related to transfer of technology 142

8. Research and systematic observation 143

8.1 General policy on research and systematic observation 143

8.1.1 Basic research 143
8.1.2 Technological research 143
8.1.3 Direct international engagement 143

8.2 Research 144

8.3 Systematic observation 144

9. Education, training and public awareness 147

9.1 Education at schools 147

9.2 Public outreach 148

9.3 Cooperation with private institutions and NGOs 148

Annex 151

1. Executive Summary

1.1 Introduction

This report summarizes the basic information and activities of the Principality of Liechtenstein with respect to climate. With a population of 36,476 at the end of 2011, Liechtenstein is a small central European State in the Alpine region. Its structure is comparable to that of its neighbouring countries, Switzerland and Austria. Liechtenstein is a constitutional hereditary monarchy on a democratic and parliamentary basis. The relationship between Liechtenstein and Switzerland is very close and strongly influenced by the Customs and Currency Treaty between the two countries (customs and currency union). The Customs Treaty with Switzerland has significant impact on environmental and fiscal strategies. Many Swiss environmental provisions are also applicable in Liechtenstein or are implemented already into Liechtenstein's law on the basis of specific international treaty rules (e.g. CO_2 Act).

At the same time, Liechtenstein has implemented numerous parts from EU legislation and has participated in various EU programs since joining the European Economic Area (EEA) in 1995.

1.2 GHG Inventory information, including information on National Systems and National Registries

In 2011, Liechtenstein emitted 222 Gg CO_2 equivalent (excluding LULUCF) to the atmosphere corresponding to 6.1 tonnes CO_2 equivalent per capita. About 84.3% of all greenhouse gas emissions were caused by energy-related processes. Emissions within this sector are distributed as follows: 42.5% by Transport, 10.4% by Manufacturing Industries and Construction, and 42.9% "Other sectors" (Residential, Institutional, and Commercial combustion). Compared to 1990, the emissions have decreased by 8.2% in this sector and overall by 3.6% (excluding LULUCF).

Carbon dioxide emissions (CO_2) account for 184.8 Gg and for 83.2% of total emissions in 2011. 42.8% of these CO_2 emissions occur in in "Other sectors", 42.6% in the Transport sector and 10.4% in Manufacturing Industries and Construction.

Methane emissions (CH_4) in 2011 amount to 0.7 Gg – corresponding 15.4 Gg CO_2 eq - and mainly occur in the Agriculture sector (82%). Compared to 1990, methane emissions have increased by 7.2 %. The share of methane on the overall Greenhouse gas emissions (in CO_2 equivalent) is 6.9%.

Nitrous oxide emissions (N_2O) in 2011 amount to 0.041 Gg – corresponding 13 Gg CO_2 eq - and arise primarily from Agriculture (81%) with additional minor contribution from Transport (5%) and Waste (8%). The share of N_2O on the overall GHG emissions (in CO_2 equivalent) is 5.8%.

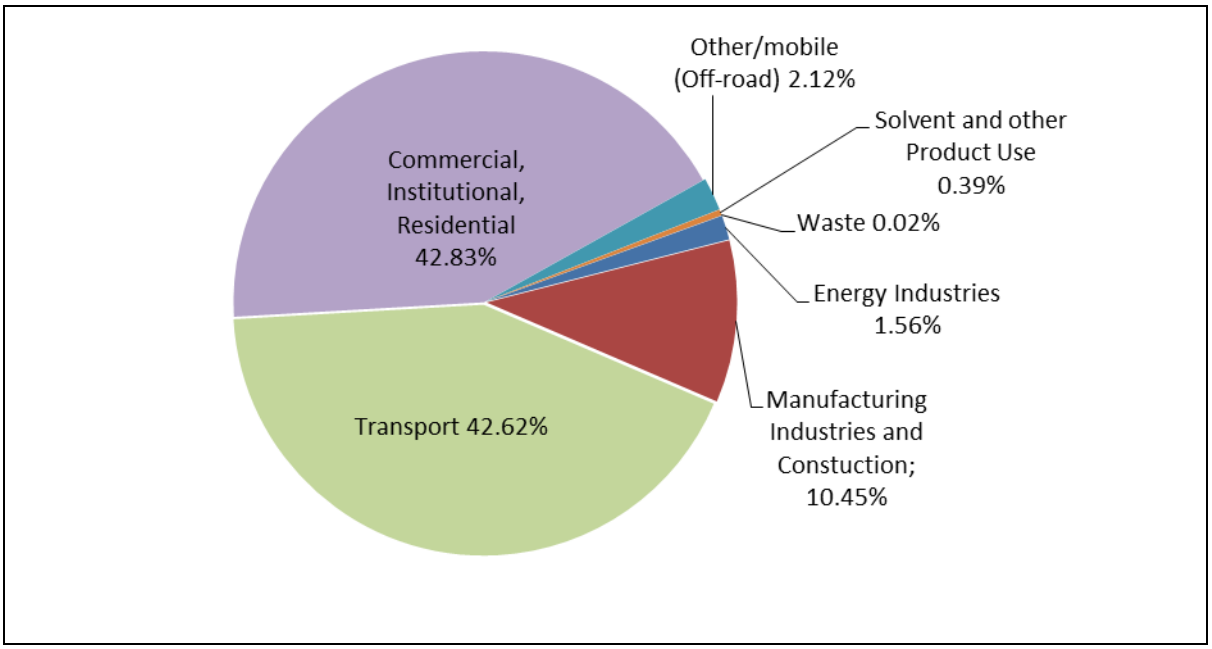

Figure 1-1 Composition of the emissions by sector.

In Figure 1-1 the emissions by sectors are displayed. Other greenhouse gases such as HFC and SF_6 play a minor role in Liechtenstein (3.9% of the national total emissions) as visible in Figure 1-2.

Figure 1-2 shows the relative development of the main climate gases and Figure 1-3 shows the development of the total GHG emissions by sources.

Table 1-1 Emissions in CO_2 equivalent by sector and by gas in 2011.

IPCC	Category	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total	Share
	Source/Sink	CO_2 equivalent (Gg)							%
1	Total Energy	184.04	1.99	1.05				187.08	84.26%
(1A)	Fuel combustion activities	184.04	0.96	1.05				186.05	83.79%
(1B)	Fugitive emissions	NA,NO	1.03	NA,NO				1.03	0.47%
2	Industrial Processes	NO	NO	NO	8.73	0.07	0.01	8.81	3.97%
3	Solvent and other Product Use	0.73		0.27				0.99	0.45%
4	Agriculture		12.74	10.63				23.37	10.52%
6	Waste	0.03	0.66	1.09				1.78	0.80%
	Total (excl. LULUCF)	**184.80**	**15.39**	**13.03**	**8.73**	**0.07**	**0.01**	**222.04**	**100.00%**
	Share (excl. LULUCF)	83.23%	6.93%	5.87%	3.93%	0.03%	0.00%	100.00%	
5	LULUCF	**-7.04**	**NO**	**0.01**				**-7.03**	-3.16%
	Total (incl. LULUCF)	**177.76**	**15.39**	**13.05**	**8.73**	**0.07**	**0.01**	**215.01**	**96.84%**
	Share (incl. LULUCF)	82.68%	7.16%	6.07%	4.06%	0.03%	0.00%	100.00%	

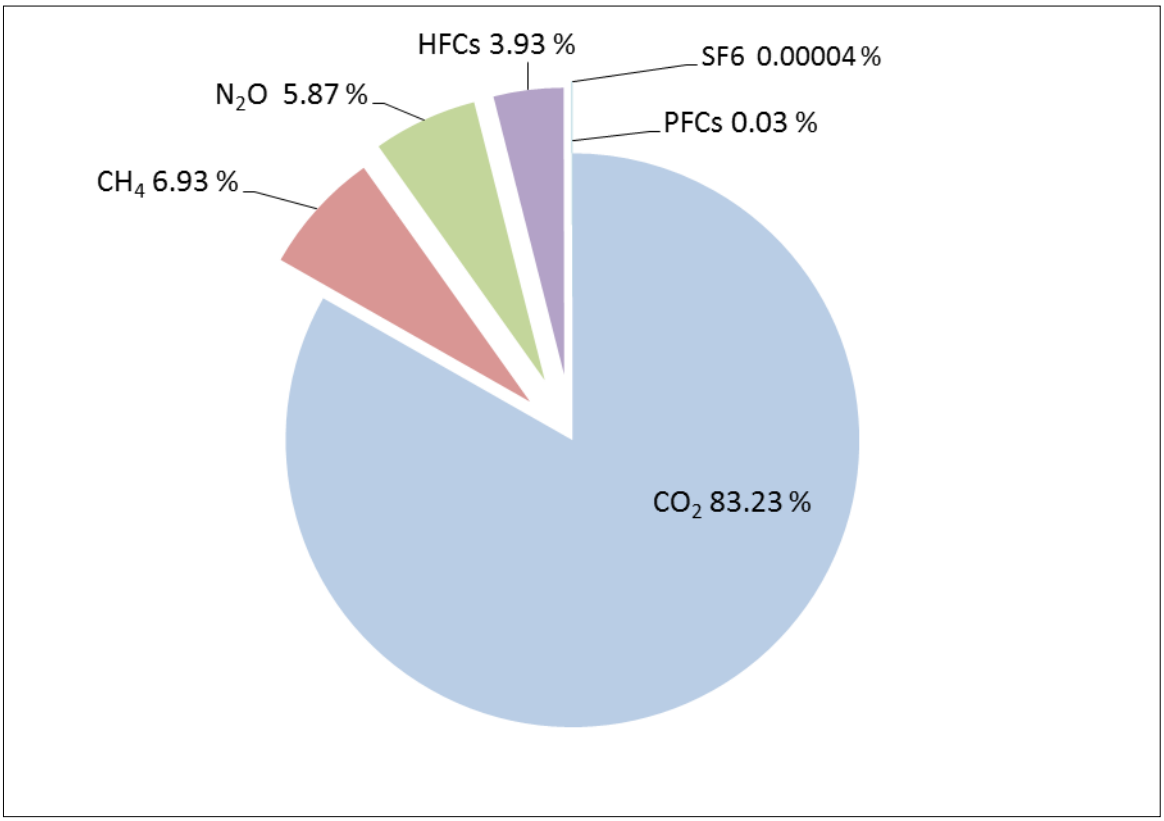

Figure 1-2 Contribution of the individual gases to Liechtenstein's total GHG emissions 2011. 100% corresponds to 222 Gg CO_2 eq. (excl. LULUCF).

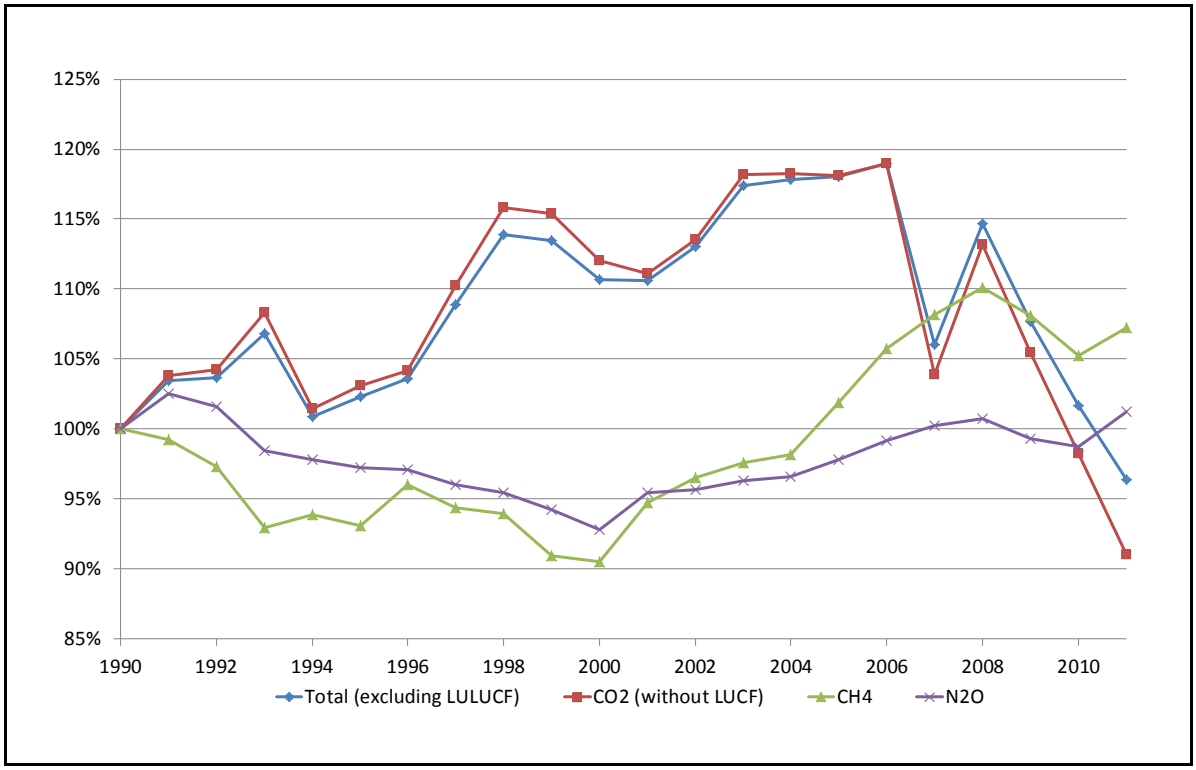

Figure 1-3 Relative trend of Liechtenstein's most important climate gases CO_2 CH_4 and N_2O and Total (all excl. LULUCF) 1990-2011.

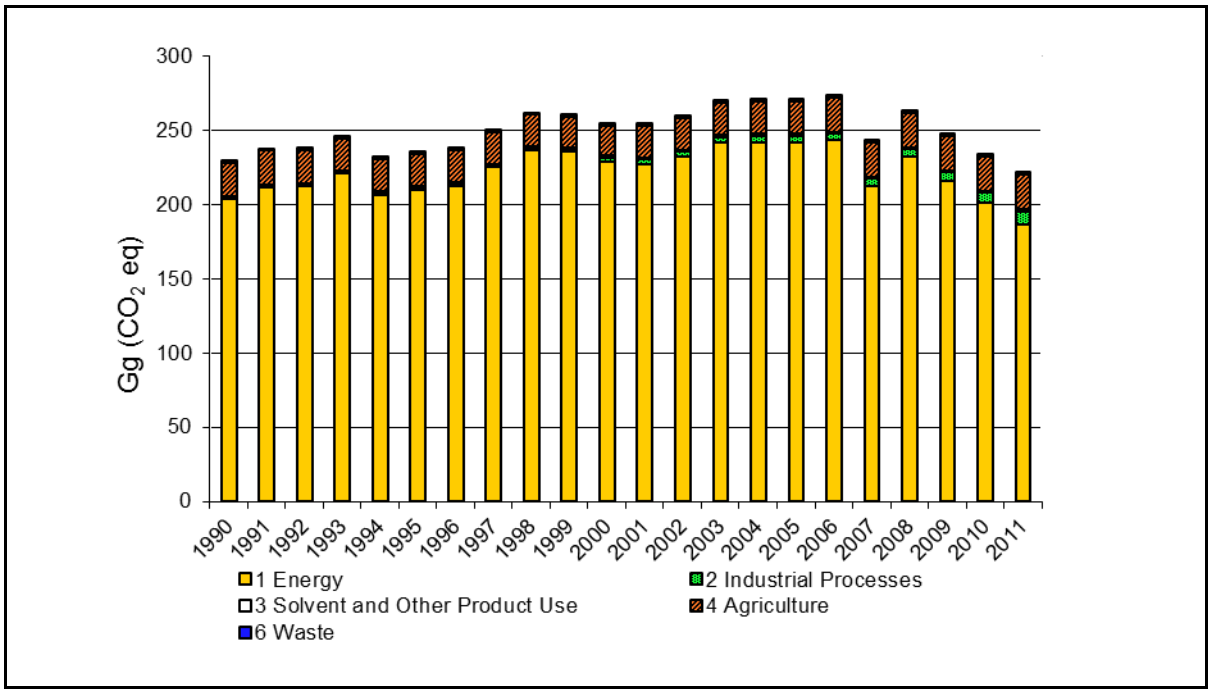

Figure 1-4 Emission trends of Liechtenstein's GHG emissions (excl. LULUCF) by main source categories, 1990-2011.

1 Energy: 84.3% (excluding LULUCF) of Liechtenstein's GHG emissions originate from the energy sector, which is 2.0% less than in 2010 and -8.2% in comparison to 1990. The source categories show following trends between 1990 and 2011: overall emissions are slightly increasing in the Energy sector until 2006. From 2006 to 2007 there is a pronounced decrease, which may be explained by very high gas oil prices and warm winter months at the beginning and at the end of 2007. Since 2008 emissions are constantly decreasing and remained in 2011 below 1990 levels for the first time in the past 21 years. The decreasing trend in the last 4 years is primarily a result of the cool down of global economic markets, comparably warm winters and of new climate policies implemented.

2 Industrial Processes: Due to the lack of heavy industry in Liechtenstein, only synthetic gases contribute to sector 2. The increasing trend is caused by HFC emissions from 2F1 Refrigeration and Air Conditioning Equipment.

3 Solvent and Other Product Use: Emissions have strongly decreased due to reduction measures for NMVOCs resulting from legal restrictions and the introduction of the VOC levy (-50.7%).

4 Agriculture: The emissions show a minimum around 2000 due to decreasing and increasing animal numbers. In 2011 the emissions are more or less on the same level as 1990 (increase of 1.8%).

5 LULUCF: The dominant category when looking at the changes in net CO_2 removals are grassland and settlements. It can be observed that land-use conversions to grassland differ significantly between the three time periods 1990 to 1996, 1997 to 2002 and 2003 to 2011. In the period 1997 to 2002 a significant higher conversion from forest land to grassland leads to a reduction of net CO_2 removals.

6 Waste: In Liechtenstein only few emissions occur from the "Waste" sector, because all municipal solid waste is exported to a Swiss incineration plant. The increasing trend of the emissions compared to 1990 (13.16%) is determined by increasing composting activities and a slight increase in emissions from waste water handling.

National System

The Government of Liechtenstein bears the overall responsibility for the National Inventory System (NIS). By Liechtenstein's Emission Trading Act (Emissionshandelsgesetz), the Office of Environment (OE) is in charge

of emission inventories and therefore also responsible for all aspects concerning the compilation of the NIS under the UN Framework Convention on Climate Change (UNFCCC) and under the Kyoto Protocol. The responsibility by OE for compiling the NIS is also described in the report of the Government to the parliament when the Kyoto Protocol was ratified. The Office of Economic Affairs (OEA) and the Office of Land Use Planning (SLP) participate directly in the compilation of the inventory. Several other administrative and private institutions are involved in inventory preparation.

1.3 Policies and measures

Liechtenstein endeavours to enshrine the principle of sustainability in its policies. This includes provident use of resources and maintenance of a high quality of life.

In 2010 Liechtenstein therefore introduced an indicator-based system for an annual assessment of the countries path towards a sustainable development. To this respect the Government has chosen to link the indicator-based assessment to the sustainability definition of the Brundtland Commission. According to that definition sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs." The system is comparable to the indicator-based assessment of the Swiss Federal Office of Statistics and the European system of Eurostat.

The assessment in Liechtenstein until today shows a mixed picture concerning sustainability. In the areas of international cooperation as well as education and culture the trends are going towards sustainability. The areas of employment, energy and climate as well as natural resources show a positive trend towards sustainability. The areas of living conditions, health and economy show no clear trend and the development must be assessed as neutral. In the areas of social cohesion and mobility, however, the developments are not going towards sustainability. The increasing motorisation rate and the decrease of the environmentally friendly passenger mobility lead to an unsustainable development in the area of mobility.

The assessment of the countries sustainable development also serves as an incentive for the development of respective policies and measures, especially in areas where an unsustainable development can be observed. To the extent possible, Liechtenstein also tries to make a contribution to the solution of global environmental problems. Climate protection enjoys a high political priority in this regard, constituting a primary field of action in Liechtenstein's environmental policy.

A core element of national environmental framework consists of Liechtenstein’s climate policy. To this respect climate policy is embedded in individual sectoral policies such as energy, transportation, agriculture, forestry and environmental issues in general. In all of these domains a variety of measures contributes to the reduction of climate gases. In order to ensure a coordinated implementation of these measures the government passed a Climate Protection Strategy in 2007. This strategy requires an interdisciplinary coordination in the fields of environment, energy, building, transportation, agriculture and forestry with respect to the development of climate policy measures. Liechtenstein’s Ministry of Environment and the Office of Environment are the coordinating authorities with respect to the executions of the Climate Protection Strategy which will be revised in the course of 2014.

Because of the small size of the country, cross-border cooperation plays also an important role. Especially important is the relationship with Switzerland and cooperation among the countries in the Lake Constance area. Due to the customs treaty, cross-border measures and their bilateral implementation are simplified in many areas, since various Swiss enactments are directly applicable in Liechtenstein pursuant to the treaty.

Liechtenstein’s legislative and administrative main arrangements to meet its commitments under the Kyoto Protocol are to be found in the Emissions Trading Act and the CO_2 Act:

The **Emissions Trading Act** (EHG) sets up the general framework for the fulfilment of Liechtenstein’s reduction obligations originating from the respective ratification of the Kyoto Protocol. In 2012 the government introduced a legally binding greenhouse gas reduction target from at least 20% compared to 1990 until 2020. In addition the EHG states that emission reductions are first and foremost to be reduced by domestic measures. If reduction obligations cannot be achieved with domestic measures, the Government may participate in emission crediting activities abroad or in international emissions trading. Besides this, the EHG implements Directive 2003/87/EC (Emissions Trading Directive) into national law and obliges two

industrial installations in Liechtenstein to participate within the European Emissions Trading Scheme. Due to comprehensive amendments of Directive 2003/87/EC the EHG has been revised in 2012. The regulations of the EHG with respect to the participation of Liechtenstein in the Kyoto Protocols flexible mechanisms as well as with respect to domestic emissions trading are implemented by the Office of Environment.

The **CO_2 Act** corresponds with the CO_2 Act of Switzerland and is in force since 2008. The Act introduces a levy on the consumption of fossil fuel. It is part of "The Bilateral Agreement between the Principality of Liechtenstein and the Swiss Confederation on Environmental Levies within the Principality of Liechtenstein". In 2013 the CO_2 Act has been revised. Besides the levy on fossil fuel an obligation to compensate CO_2 emissions from the use of motor fuels (gasoline and diesel) as well as emission regulations for passenger cars has been introduced. From 2014 on Liechtenstein will levy 60 CHF per ton CO_2, which corresponds to around 16 Rp per liter heating oil (until 2013 it was 36 CHF per ton CO_2 which corresponded to around 10 Rp per liter oil). Approximately 2/3 of the total CO_2 levy revenues from 2014 are earmarked for environmental purposes, thus strengthening the financial capabilities of the Government with respect to future measures within the national climate change framework.

The commitment to saving energy was – however – already legally enshrined in the **Energy Ordinance of the respective Building Act** in 2008.

Planned policies

Measures on national level are given high priority among the policies envisaged. Accordingly the following policies are about to be implemented in near future:

In 2012 the Government adopted the "Energy Strategy 2020". The strategy provides future-oriented impulses for the national energy policy. The focus areas of the concept are the promotion of efficient energy use, the use of renewable energies, and energy conservation. To this respect the strategy provides a comprehensive list of recommended measures in order to achieve its goals:

- Increase the share of renewable energy in total energy use from 8% to 20% by 2020;
- Increase the energy efficiency to 20% to stabilize the energy consumption on the level of 2008 by 2020;
- Reduce the CO_2 emissions of 1990 by 20% until 2020.

Liechtenstein also intends to implement further appropriate measures following potential changes in Swiss climate policies.

In the course of 2015 the emissions regulation for passenger cars, established 2012 by the revised CO_2 Act will be adjusted in order to also cover light vehicles.

In 2014 the Government will also release a new National Climate Strategy which will substitute the Strategy from 2007.

Projections and the total effect of measures

The starting point for Liechtenstein's projections is the Energy Strategy 2020. The strategy describes three different energy scenarios until 2020. Two of them have been used in order to define Liechtenstein's emission scenarios "with measures" (WM) and "with additional measures" (WAM) within the energy-related sectors (see 5.3.1).

The projections presented for the years 2015, 2020 and 2030 rely on the latest emission and energy use data available for Liechtenstein, projections of reductions through measures implemented from the Bureau of Energy Consumption and Conservation as well as on comparisons and analogies with the projections and assumptions developed for Switzerland.

Based on various national acts a number of measures have already been or are currently planned to be implemented. This includes environmental levies, the package of energy related measures in the Energy Strategy 2020 and direct payments for agriculture.

Liechtenstein's financially most relevant and for projections most reliably quantifiable measures currently in place, focus on the refurbishment of old buildings, on solar collector systems and on substitutions towards heat pumps and wood heater induced under the Energy ordinance (EEG). Their effects are visible in a reduction in the consumption of heating fuels and finally in the reduction of emissions in the sectors Industry (1A2) and "Others" (1A4). The municipalities individually supplement the national subsidies with additional funds. Other measures, such as savings through more efficient new private heaters or recovery of steam in industry, are independent of the EEG but relevant for emission reduction.

The following Table 1-2 and Table 1-3 show the development of total GHG emissions in CO_2 equivalent between 1990 and 2030 in scenario "with measures implemented" (WM) and "with additional measures" (WAM) respectively. In both scenarios, total emissions decreased by 4% between 1990 and 2011.

For the WM scenario it is expected that after 2011 total GHG emissions (in CO_2 equivalent) remain constant until approximately 2015, due to technical related reasons, when combining inventory figures with measures defined in the Energy Strategy 2020. After 2015 total GHG emissions start to decrease. In this scenario Liechtenstein will not fully reach its emission target of total GHG emissions of 184 Gg CO_2 equivalent by domestic measures only. The deviation from this target accounts for approximately 12.3 Gg CO_2 equivalent.

The WAM scenario additional measures, that would be implemented already, could curb emissions in the years between 2011 and 2015 and lead to a 14% decrease in total emissions in this period alone. Given the results from emission modeling for the year 2020, Liechtenstein will reach total GHG emissions of approximately 161.0 Gg CO_2 equivalent. This would equal a decrease of 30.1% compared to 1990 baseline emissions and thus fulfill Liechtenstein's pledge under Kyoto II. Projected total emissions in 2030 are 140.81 Gg CO_2 equivalent.

Table 1-2 Total GHG emissions in CO2 equivalent by sector from 1990 to 2030 "with measures implemented" (WM). The numbers 1990-2011 are taken from the inventory submitted in April 2013 (OEP 2013). The numbers 2015-2030 are projected.

	CO_2 in Gg CO_2 equivalent										
		Inventories						Projections			
IPCC	**Source/Sink Categories**	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2015**	**2020**	**2025**	**2030**
Total	**Emissions without LULUCF WM**	**230.33**	**235.70**	**254.90**	**271.84**	**234.12**	**222.04**	**222.26**	**193.99**	**186.35**	**176.80**
1	**All Energy**	**203.78**	**210.56**	**229.46**	**242.11**	**201.89**	**187.08**	**187.73**	**160.11**	**153.13**	**144.24**
1A	Fuel Combustion	203.46	210.04	228.73	241.09	200.83	186.05	186.76	159.21	152.31	143.50
	1 Energy/Transformation	0.18	2.04	2.72	3.07	3.20	3.00	3.66	4.30	4.80	5.29
	2 Industry	35.33	34.35	34.34	36.20	22.39	19.36	18.33	15.48	15.48	15.48
	3 Transport	76.69	81.55	95.84	85.57	80.47	79.53	85.61	82.33	74.94	65.63
	4 Other Sectors	88.87	89.88	92.84	112.70	91.27	80.19	75.00	53.10	53.10	53.10
	5 Other (Off road)	2.39	2.22	3.00	3.54	3.51	3.97	4.16	4.00	4.00	4.00
1B	Fugitive Emissions	0.32	0.53	0.73	1.02	1.05	1.03	0.97	0.89	0.82	0.74
	1 Solid fuels	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
	2 Oil/Natural Gas	0.32	0.53	0.73	1.02	1.05	1.03	0.97	0.89	0.82	0.74
2	**Industrial Processes**	**0.00**	**0.38**	**2.41**	**4.68**	**6.75**	**8.81**	**8.67**	**8.49**	**7.71**	**6.93**
3	**Solvent Use**	**2.02**	**1.61**	**1.24**	**1.02**	**0.99**	**0.99**	**0.98**	**0.95**	**0.87**	**0.78**
4	**Agriculture**	**22.96**	**21.62**	**20.07**	**22.12**	**22.73**	**23.37**	**22.81**	**22.10**	**22.10**	**22.10**
5	**LULUCF**	**-9.46**	**-9.64**	**-8.59**	**-7.71**	**-7.14**	**-7.03**	**-6.57**	**-5.99**	**-5.42**	**-4.85**
6	**Waste**	**1.58**	**1.52**	**1.72**	**1.91**	**1.77**	**1.78**	**2.08**	**2.33**	**2.54**	**2.74**
1A3 ai	**International Bunkers**	**0.43**	**0.43**	**0.49**	**0.48**	**0.78**	**0.84**	**0.90**	**0.98**	**1.06**	**1.14**

Table 1-3 Total GHG emissions in CO2 equivalent by sector between 1990 and 2030 in the scenario "with additional measures"(WAM). The numbers 1990-2011 are taken from the inventory submitted in April 2013 (OEP 2013). The numbers 2015-2030 are projected.

	CO_2 in Gg CO_2 equivalent										
		Inventories						Projections			
IPCC	**Source/Sink Categories**	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2015**	**2020**	**2025**	**2030**
Total	**Emissions without LULUCF WAM**	**230.33**	**235.70**	**254.90**	**271.84**	**234.12**	**222.04**	**209.91**	**161.00**	**150.80**	**140.81**
1	**All Energy**	**203.78**	**210.56**	**229.46**	**242.11**	**201.89**	**187.08**	**175.48**	**127.37**	**119.54**	**111.92**
1A	Fuel Combustion	203.46	210.04	228.73	241.09	200.83	186.05	174.51	126.47	118.72	111.18
	1 Energy/Transformation	0.18	2.04	2.72	3.07	3.20	3.00	4.19	5.67	5.57	5.67
	2 Industry	35.33	34.35	34.34	36.20	22.39	19.36	16.61	10.74	10.74	10.74
	3 Transport	76.69	81.55	95.84	85.57	80.47	79.53	83.40	78.04	70.39	62.74
	4 Other Sectors	88.87	89.88	92.84	112.70	91.27	80.19	66.14	28.01	28.01	28.01
	5 Other (Off road)	2.39	2.22	3.00	3.54	3.51	3.97	4.17	4.01	4.01	4.01
1B	Fugitive Emissions	0.32	0.53	0.73	1.02	1.05	1.03	0.97	0.89	0.82	0.74
	1 Solid fuels	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
	2 Oil/Natural Gas	0.32	0.53	0.73	1.02	1.05	1.03	0.97	0.89	0.82	0.74
2	**Industrial Processes**	**0.00**	**0.38**	**2.41**	**4.68**	**6.75**	**8.81**	**8.57**	**8.27**	**7.27**	**6.26**
3	**Solvent Use**	**2.02**	**1.61**	**1.24**	**1.02**	**0.99**	**0.99**	**0.97**	**0.93**	**0.82**	**0.70**
4	**Agriculture**	**22.96**	**21.62**	**20.07**	**22.12**	**22.73**	**23.37**	**22.81**	**22.10**	**20.64**	**19.18**
5	**LULUCF**	**-9.46**	**-9.64**	**-8.59**	**-7.71**	**-7.14**	**-7.03**	**-6.57**	**-5.99**	**-5.42**	**-4.85**
6	**Waste**	**1.58**	**1.52**	**1.72**	**1.91**	**1.77**	**1.78**	**2.08**	**2.33**	**2.54**	**2.74**
1A3 ai	**International Bunkers**	**0.43**	**0.43**	**0.49**	**0.48**	**0.78**	**0.84**	**0.90**	**0.98**	**1.06**	**1.14**

Based on these measures the following emissions until 2030 are projected in Figure 1-5:

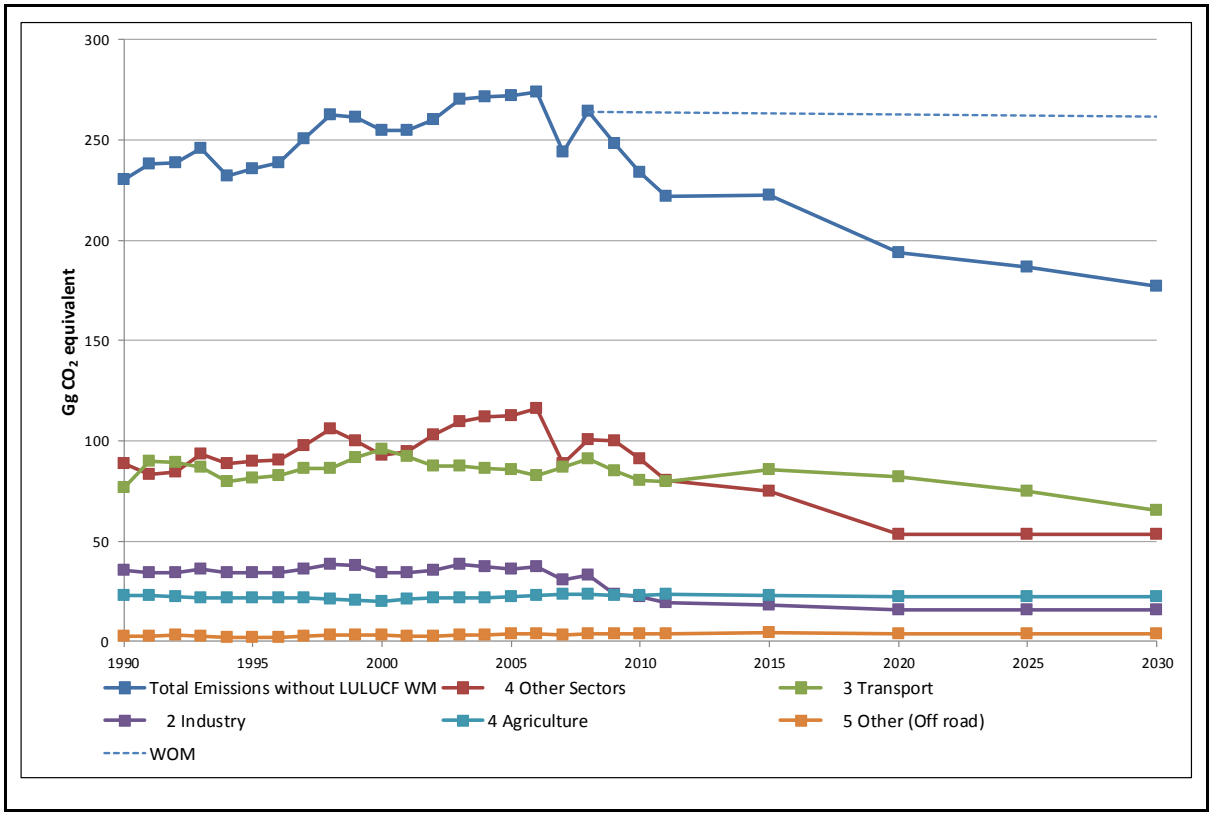

Figure 1-5 Total CO2 (in CO2 eq., excl. LULUCF) by sector 1990-2030 "with measures implemented".

Kyoto Protocol – First commitment period 2008 – 2012

The assigned amount of emissions in the first commitment period (2008-2012) for Liechtenstein under the Kyoto Protocol is 211.99 Gg CO_2 equivalents per year which is a reduction of 8% below 1990 levels (230.33 Gg CO_2 eq.). Liechtenstein decided not to account for Art. 3.4. of the Kyoto Protocol. In 2007 the Government decided to make use of the flexible mechanisms and purchase about 230 Gg CO_2 eq within the period of 2008 – 2012. The respective investments shall help to realize climate protection projects that show ecological benefits and social-ethical acceptability for the population of the host country. In order to ensure these quality standards Liechtenstein's National Climate Protection Strategy aims at the acquisition of such emission reductions that are certified by additional quality labels (e.g. Gold Standard). The strategy further excludes the purchase of Assigned Amount Units for the purpose of Liechtenstein's Kyoto Compliance – unless a "Green Investment Scheme" has been defined by the respective host country. Emission reductions from HFC-23 and carbon capture storage projects will not be purchased.

Total greenhouse gas emissions decreased by 3.6% between 1990 and 2011. Accordingly the Kyoto target in 2012 might not be reached by domestic action only.

Kyoto Protocol - Second commitment period 2013-2020

With respect to the second commitment period (2013-2020) Liechtenstein's target of total GHG emissions (in CO_2 equivalent) is 20% below 1990 levels (which corresponds to 184 Gg CO_2 eq in 2020).

Regarding the achievement of the abovementioned target the priority remains on the implementation of domestic measures. The legal framework that ensured the focus on domestic reduction measures has been transferred into the new Emissions Trading Act from September 2012. Under current projections it seems – however – unlikely that Liechtenstein will achieve its reduction target within the second commitment period under the Kyoto Protocol by domestic measures only. The projections of average annual emissions from 2013 to 2020 lead to a shortage of around 22'400 CO_2 eq. To that respect Liechtenstein envisages to

take the option of continuing its engagement within the Kyoto Protocol's flexible mechanism. This engagement will be guided by the National Climate Strategy, which will be revised in the course of 2014.

Table 1-4 Kyoto targets 2008-2012 and 2013 - 2020

Gross and net GHG emissions during the commitment periode 2008-2012	
Kyoto protocol emissions (Gg CO_2 eq.)	
Kyoto target (assigned amount units per year, average 2008-2012)	211.99
Total projected gross GHG emissions WM (projection for 2010)	232.05
Use of Kyoto mechanisms (CDM), annually	46
Net GHG emissions	186.05

Gross and net GHG emissions during the commitment periode 2013-2020	
Kyoto protocol emissions (Gg CO_2 eq.)	
Kyoto target 2020 (-20% to 1990 levels (as of submission 2013))	184.26
Total projected gross GHG emissions WM (projection for 2020)	193.99
Use of Kyoto mechanisms (CDM), annually	22
Net GHG emissions	171.58

1.4 Impacts, vulnerability assessment and adaptation

In recent years, various research programs on the effects of global climate warming in the Alpine region have been conducted. The development so far and projections indicate that noticeable effects are to be expected. Changes to the permafrost boundary and water drainages will play a central role in this regard. Liechtenstein is also affected by these developments.

Impacts

The mean annual temperature at the SwissMetNet station of Vaduz is 10.0 °C for the current standard reference period 1981-2010 (MeteoSwiss 2013a). Figure 1-6 illustrates observed seasonal temperature changes for northeastern Switzerland including Liechtenstein, as well as projected seasonal temperature changes for three different emission scenarios and selected time periods. Compared the 1980-2009 period the best estimates for the non-intervention scenarios project an increase of seasonal mean temperature of 3.2-4.8°C by the end of the century for the A2 scenario and 2.7-4.1°C for the A1B scenario (CH2011 2011).

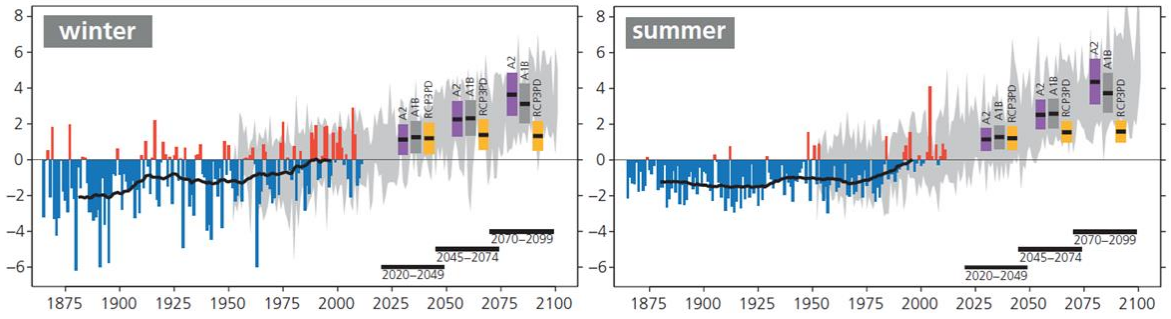

Figure 1-6 Past and future changes in seasonal temperature (°C) over north-eastern Switzerland (including the Principally of Liechtenstein). The changes are relative to the reference period 1980–2009. The thin coloured bars display the year-to-year differences with respect to the average of observations over the reference period; the heavy black lines are the correspon ding

smoothed 30-year averages. The grey shading indicates the range of year-to-year differences as projected by climate models for the A1B scenario (specifically, the 5–95 percentile range for each year across the available model set). The thick coloured bars show best estimates of the future projections, and the associated uncertainty ranges, for selected 30-year time-periods and for three greenhouse gas emission scenarios (from CH2011 2011).

Precipitation is projected to change towards the end of the 21st century (see Figure 6-2). Summer mean precipitation will likely decrease by the end of the century all over Switzerland (including Liechtenstein), while winter precipitation will likely increase in Southern Switzerland for the investigated emission scenarios A2, A1B and RCP3PD. In other regions and seasons, models indicate that mean precipitation could either increase or decrease.

In the near future (until 2035), annual runoff in Switzerland and Liechtenstein will change very little. In the long term (by 2085) the annual runoff will fall slightly. However, the seasonal distribution of runoff (runoff regime) will shift in Switzerland and Liechtenstein. In this context lower groundwater levels and lower spring discharge rates may occur more frequently, although no trend exists yet (FOEN 2014). Concerning temperatures of rivers and lakes the analyses of various long time measurements show clear tendencies towards increased annual mean temperatures of up to 1.2 °C, and 1.5 – 3 °C in summer, particularly in lower altitudes, as well as in areas affected by lakes (Jakob et al. 2010).

Accordingly the warming trend and changing precipitation patterns are also expected to have significant effects on ecosystems. The Biodiversity Monitoring Switzerland reports that impacts of climate change are being observed even within limited time frames. For instance, typical alpine vascular plants have shifted their distribution in the uphill direction during the past few years. Moreover, disruptions in species interactions caused by individual migration rates or phenological shifts are likely to have consequences for biodiversity (Walther 2010). Furthermore water temperature is one of the most important regulators of life processes in aquatic groundwater ecosystems. Temperature regulates the metabolic and redox processes and defines the evolution, the growth rate and the composition of biocenosis.

In accordance with remarks in FOEN (2014) climate change in Switzerland is expected to entail a shift of suitable areas for agricultural production, and to involve both positive (e.g. a longer vegetation period) and negative aspects (e.g. increasing incidence of [insect] pests owing to the milder winters). Changes in the nature of extreme weather events, in particular more frequent, intense and longer-lasting summer heat waves could also challenge agriculture e.g. by reducing the reliability of harvests.

The expected increased intensity of storms and reduced snowfall and snow cover duration are particularly important for alpine areas, tourism and forestry due to more frequent floods, landslides and debris flows and an increased danger of avalanches. In wintertime, the seasonal freezing level (altitude, where surface air temperature is 0°C) has risen by about 200 m per degree of warming from approximately 600 m in the 1960s to approximately 900 m in the 1990s (Scherrer and Appenzeller 2006). On the other hand, despite the warming trend, winter temperatures above about 2000 m a.s.l. are still predominantly below freezing and changes in snow cover have thus not yet been observed.

Vulnerability assessments

It is difficult to transfer the consequences of global climate warming calculated on the basis of models to the spatial scale of Liechtenstein. The available climate models are not yet able to predict detailed regional consequences. Overall, however, the following general effects can be expected as a consequence of a further increase of the CO_2 concentration and the associated rise in temperature and reduction of permafrost:

Health: The increase in intensity of heat waves in combination with high tropospheric ozone concentrations represents the greatest risk that climate change poses to people's health. Another important risk of climate change for health is the occurrence of vector-borne diseases. There is still a great deal of uncertainty as to what future developments will be.

Ecosystems: Warming changes the composition of forest vegetation. Deciduous trees may become more important than today. Additional weather instabilities (e.g. storms, avalanches) may have a further negative effect on forest vegetation.

Water cycles and soil: The increasing weather instabilities may lead to floods in the winter and droughts in the summer. A great danger in this regard exists in the narrow Alpine valleys (mountain streams), where various protective measures (e.g. rock fall barriers and water course corrections) are necessary.

Tourism: Within the next decades Liechtenstein's tourism sector will have to deal with great challenges caused by climate change related developments in Liechtenstein's ecosystems. Especially the winter tourism sector will be hit by higher temperature as the rise of the freezing level will lead to higher snow lines.

Other economic sectors: Global climate warming will affect further economic sectors in Liechtenstein. Because of the processes described above, agriculture and forestry will be affected directly. A rise in temperature will have a negative effect on the productivity of grain cultivation in the long term (Fuhrer 2003). The expected increase in elevation of snow and permafrost boundaries and increasing weather instability also have an effect on the important recreation area of Malbun and Steg. The international engagement of the insurance sector will likely suffer the most severe consequences from an increase in the probability of losses.

Adaptation

The projected consequences of an ongoing climate change require the immediate implementation of the so called Two-Pillar-Strategy – Mitigation (Pillar1) and Adaptation (Pillar2)

Mitigation: The necessary reduction of greenhouse gases can only be achieved if concrete measures are implemented in due time. Liechtenstein has launched a set of measures to address the problem of growing greenhouse gas emissions such as the Energy Strategy 2020 (2012), the revised Emissions Trading Act (2012), Energy Efficiency Act (2008), the revised CO_2 -Act (2013), Environmental Protection Act (2008), National Transport Policy (2008), National Climate Protection Strategy (2007) and Action Plan Air (2007). Liechtenstein's climate policy goal is – in the midterm – to fulfill the obligations originating from the Kyoto Protocol. The mitigation measures however will be further developed, especially with respect to sectors that have not yet been totally included into strict climate change regulation (e.g. traffic and transportation).

Adaptation: It is already obvious that certain climate change related consequences will become irreversible. Pillar 2 deals with the question of how these future threats could be addressed and how potential future damages can be limited or even avoided.

Natural hazard: Liechtenstein has established so called "Geological Risk Maps" with a special focus on residential areas. These maps provide regional information on the specific risks regarding avalanches, rock- and landslides and flooding.

Agriculture: Identified adaptation measures are an increased use of appropriate corn provenances that have already anticipated future conditions of the changing environment. However, the use of genetically modified crops is not foreseen. The irrigation of agricultural fields will increasingly be used thereby causing conflicts with other public interests, especially during longer draught periods.

Forestry: The increase of draught periods with consequential damages caused by insects, pathogens (viruses, bacteria, fungus) fire or storms will lead to a decrease of the forests protection abilities in Liechtenstein. Adaptation measures that address the problems of these projected situations and that are already executed are the conversion of spruce and fir stocks into mixed deciduous and coniferous forests.

Tourism: Further examinations have to be concluded within the next years. The production of artificial snow, as currently practiced, is not considered to be a sustainable solution. Nevertheless, various municipalities and institutions have introduced new offerings for winter and summer tourism, in order to counter potential revenue losses. The focus is on strategies to promote "gentle tourism".

1.5 Financial resources and transfer of technology

Liechtenstein recognizes its humanitarian responsibility on international levels. Assisting poor countries and regions that are affected by disasters and armed conflicts is an established part of Liechtenstein's foreign policy. The operational tasks of International Humanitarian Cooperation and Development (IHCD) are

carried out by the Office for Foreign Affairs, the Immigration and Passport Office and the Liechtenstein Development Service (LED) (a foundation under private law). The overall coordination of the IHCD activities is within the responsibility of the Office for Foreign Affairs.

IHCD encompasses all forms of the humanitarian and development policy of the State of Liechtenstein and of the LED. These activities are set out in the Law on International Humanitarian Cooperation and Development (IHCD Act) of 2007. Liechtenstein's engagement focuses on **emergency and reconstruction assistance**, **international refugee and migration assistance** as well as **bilateral and multilateral development cooperation**.

Liechtenstein works closely together with the affected population and local organizations, with aid and development organizations in Liechtenstein, Switzerland, Austria and Germany as well as with European and international organizations. Liechtenstein, through its IHCD, maintains working relationships with a large number of partners. The bulk of Liechtenstein's support is provided in the form of financial resources. Nevertheless, the LED maintains three coordination offices on the ground, namely in Moldova, Bolivia and Zimbabwe from where it can directly supervise its projects.

In 2012, Liechtenstein IHCD had financial resources of about 25.8 million Swiss francs at its disposal which equals about 700 Swiss francs per capita. Total Official Development Assistance (ODA) reached 26.8 million Swiss francs in 2012. The most recent ODA-percentage for the year 2010 is 0.62%.

In connection with the protection and preservation of the environment, Liechtenstein as an alpine country is particularly engaged in the development of mountain regions. Under the umbrella of the Alpine Convention, alpine countries cultivate a partnership with mountain regions in the Balkans, the Carpathians, the Caucasus, and Central Asia.

1.6 Research and systematic observation

Research

The Alpine Rhine Valley is an ideal object for interdisciplinary, scientifically challenging, practice-oriented and regionally anchored research projects. In line with its official mission, the University of Liechtenstein conducts application-oriented research in selected research areas. Around 1200 students from over 40 countries provide an international atmosphere to the small university in the Alpine Rhine Valley. Primary responsibility for research lies with the institutes and associated institutes.

Two of the University's institutes (Institute for Architecture and Planning and Institute for Financial Services) are directly involved in the examination of sustainable and ecological developments within their specific fields of activities.

One of the main focus points of the Institute for Architecture is the establishment of concepts for a sustainable regional development with respect to settlement, transport and landscape.

The Institute for Financial Services examines the impacts, challenges and opportunities of financial markets and their impact on social or environmental developments. In the context of natural scientific research on the country, national authorities and private organizations are also collaborating with foreign university research facilities and institutes. The goal is to gain ecological insights on a scientific basis that constitute a basis for formulating a sustainable development policy in conjunction with insights gained from economic and socio-cultural surveys and research.

Liechtenstein supports research activities abroad by annual contributions in the total amount of 250,000 CHF (2013) each to Switzerland (Swiss National Science Foundation, SNSF) and Austria (Austrian Science Fund, FWF). As a member of the EEA, Liechtenstein also participated in the European research programs (7th Framework Program on Research, 11.7 million CHF from 2007 to 2013).

Public institutions in Liechtenstein are also indirectly engaged in technology research. The University of Liechtenstein contributes a budget of 10, 8 million CHF (2012) to the training of experts and 3 million CHF (2012) to research as a base amount. Approximately 2/3 of this sum is dedicated to economic institutes and 1/3 to the Institute of Architecture and spatial planning. As one of the co-owners Liechtenstein also

supports the Interstate University of Applied Sciences of Technology Buchs (NTB) with an annual contribution of 1,1 million CHF (2012).

Liechtenstein envisages contributing another 200'000 CHF annually (from 2014) to the establishment of Rhysearch Innovation Center – a center of research and development, based in neighboring Buchs, Switzerland. The activities of Rhysearch are dedicated to small and midsized enterprises within the Rhine valley region and focus amongst others on the development of new energy systems.

Systematic observation

Liechtenstein collects a wide range of data relating to climate, both through its own measuring stations and through interregional cooperation, especially with Switzerland. Since 1974, the largest measuring station in the country has been in operation in Vaduz, measuring common meteorological data (air pressure, air temperature, relative humidity, wind direction, wind speed, precipitation, radiation, etc.). A private company has also measured similar data at several locations since 1997. Since 1970, the Office of Civil Engineering has been measuring snow depth at 10 locations. Since the 1960's, the Office of Environmental Protection has taken water samples at various locations to monitor quality and to determine groundwater levels.

Since 2001 the Eastern Swiss cantons and Liechtenstein jointly monitor ambient concentration of air pollutants.

Since 2003, Liechtenstein has also participated in the GLOBE program. GLOBE is a worldwide information network with more than 100 countries participating. Its goal is to sensitize young people to the global character of environmental issues by compiling ecological data and feeding data into the program.

1.7 Education, training and public awareness

Education at schools

The responsibility for the coordination of education lies with the Ministry of Education. The relevant legislative provisions are the Education Act, the Vocational Education and Training Act and the Higher Education Act along with the relevant ordinances.

Since 2005 environmental education officially forms part of Liechtenstein's all-encompassing educational program. Its origin is to be found on the national curriculum for Kindergarten, Primary and Secondary School of the Principality of Liechtenstein (2005, 2nd Edition). As one out of several reasons for the faculty of "Human and Environment" (topics are, among others: Climate, Weather, Economy, Industrialization) the respective curriculum states: "Students deal with humans as part of society and environment. They recognize dependencies as well as the possibility to act for or to influence relevant procedures. Thanks to this approach environmental education influences the content of various school subjects – it is not only a part of subjects like "Biology" or "Nature" (ecology) but also of "Economy and Policy" (ecological and economic relations).

In addition to the abovementioned the Government has set eco-friendly office and school supply goals: A specific catalogue recommends eco-friendly office and school supplies to teachers (paper, notebooks, writing implements, etc.). Moreover various school projects on environmental education were conducted at Liechtenstein schools, including the establishment of environmental focal points, ecofriendly offices and other support activities such as the participation within the "Youth Parliament of the Alpine Convention" (YPAC, 2012).

Public outreach

Public outreach is the responsibility of the administrative office assigned to the area in question. In addition, some tasks are delegated to external institutions and individual outreach campaigns by NGOs are supported.

The Government also supports initiatives and projects in the field of environmental protection:

- In 2010 an architectural competition for projects that serve as showcases within the field of sustainable housing and renovations of old buildings throughout the alpine region was launched. In 2013 the Government continued the competition together with the Swiss Federal Office of Spatial Development, the University of Liechtenstein and the International Alpine Convention, CIPRA. The new cooperation created the international annual reward for architecture „Constructive Alps“ with a price worth 50‘000, - Euro.
- Further financial support was provided to the Implementation of a personal carbon footprint program within the framework of a social networking platform (KLIMACODE).

The population is also provided with information on individual environmental concerns through reports in the newspapers. Research and survey results concerning the condition of the mountain region and information on environmental developments and changes are regularly brought to the attention of the public by authorities and public authorities via publication series, thematic brochures, posters, and reports in newspapers. Specialized excursions with school classes, population groups, and professional organizations conducted by various authorities constitute an important component of public outreach. An audit is currently under development with the goal of improving the compatibility of winter sports facilities with the landscape and the environment.

2. National circumstances relevant to greenhouse gas emissions and removals

2.1 Governmental structure

System of State

The Principality of Liechtenstein is a constitutional hereditary monarchy on a democratic and parliamentary basis. The power of the State is embodied in the Reigning Prince and the People. The relatively strong position of the Reigning Prince is balanced by far-reaching direct-democratic rights of the people.

Separation of powers

In the dualistic system of State of the Principality of Liechtenstein, the power of the State is embodied in both the Reigning Prince and the People. Separation of powers is further safeguarded by vesting separate rights in the executive branch (Government), the legislative branch (Parliament), and the judicial branch (courts).

Reigning Prince (Head of State)

The Reigning Prince is the Head of State and represents the State in all its relations with foreign States, notwithstanding the requisite participation of the competent Government. On the proposal of Parliament, the Reigning Prince appoints the Members of the Government. He is also responsible for appointing judges, the election of which is undertaken by Parliament on the proposal of a special selection body. On important grounds, the Reigning Prince may dissolve Parliament and dismiss the Government. The Reigning Prince may also exercise emergency powers as well as the powers of pardon, mitigation, and quashing with respect to criminal investigations. Furthermore, every law requires the sanction of the Reigning Prince to enter into force. In exercising his powers, the Reigning Prince is bound by the provisions of the Constitution.

Parliament

The Liechtenstein Parliament is elected every four years. Parliament consists of 25 Members. They are elected in universal, equal, direct, and secret elections in accordance with proportional representation. In the current legislative term (2013-2017), four parties are represented in Parliament. The Progressive Citizens' Party (FBP) is the strongest party with 10 seats. The Patriotic Union (VU) has 8 seats, the Independents (DU) have 4 seats and the Free List (FL) is represented with 3 seats.

The most important responsibilities of Parliament are participation in the legislative process, assent to international treaties, approval of State funds, election of judges on the proposal of the selection body, and supervision of the National Administration. Parliament elects the Government and proposes its appointment to the Reigning Prince. It can also trigger dismissal of the Government when the Government loses its confidence. Parliament constitutes a quorum if at least two thirds of its Members are present.

Government

The Government consists of five Ministers: the Prime Minister, the Deputy Prime Minister, and three other Ministers. The Ministers are appointed by the Reigning Prince on the recommendation of Parliament. The

Government is the supreme executive authority, to which 30 offices and several diplomatic missions abroad are subordinate. About 50 commissions and advisory councils support the work of the Administration.

Jurisdiction

Jurisdiction is divided into jurisdiction under public law (special jurisdiction) and ordinary jurisdiction. Jurisdiction under public law is exercised by the Administrative Court and the Constitutional Court. The Administrative Court is the instance for complaints against decisions and orders of the Government or commissions acting on the Government's behalf. The responsibilities of the Constitutional Court include in particular the protection of the rights guaranteed by the Constitution, the European Convention on Human Rights, and the human rights instruments of the United Nations to which Liechtenstein is a State party. It also reviews the constitutionality of laws and international treaties and the legality of Government ordinances.

Ordinary jurisdiction encompasses the administration of justice in civil and criminal matters. The first instance is the Liechtenstein Court of Justice in Vaduz. Before a complaint can be lodged with the Liechtenstein Court of Justice in contentious civil matters, a mediation procedure must be undertaken in the municipality of residence of the defendant. Only if the mediation procedure fails the Liechtenstein Court of Justice will be invoked as the first instance. Ordinary jurisdiction in the first instance is exercised by individual judges. The second instance is exercised by the Court of Appeal, and the third instance by the Supreme Court. Both courts are collegial bodies.

Municipalities

Municipal autonomy plays an important role in Liechtenstein. The autonomous scope of authority of the 11 municipalities is laid down in article 110 of the Constitution. The eligible voters of each municipality elect a Municipal Council headed by a Mayor who, depending on the size of the municipality, exercises his office full-time or part-time. The municipal authorities conduct their affairs autonomously and manage the municipal assets. Citizens may call a referendum against their decisions.

Relations with Switzerland

The relations between Liechtenstein and Switzerland are very close and friendly. The two countries have concluded numerous bilateral agreements. The most important treaty is the Customs Treaty, which, together with other agreements, ensures an open border between Liechtenstein and Switzerland also for passenger traffic. Also of great importance to the Liechtenstein economy is the Currency Treaty, which governs the use of the Swiss franc as the official currency in Liechtenstein.

The Customs Treaty ensures that all Swiss customs regulations and all other Swiss federal legislation shall apply to Liechtenstein to the extent to which their application is necessary for the customs union. All provisions of Swiss federal legislation are exempt from this rule that would give rise to a contribution requirement by the Swiss Confederation. In addition, all trade and customs treaties concluded between Switzerland and third countries apply to Liechtenstein pursuant to the Customs Treaty. Switzerland is also authorized to represent Liechtenstein at such negotiations and to conclude these treaties effective for Liechtenstein. In principle, the Customs Treaty is limited to the transport of goods. In the 1990's, the Customs Treaty was adapted as a consequence of European integration. Since then, Liechtenstein has been able to become a State party to international conventions and a member of international organizations concerning the scope of the Customs Treaty, as long as Switzerland also belongs to these conventions and organizations. On the other hand, Liechtenstein may also join such conventions and organizations even if Switzerland does not join. In this event, Liechtenstein and Switzerland conclude a special agreement, such as in 1994 pursuant to Liechtenstein's accession to the European Economic Area (EEA). In addition to its effect under international law, the Customs Treaty also has symbolic significance for the particularly close relations between Liechtenstein and Switzerland. It has created the basis for legal alignment and harmonization in the fields of economics and social law, extending far beyond the scope of the treaty. These close links manifest themselves today in a wide range of agreements and treaties, including the areas of social security, vocational training, transport, indirect taxes, and cross-border police cooperation.

The Customs Treaty is also relevant to environmental law. The bulk of Swiss environmental standards also apply to Liechtenstein. Environmental taxes and tax incentives are not covered by the Customs Treaty, due

to Liechtenstein's tax sovereignty. Liechtenstein has therefore concluded "The bilateral Agreement between the Principality of Liechtenstein and the Swiss Confederation on Environmental Levies within the Principality of Liechtenstein" to ensure a parallel levying of environmental taxes in Liechtenstein. A similar treaty framework already exists in the area of transport with respect to the Heavy Vehicle Fee (HVF).

Liechtenstein and the EU

The relations between Liechtenstein and the EU are close, and cooperation is intensive. Since 1 May 1995, Liechtenstein has been linked with the European Union (EU) and its member States through an extensive association agreement – the Agreement on the European Economic Area (EEA). This agreement extends the Single Market of the EU by three of the four EFTA States, namely Liechtenstein, Iceland, and Norway. Including Croatia that joined on 1 July 2013, the EU now has 28 members and the EEA 31 members.

Through the EEA Agreement, the EU member States and the three EEA/EFTA States Liechtenstein, Iceland, and Norway are brought together into a Single Market, in which the same basic rules (acquis communautaire) apply to all participating States. The rules relate to the four basic freedoms (free movement of goods, free movement of persons, free movement of services, free movement of capital) and to joint competition rules.

In addition to the legal provisions concerning the Single Market, the EEA Agreement also contains horizontal and flanking policies aimed at strengthening the Single Market. These additional areas of cooperation include environmental protection, consumer protection, research and development, education, statistics, company law, and social policy. A large share of EU environmental standards therefore also applies in Liechtenstein. Liechtenstein also takes part in EU programs in the aforementioned areas and, through its participation in committees, has a voice in the development and execution of the programs.

2.2 Population

At the end of 2011, Liechtenstein had a population of 36,476, a third (33.3%) of whom were foreign citizens (especially Swiss, Austrians, Germans and Italians). The population density in 2011 was 227 inhabitants per km2. Figure 2-1 indicates the development of Liechtenstein's population between 1960 and 2011.

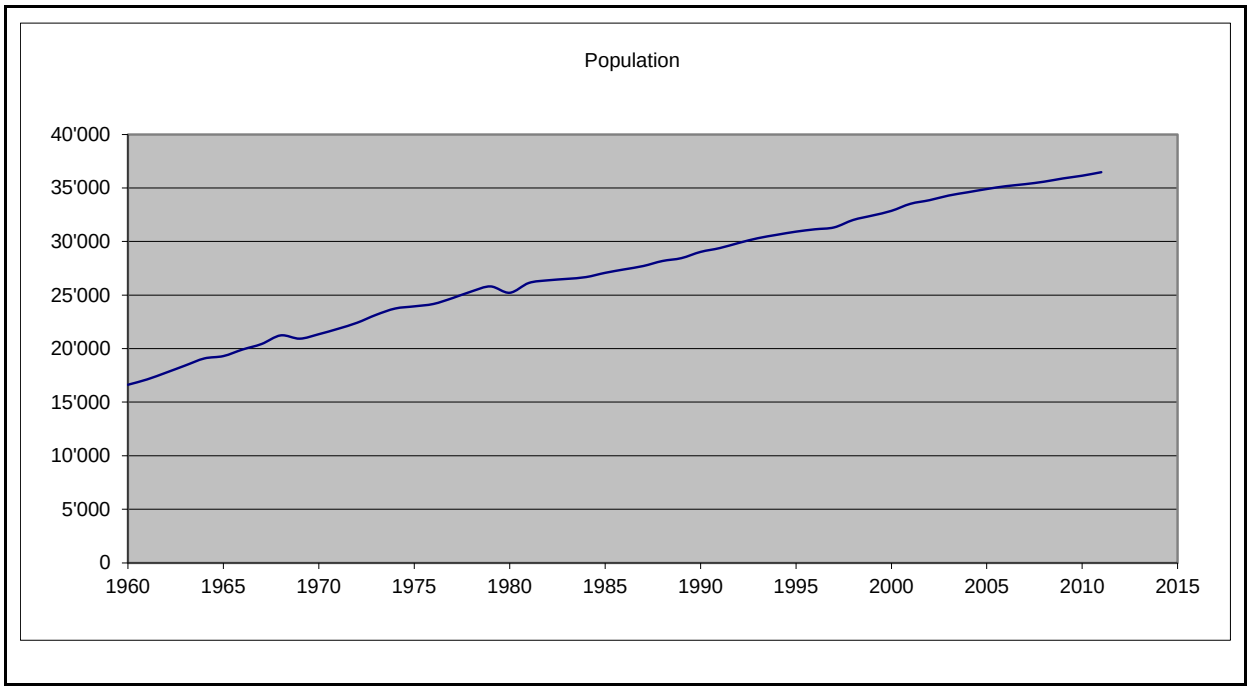

Figure 2-1 Population 1960-2011

2.3 Climate

Liechtenstein has a continental climate, i.e., the weather varies considerably over the course of the year. In the capital Vaduz, at 456 meters elevation, the average annual temperature was 11.3°C in the year 2011. The average precipitation has not changed appreciably in the last 20 years. In Vaduz, it is approximately 970 mm per year (annual average precipitation 1974-2007).

2.4 Geography

The Principality of Liechtenstein is located between 47°02' and 47°16' north and 9°28' to 9°38' east. It is situated in the heart of Europe, between Austria and Switzerland, and covers an area of 160 km^2. The transport axes Munich-Milan and Zurich-Vienna intersect near the Principality of Liechtenstein. There are no motorways on Liechtenstein's territory so that Liechtenstein's road network is only of regional importance. A high mountain range (the Alps) in the east constitutes the natural border to Austria; the River Rhine marks the border to Switzerland.

Figure 2-2 The Principality of Liechtenstein

2.5 Economy

At the end of 2011, Liechtenstein had 35,253 employed persons. More than half of the work force lives abroad commuting from Switzerland, Austria or Germany to Liechtenstein. Over two thirds of the work force are foreign citizens. In 2011 59.9% of the employed persons worked in the sector services, 39.4% in the sector manufacturing and 0.8% in the sector agriculture and forestry.

In 2012 the annual unemployment rate was 2.4%.

The gross domestic product (GDP) and the gross national income (GNI) were determined for the first time in 1998, as part of Liechtenstein's National Economic Accounting. Older GDP and GNI figures were calculated using a different method and can therefore not be compared directly. In 2010, the GDP stood at 5.3 billion (thousand million) Swiss francs and economic growth was 8.7%. The GNI was at 4.5 billion Swiss francs. A first estimation for the GDP in 2011 is 5.4 billion Swiss francs. Figure 2-3 shows the development of the GDP and GNI between 1998 and 2006.

According to economic sector, industry and manufacturing generated 39% of gross value added in 2010, general services 27%, financial services 27%, and agriculture and households 7%.

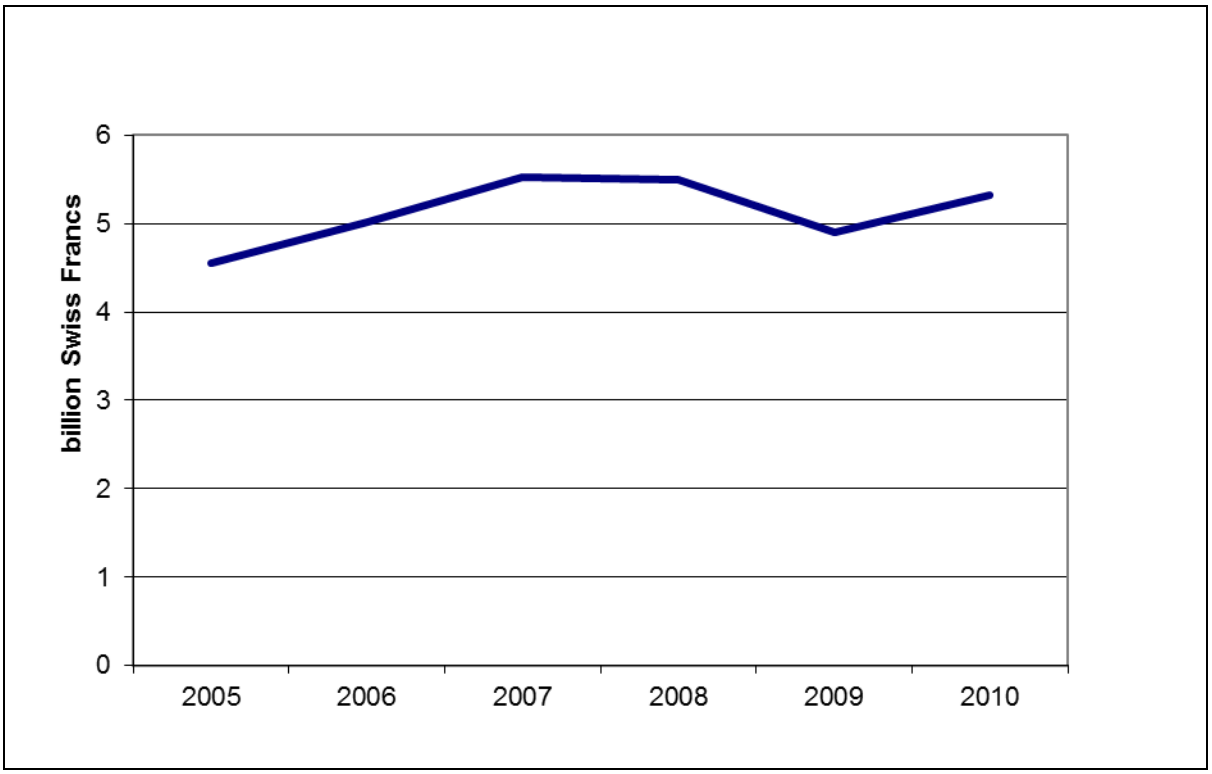

Figure 2-3 GDP at current prices 2005-2011

Figure 2-4 shows the development of GDP per employed person (in full-time equivalents) and GNI per inhabitant. In 2010 GDP per employed person was 182,000 CHF and GNI per inhabitant was 125,000 CHF. A distinctive feature of the Liechtenstein GDP is that it derives to a considerable extent from the work done by working personnel domiciled abroad. In 2010 52% of people at work in Liechtenstein were cross-border commuters from abroad. For this reason, it is not valid to calculate per capita GDP based on inhabitants. This would yield to misleading results in comparison with other countries.

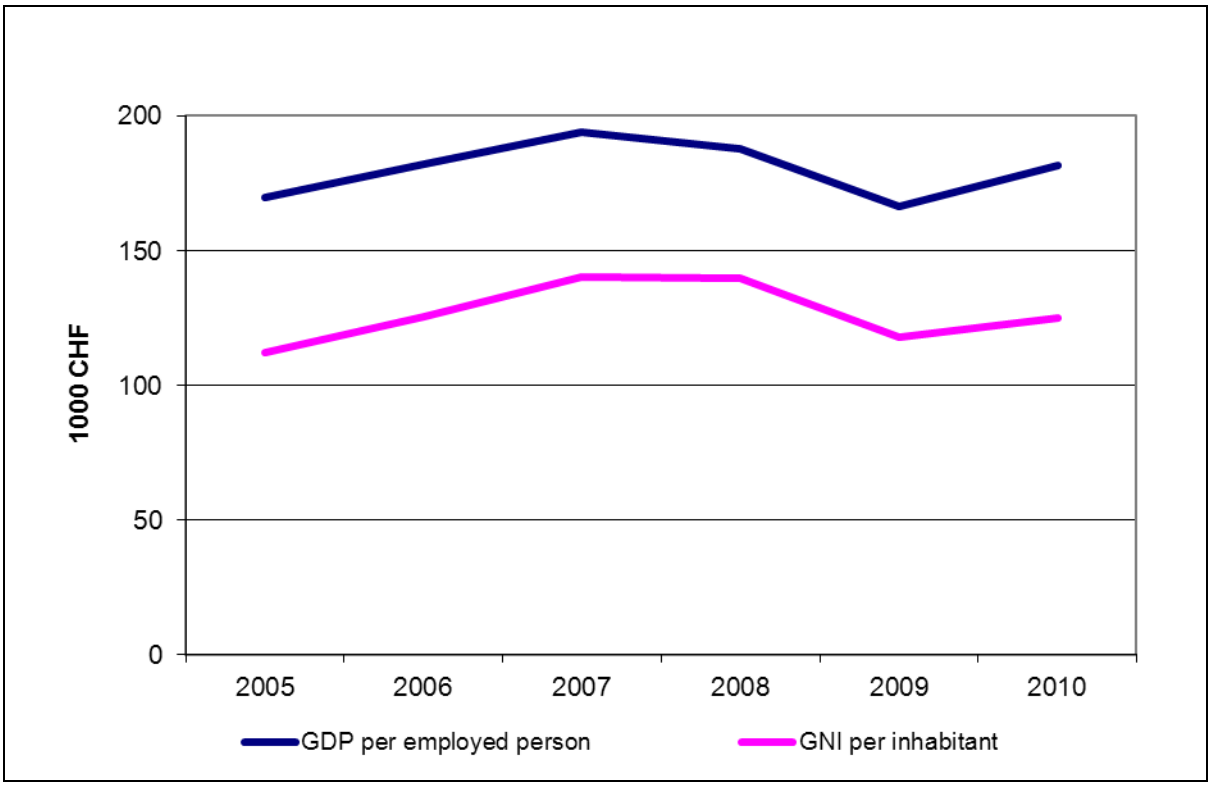

Figure 2-4 GDP at current prices per employed person (in full-time equivalents) and GNI at current prices per inhabitant 2005-2010

2.6 Energy

Energy supply

Liechtenstein has no fossil fuel resources of its own. In the year 2012, 10.7% of the energy used comes from Liechtenstein. Regarding electricity, 20.6% was produced in Liechtenstein. Liechtenstein's own supply of energy is limited to firewood, ambient heat, and electricity (hydroelectric power plants, photovoltaic systems, biogas and natural gas block-heating plants).

Total energy consumption in 2012 was 1,360 GWh (4,895 TJ). Natural gas (22%) and electricity (30%) constitute the greatest share of the total energy consumption.

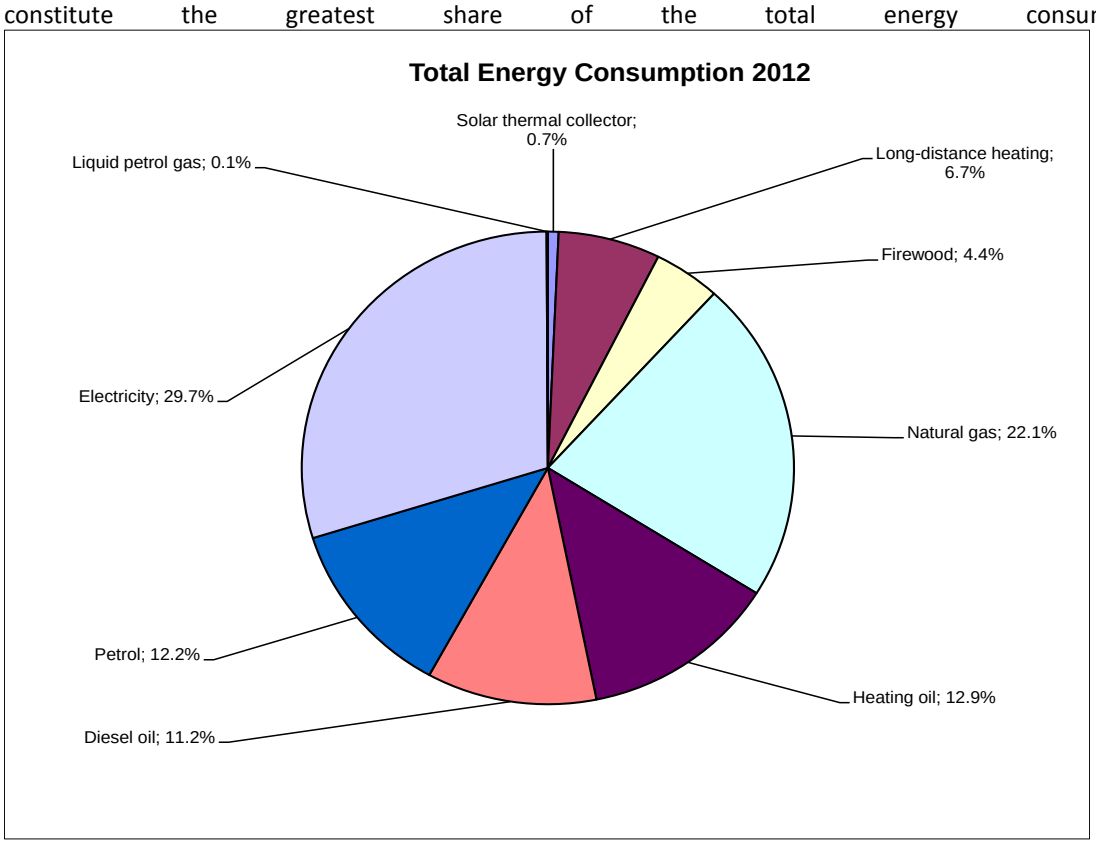

Figure 2-5 illustrates energy consumption and energy imports by energy source in 2012.

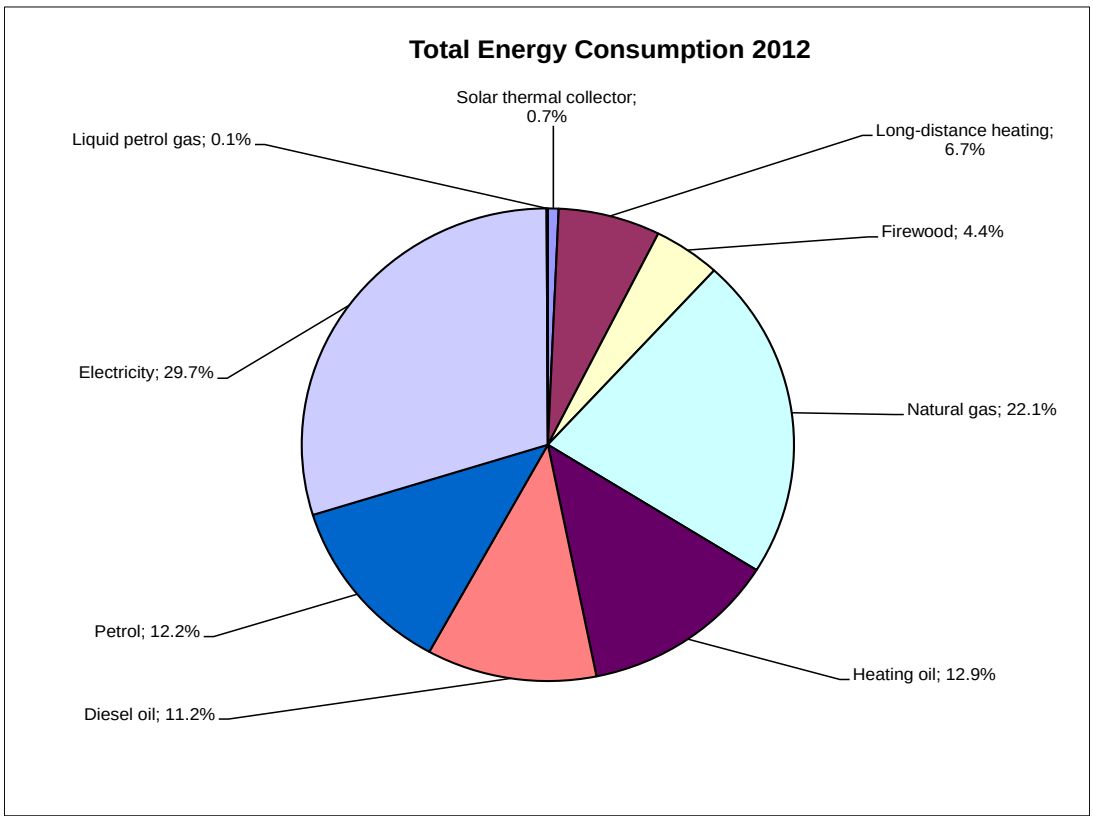

Figure 2-5 Energy consumption by fuels, 2012. 100% corresponds to 1,360 GWh or 4,895 TJ.

In 2012, total energy consumption per capita reached 36.9 MWh. Figure 2-6 illustrates energy consumption per inhabitant between 1965 and 2012. Energy productivity decreased between 2000 and 2002, but reached the level of 1998-1999 again in 2003 and 2004.

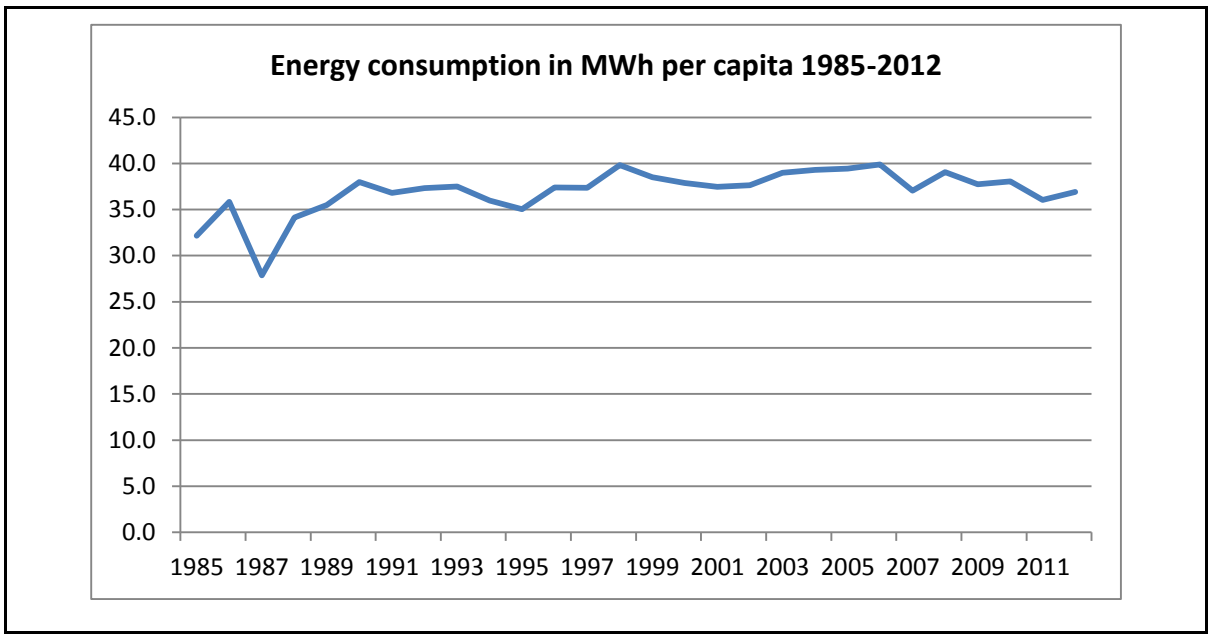

Figure 2-6 Energy consumption per capita 1985-2012.

Energy prices

Liechtenstein does not compile its own statistics on the development of energy prices; however, energy prices are comparable to those in Switzerland. Figure 2-7 illustrates the development of real energy prices for the most important energy sources – electricity, natural gas, petroleum and light heating oil – in Switzerland between 1960 and 2012. After rather low energy prices in the early 70ies, real prices of energy sources increased between 1978 and 1985. Prices for heating fuel then reached a historic low in the mid 90ies. However, from the end of the 1990ies, real energy prices have risen again, with a stronger increase since 2004. In particular a very strong increase between 2007 and 2008 occurred for heating fuel prices that remained high until 2012. Electricity is an exception since its real prices tended to decrease since the mid-1990ies. However also for electricity a slight increasing trend can be observed in recent 5 years.

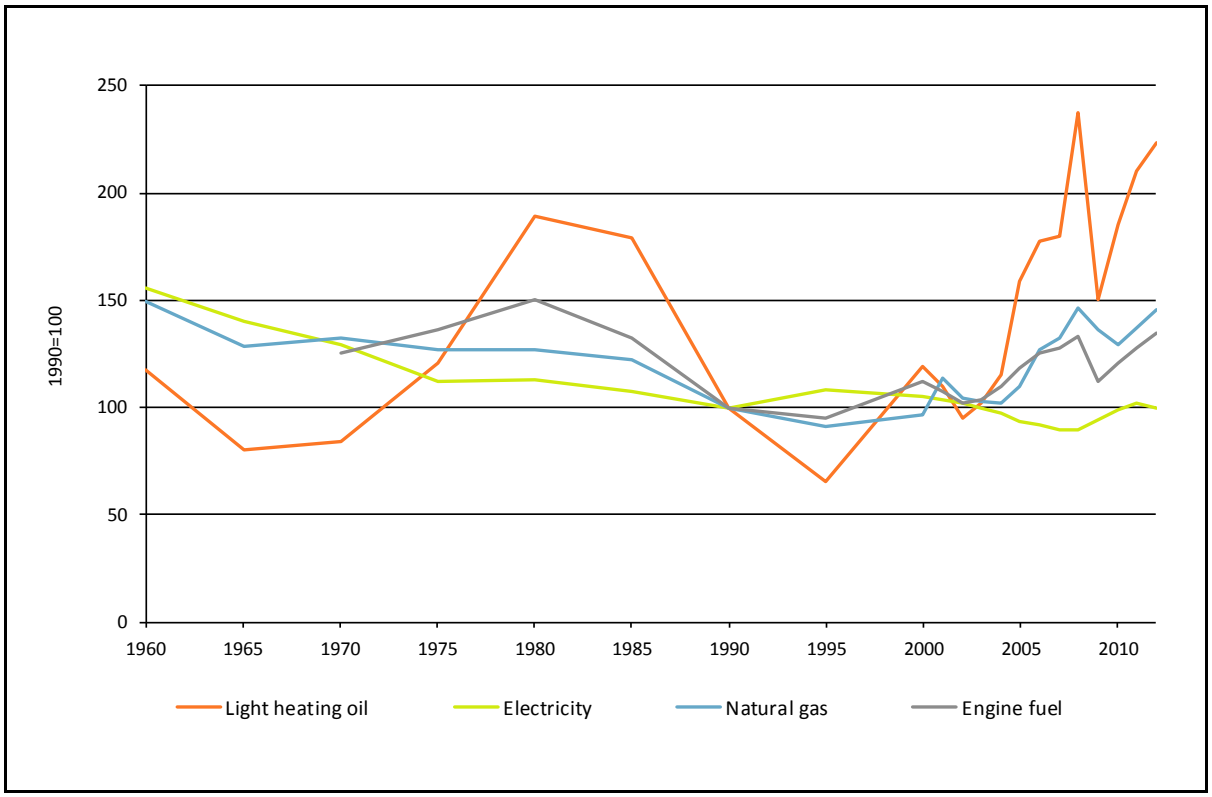

Figure 2-7 Real energy prices of the most important energy sources 1960-2012, Index 1990=100 (SFOE 2012)

Electricity

In 2011, the electricity fed into the national network amounted to 398 GWh. About four fifths (83%) of the energy consumed in Liechtenstein is being imported. Liechtenstein's own production amounts to approximately 72 GWh (hydroelectric plants, block-heating plants, photovoltaic systems).

2.7 Transport

The most important transport network in Liechtenstein is the road network. The only railway is a 9km long route crossing the country from Feldkirch (Austria) to Buchs (Switzerland), operated by the Austria Federal Railway (ÖBB). Public transport is ensured by a dense network of buses. On the Swiss side of the Liechtenstein border, there is a freeway.

Over the last thirty years, the number of motor vehicles in Liechtenstein has more than doubled. In 2012, 28,004 automobiles were registered (degree of motorization: 768 automobiles per 1000 inhabitants). Figure 2-8 illustrates the development of the number of vehicles between 1970 and 2012, and Figure 2-9 shows the automobiles by unladen weight in kg in 2012.

Pursuant to decision 1753/2000/EC, which has been incorporated into the EEA Agreement, Liechtenstein is required to determine the average CO_2 emissions of automobiles newly introduced into circulation.

Liechtenstein also follows the path established by Regulation (EC) 443/2009, which sets emission performance standards for new passenger cars. The Regulation's goal by 2015 is to set the average emissions for new passenger cars at 130g CO_2/km. From 2020 onwards this Regulation sets a target of 95 g CO_2/km. The current Liechtenstein data is still far from achieving this goal.

The average CO_2 emissions of all vehicles newly introduced into circulation was 158 g/km in 2012 (compared to 190 g/km in 2008). The emissions of petrol vehicles were 160 g/km, slightly higher on average than the 159 g/km emitted by diesel vehicles.

CO_2 emissions rise with increasing engine sizes, engine power, and vehicle weight. In the past years most of the technically achieved reductions in CO_2 emissions have been cancelled out by the larger and more powerful engines and heavier vehicles that continue to be popular. However, the proportion of economically, light vehicles rises und also the number of vehicles with alternative fuels (natural gas, hybrid) continues to increase.

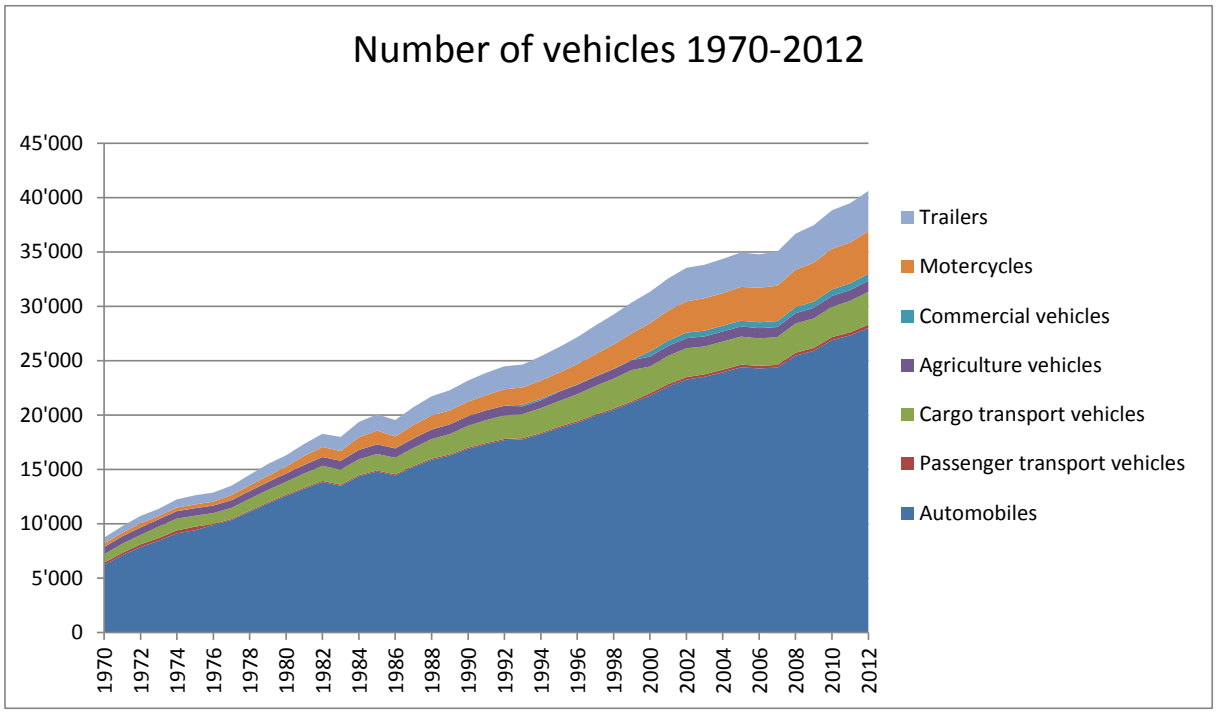

Figure 2-8 Number of vehicles 1970-2012 (OS 2012).

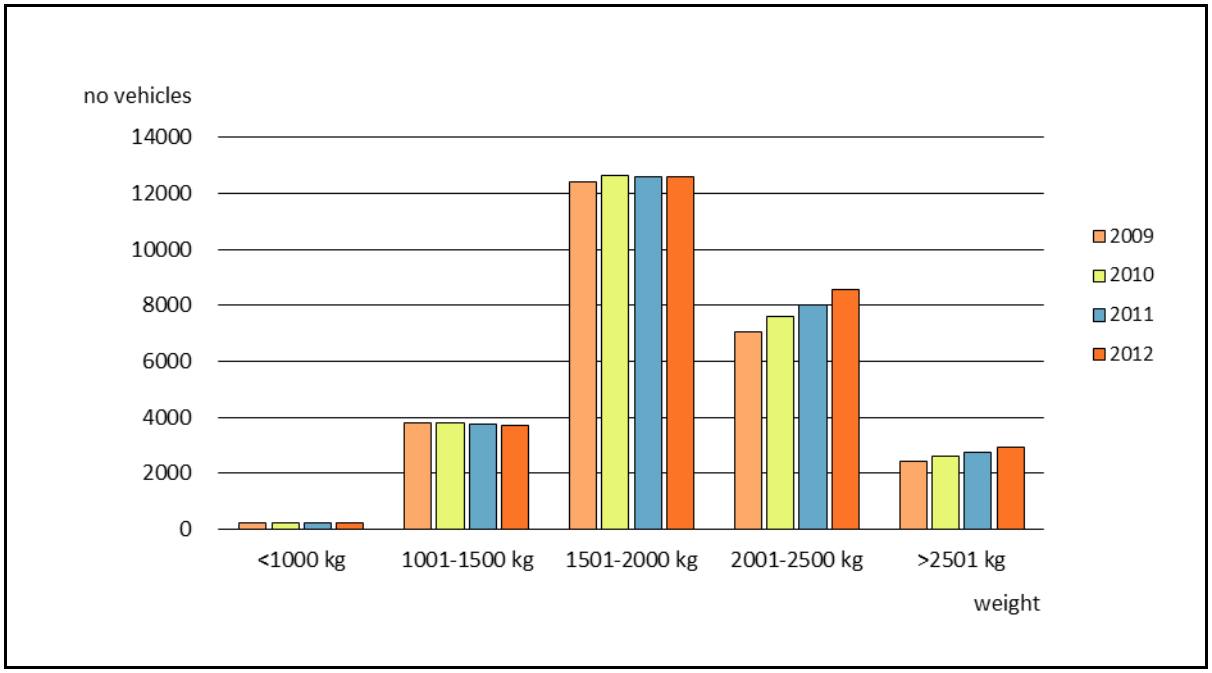

Figure 2-9 Number of vehicles by total weight 2012 (OS 2012)

2.8 Industry

Liechtenstein's economy has a significant emphasis on industrial production. In 2010, the production sector provided 39% of employment, which is, in comparison with other European countries, extraordinarily high. The most important industrial branches are mechanical engineering, electrical machinery, vehicle components, dental technology, food products as well as construction work.

Due to Liechtenstein's limited domestic market, especially the larger enterprises are heavily export-oriented. A vast majority of their goods production is sold abroad. The most important export countries of Liechtenstein's industry and goods production sector are Switzerland, Germany and the USA.

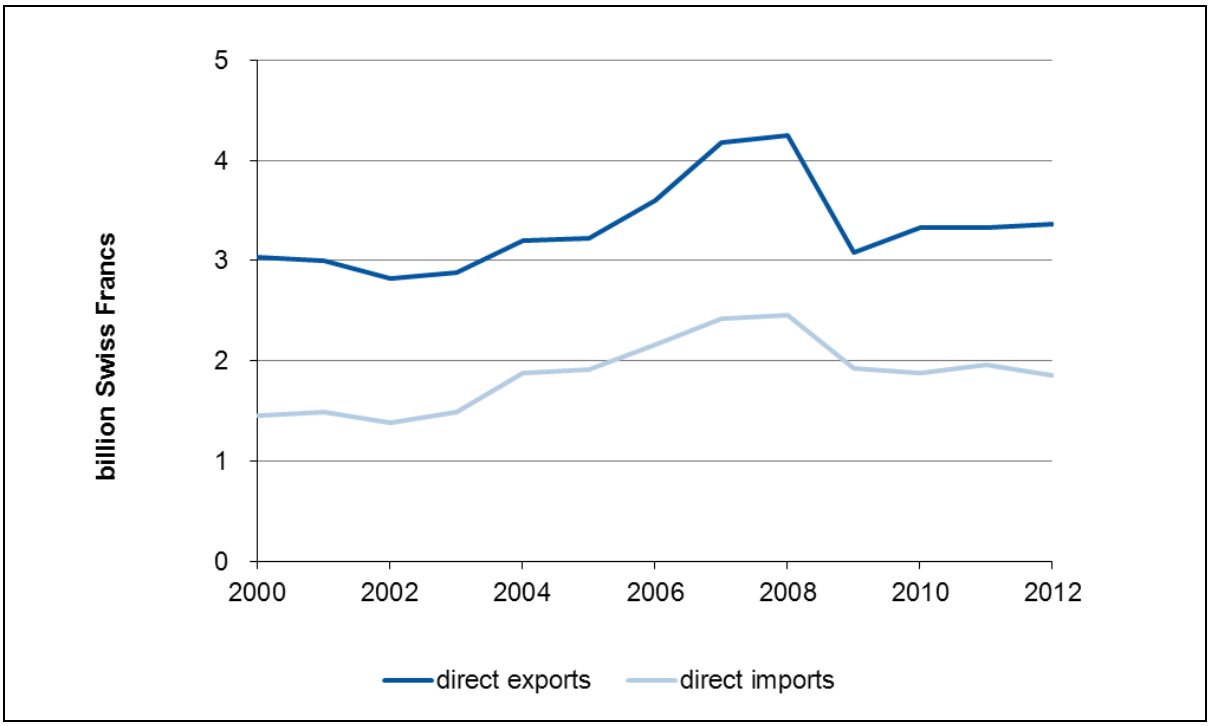

Figure 2-10 Direct goods Imorts and exports since 2000 in billion CHF. Exchange of goods with Switzerland is not included (OS 2013).

2.9 Waste

After the implementation of fees on municipal waste considering the polluter-pays-principle in 1994 the amount of waste apparently declines. In the following years, the amount develops parallel to the population growth. The recycling quote was 60.3% in 2010.

The amount of landfill volume fluctuates strongly depending on building activities and market conditions. There is no landfill for hazardous waste. In Liechtenstein only excavated material and construction waste are deposited.

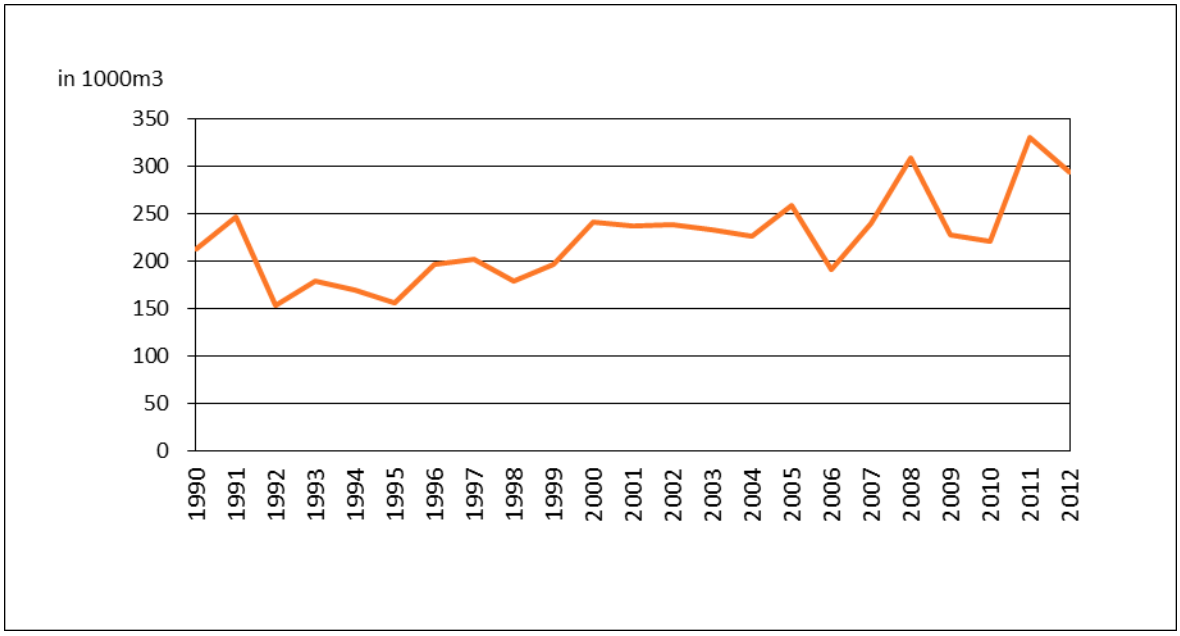

Figure 2-10 Development of landfill volumes since 1990 in 1000 cubic metres (OE 2013).

After the implementation of fees on municipal waste considering the polluter-pays-principle in 1994 the amount of waste apparently declines. In the following years, the amount develops parallel to the population growth. The recycling quote was 60.3% in 2010.

2.10 Building stock and urban structure

Between 1984 and 2008 the settlement area increased by 426 hectares (33.8%) to 16.9 km^2 or 11% of the country's area. The transport infrastructure covered 2.8% of the country's area in 2008. 4.0% of the country's area were living area. In 2010 there existed 10,383 residential buildings in Liechtenstein. In 1970 the number of residential buildings in Liechtenstein was 4,632.

2.11 Agriculture and Forestry

The country covers 160 km^2, 41% of which is forested, 33% agricultural (cropland, pastures, plantations, alp meadows), 11% populated, and 15% unproductive (as of the end of 2008). Between 1984 and 2008 the agricultural area decreased from 58.3 km^2 to 53.3 km^2.

The abovementioned data (Chapter 2.10 and 2.11) originate from Liechtenstein's population census in 2002 and Liechtenstein's Areal Statistic from 2008 (published in the Environment Statistics 2011) and from Liechtenstein's population and housing census in 2010 (provisional data).

References

OS (Office of Statistics), 2013: Key Data for Liechtenstein, Vaduz.

OS (Office of Statistics), 2012: National Accounts 2010, Vaduz.

OS (Office of Statistics), 2013: Statistical Yearbook 2013, Vaduz.

OS (Office of Statistics), 2011: Energy Statistics 2011, Vaduz.

OS (Office of Statistics), 2011: Environment Statistics 2011, Vaduz.

OS (Office of Statistics), 2012: National Accounts - Estimation of Gross domestic product 2011, Vaduz.

OS (Office of Statistics), 2012: Agriculture Statistics 2010, Vaduz.

OS (Office of Statistic), 2012: Motor Vehicle Statistics, 1 July 2012, Vaduz.

SFOE (Swiss Federal Office for Energy), 2012: Energy Statistics 2012. Bern. Switzerland.

3. GHG Inventory information, including information on National Systems and National Registries

3.1 Summary tables

Summary tables of the national greenhouse gas inventory in the common reporting format are provided in Annex 1.

3.2 Trends in greenhouse gas emissions and removals (1990-2011)

3.2.1 Aggregated greenhouse gas emissions 2011

In 2011, Liechtenstein emitted 222 Gg CO_2 equivalent (excluding LULUCF) to the atmosphere corresponding to 6.1 tonnes CO_2 equivalent per capita.

With a share of 83.2% the largest contributor gas was CO_2. The most important source was sector 1 Energy with 84.3% share (187.1 Gg CO_2 equivalent). Table 3-1 shows emissions by gas and sector in Liechtenstein for the year 2011. A breakdown of Liechtenstein's total emissions by gas is given in Table 3-2

Figure 3-1 shows the relative contributors of the individual gases to the total greenhouse gas emissions (excluding LULUCF).

Fuel combustion within the energy sector was by far the largest single source of emissions of CO_2 in 2011.

Emissions of CH_4 and N_2O originated mainly from agriculture.

Table 3-1 Summary of Liechtenstein's GHG emissions by gas and sector in CO_2 equivalent (Gg), 2011. (Numbers may not add to totals due to rounding.)

Emissions 2011	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total
	CO_2 equivalent (Gg)						
1 Energy	184.0	2.0	1.0				**187.1**
2 Industrial Processes	NO	NO	NO	8.7	0.1	0.0	**8.8**
3 Solvent and other Product Use	0.7		0.3				**1.0**
4 Agriculture		12.7	10.6				**23.4**
6 Waste	0.0	0.7	1.1				**1.8**
Total (excluding LULUCF)	**184.8**	**15.4**	**13.0**	**8.7**	**0.1**	**0.0**	**222.0**
5 LULUCF	-7.0	NO	0.0				**-7.0**
Total (including LULUCF)	177.8	15.4	13.0	8.7	0.1	0.0	**215.0**
International Bunkers	*0.8*	*0.0*	*0.0*				***0.8***

Table 3-2 Overview of the greenhouse gas emissions of Liechtenstein for the year 2011 in Gg.

IPCC	Category	CO_2	CH_4	N_2O	SF_6	NO_x	CO	MNVOC	SO_2
	Source/Sing								
1	Total Energy	184.04	0.09	0.00		NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO
(1A)	Fuel combustion activities	184.04	0.05	0.00		NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO
(1B)	Fugitive emissions from fuels	NA, NO	0.05	NA, NO		NA, NO	NA, NO	NA, NO	NA, NO
2	Industrial processes	NO	NO	NO	0.00	NA, NO	0.01	0.02	NA, NO
3	Solvents and Other Product use	0.073		0.00		NO	NO	0.19	NO
4	Agriculture		0.61	0.03		NA, NO	NA, NO	NA, NE, NO	NO
6	Waste	0.03	0.03	0.00		NA, NO	NA, NO	NA, NO	NA
	Total excl. LULUCF	184.14	0.74	0.03	0.01	NA, NE, NO	NA, NE, NO	0.21	NA, NE, NO
5	LULUCF	-7.04	NO	0.00	0.00	NE, NO	NE, NO	NE, NO	NO
	Total incl. LULUCF	177.1	0.74	0.03	0.06	NA, NE, NO	0.01	0.21	NA, NE, NO
Memo	International Bunkers	0.83	0.00	0.00		NE, NO	NE, NO	NE, NO	NE, NO

Please note: The IPCC categories 1-4 and 6 are added, generating the "Total excluding LULUCF". IPCC category 5, LULUCF may either be a source or a sink. The sum of all IPCC categories 1-6 are called "Total including LULUCF.

To compare the climate gases with each other, they must be converted into CO_2 equivalent according to their Global Warming Potential (GWP). The GWP varies for each gas. 1 ton of methane has the same GWP as 21 tons of CO_2 meaning that GWP (CH_4) = 21. For nitrous oxide, the factor is even much higher GWP (N_2O) = 310 (UNEP / WMO / IPCC, 1996). To add the GWP of all gases, the emissions of methane and nitrous oxide must first be multiplied by their GWPs. This results in Gg CO_2 equivalent.

Table 3-3 GHG emissions of Liechtenstein in 2011 in CO_2 equivalent. The column to the right represents the share of the sectors.

IPCC	**Category**	**CO_2**	**CH_4**	**N_2O**	**HFCs**	**PFCs**	**SF_6**	**Total**	**Share**
	Source/Sink	CO_2 equivalent (Gg)							%
1	Total Energy	184.04	1.99	1.05				187.08	84.26%
(1A)	Fuel combustion activities	184.04	0.96	1.05				186.05	83.79%
(1B)	Fugitive emissions	NA,NO	1.03	NA,NO				1.03	0.47%
2	Industrial Processes	NO	NO	NO	8.73	0.07	0.01	8.81	3.97%
3	Solvent and other Product Use	0.73		0.27				0.99	0.45%
4	Agriculture		12.74	10.63				23.37	10.52%
6	Waste	0.03	0.66	1.09				1.78	0.80%
	Total (excl. LULUCF)	**184.80**	**15.39**	**13.03**	**8.73**	**0.07**	**0.01**	**222.04**	**100.00%**
	Share (excl. LULUCF)	83.23%	6.93%	5.87%	3.93%	0.03%	0.00%	100.00%	
5	LULUCF	**-7.04**	**NO**	**0.01**				**-7.03**	-3.16%
	Total (incl. LULUCF)	**177.76**	**15.39**	**13.05**	**8.73**	**0.07**	**0.01**	**215.01**	**96.84%**
	Share (incl. LULUCF)	82.68%	7.16%	6.07%	4.06%	0.03%	0.00%	100.00%	

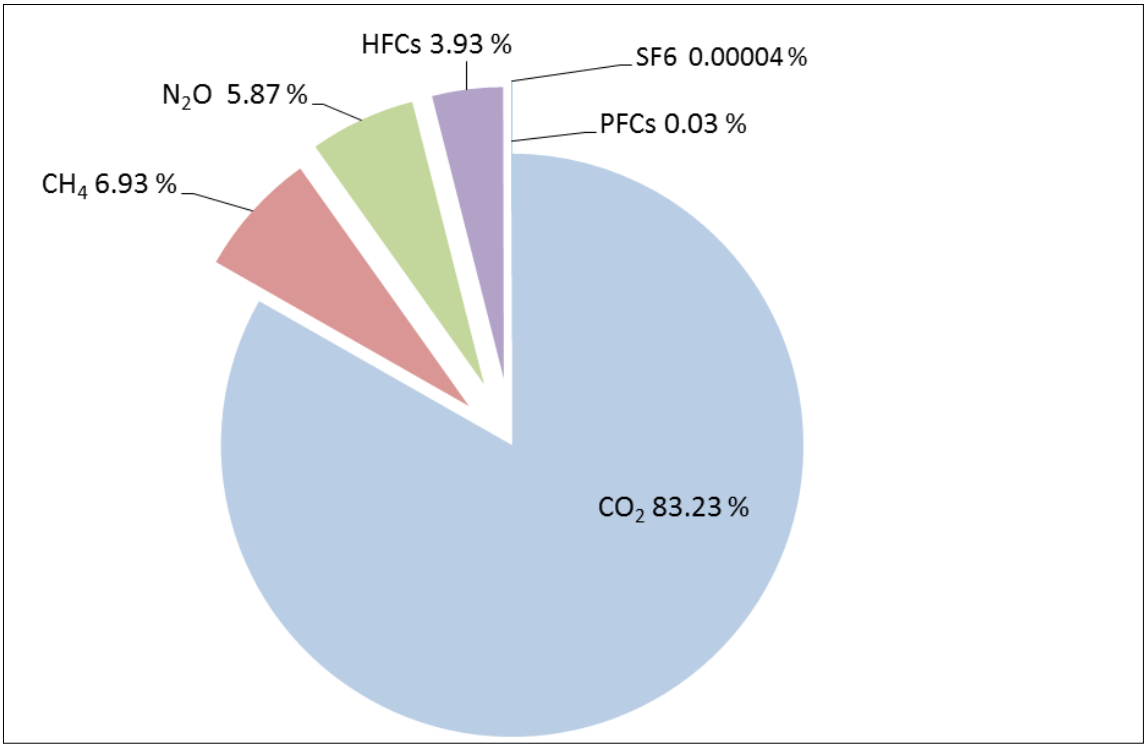

Figure 3-1 Liechtenstein's GHG emissions by gas excluding LULUCF in 2011.

CO_2 (excl. LULUCF)

In 2011, 184.8 Gg of gross CO_2 emissions were produced, which corresponds to 5.1 tonnes per capita. Approximately two fifths (42%) of these emissions were generated by Transport (composed of Transport and Offroad Vehicles and Machinery). Commercial, Institutional and Residential users (room heating and warm water) account for another two fifths (42%) of emissions. Industry (composed of Energy Industries and Manufacturing Industries and Combustion) contributes with 12% of emissions. Other sources such as Waste and Solvent and Other Product Use play an insignificant role by comparison, while Agriculture is not a source of CO_2 at all.

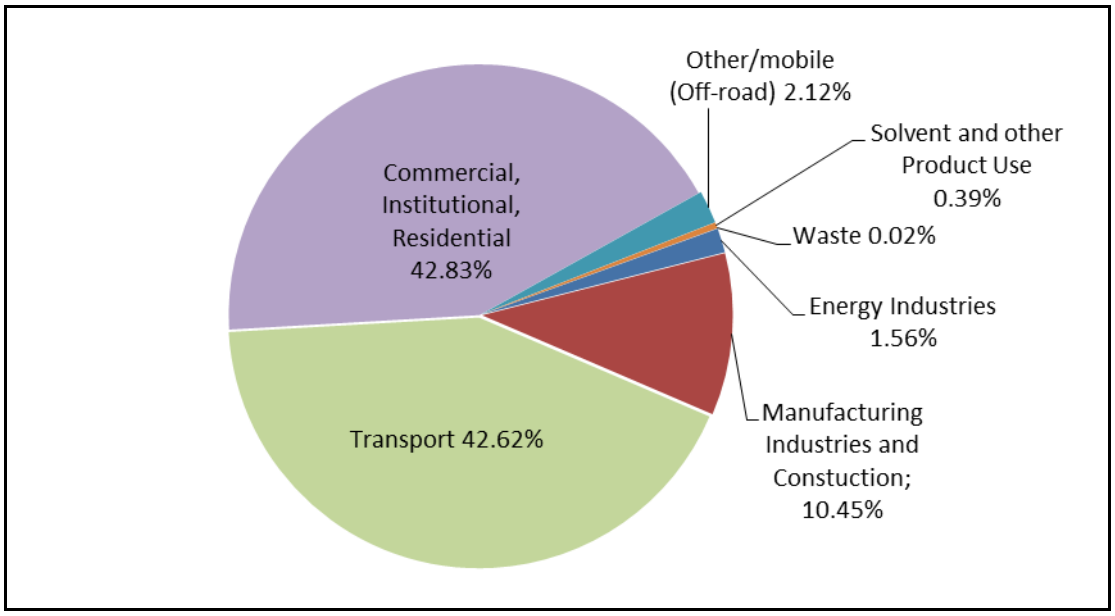

Figure 3-2 CO_2 emissions by sector in 2011 (assignment to IPCC categories: see Table 3-1). 100% corresponds to 184.8 Gg.

CH_4

In 2011 0.7 Gg of CH_4 were emitted corresponding to 15.4 Gg of CO_2 equivalents. 82 % of this volume was generated by the agriculture sector, whereof 73% were caused by ruminants. 7% derive from Fugitive Emissions, namely losses from the natural gas network. Other sources such as Residential, Institutional, and Commercial users (room heating and warm water) account for 4%, as well as the source Waste (4%). Industrial processes account and Energy Industries account each for 0.2% of the CH_4 emissions, transport emissions for only 1% respectively.

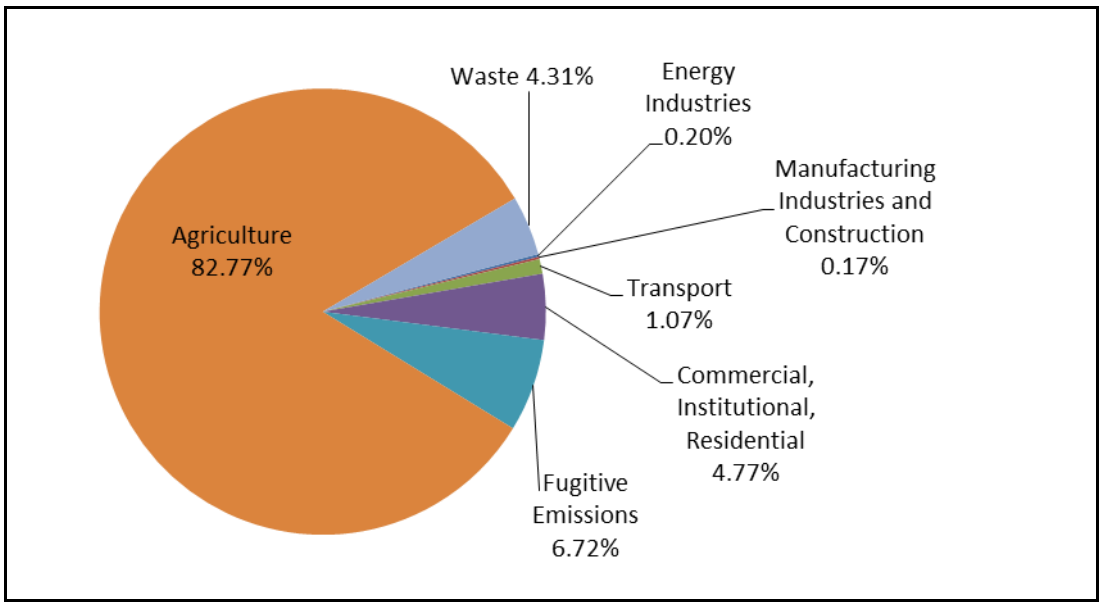

Figure 3-3 CH_4 emissions by sector in 2011 (assignment to IPCC categories: see Table 3-1). 100 % corresponds to 15.39 Gg CO_2 eq.

N_2O

In 2011, 0.041 Gg N_2O were emitted corresponding to 13 Gg CO_2 equivalents. Approximately four fifths are generated by Agriculture (81.56%). Further important sources are Waste with a share of 8.35 % and Transport with a share of 4.61 %. Contribution of other sources such as Residential, Institutional, and Commercial users as well as Industry and Solvent and other Product Use are very minor in comparison.

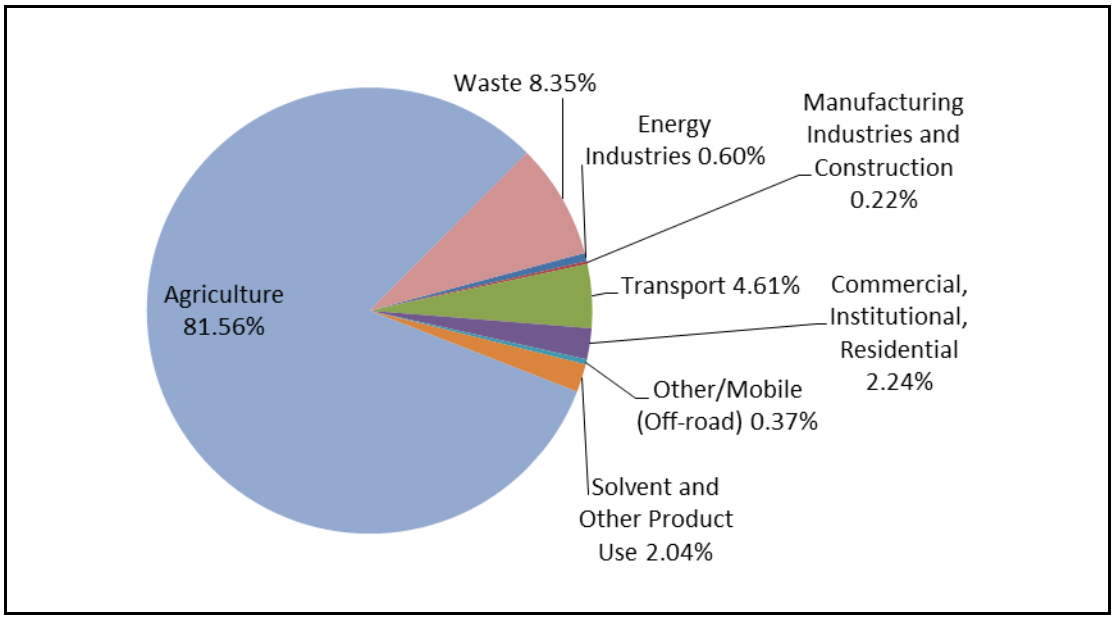

Figure 3-4 N_2O emissions by sector in 2011 (assignment to IPCC categories: see Table 3-1) 100 % is 13.03 Gg CO_2 eq.

3.2.2 Other greenhouse gases (HFC, PFC, SF_6, precursors)

Synthetic gases

Sulfur hexafluoride emissions (SF_6) account for 14.1 t CO_2 equivalents deriving from transformer stations of the Liechtenstein Power Authority. Furthermore, there are 8.73 Gg CO_2 eq. deriving from HFC mainly from refrigeration and air conditioning appliances. Further emissions of synthetic gases (such as PFC) are not known for Liechtenstein so far (in Switzerland, the emissions of PFC contribute 0.1% to the national total).

Up to now Synthetic gases emissions have been of marginal importance with 2.6% if the gross greenhouse gas emissions in 2011.

Precursor substances and SO_2

For the precursor substances NO_x, CO and NMVOC as well as for the gas SO_2, data from the submission under the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP) are used. The system boundaries for the transportation sector are not the same as under the UNFCCC reporting since the CLRTAP uses the territorial principle. In 2011, 0.652 Gg NO_x, 0.676 Gg CO, 0.414 Gg NMVOC and 0.030 Gg SO_2 were emitted.

3.2.3 Emission trends by gas

Emission trends by gas for the period 1990–2011 are summarized in

Table 3-4. The percentage shares of the individual gases excluding LULUCF are shown for selected years in Table 3-5.

Table 3-4 Summary of Liechtenstein's GHG emissions in CO_2 eq. (Gg) by gas 1990.2011. The column on the far right (digits in italics) shows the percent change in emissions in 2011 as compared to the base year 1990.

Greenhouse Gas Emissions	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
	CO_2 equivalent (Gg)									
CO_2 emissions including net CO_2 from LULUCF	193.6	201.3	202.2	210.4	196.5	199.8	201.9	214.5	226.1	225.5
CO_2 emissions excluding net CO_2 from LULUCF	203.1	210.8	211.7	220.0	206.1	209.4	211.6	223.9	235.2	234.3
CH_4 emissions including CH_4 from LULUCF	14.4	14.2	14.0	13.3	13.5	13.4	13.8	13.5	13.5	13.1
CH_4 emissions excluding CH_4 from LULUCF	14.4	14.2	14.0	13.3	13.5	13.4	13.8	13.5	13.5	13.1
N_2O emissions including N_2O from LULUCF	12.9	13.2	13.1	12.7	12.6	12.5	12.5	12.4	12.3	12.1
N_2O emissions excluding N_2O from LULUCF	12.9	13.2	13.1	12.7	12.6	12.5	12.5	12.4	12.3	12.1
HFCs	0.0	0.0	0.0	0.1	0.1	0.4	0.7	1.0	1.4	1.8
PFCs	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.0	0.0
SF_6	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.0	0.0	0.0	0.0
Total (including LULUCF)	**220.9**	**228.8**	**229.2**	**236.5**	**222.7**	**226.1**	**228.9**	**241.5**	**253.2**	**252.5**
Total (excluding LULUCF)	**230.3**	**238.3**	**238.8**	**246.1**	**232.3**	**235.7**	**238.6**	**250.9**	**262.4**	**261.3**

Greenhouse Gas Emissions	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
	CO_2 equivalent (Gg)									
CO_2 emissions including net CO_2 from LULUCF	219.0	217.3	222.5	232.1	232.3	232.2	234.0	203.4	222.5	206.9
CO_2 emissions excluding net CO_2 from LULUCF	227.6	225.6	230.6	240.0	240.2	239.9	241.6	210.9	229.9	214.2
CH_4 emissions including CH_4 from LULUCF	13.0	13.6	13.9	14.0	14.1	14.6	15.2	15.5	15.8	15.5
CH_4 emissions excluding CH_4 from LULUCF	13.0	13.6	13.9	14.0	14.1	14.6	15.2	15.5	15.8	15.5
N_2O emissions including N_2O from LULUCF	12.0	12.3	12.3	12.4	12.4	12.6	12.8	12.9	13.0	12.8
N_2O emissions excluding N_2O from LULUCF	12.0	12.3	12.3	12.4	12.4	12.6	12.8	12.9	13.0	12.8
HFCs	2.3	3.0	3.3	3.8	4.3	4.4	4.4	4.7	5.1	5.3
PFCs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
SF_6	0.1	0.2	0.3	0.3	0.3	0.3	0.1	0.1	0.4	0.1
Total (including LULUCF)	**246.3**	**246.4**	**252.2**	**262.5**	**263.5**	**264.1**	**266.4**	**236.7**	**256.8**	**240.8**
Total (excluding LULUCF)	**254.9**	**254.7**	**260.3**	**270.5**	**271.3**	**271.8**	**274.0**	**244.2**	**264.2**	**248.0**

Greenhouse Gas Emissions	**2010**	**2011**	**1990-2011**
	CO_2 equivalent (Gg)		%
CO_2 emissions including net CO_2 from LULUCF	192.4	177.8	-8.2
CO_2 emissions excluding net CO_2 from LULUCF	199.6	184.8	-9.0
CH_4 emissions including CH_4 from LULUCF	15.1	15.4	7.2
CH_4 emissions excluding CH_4 from LULUCF	15.1	15.4	7.2
N_2O emissions including N_2O from LULUCF	12.7	13.0	1.3
N_2O emissions excluding N_2O from LULUCF	12.7	13.0	1.2
HFCs	6.7	8.7	---
PFCs	0.1	0.1	---
SF_6	0.0	0.0	---
Total (including LULUCF)	**227.0**	**215.0**	**-2.7**
Total (excluding LULUCF)	**234.1**	**222.0**	**-3.6**

Table 3-5 Liechtenstein's total GHG emissions (excl. LULUCF) in CO_2 eq. in selected years and the percentage shares of the different GHG.

Greenhouse Gas Emissions excl. LULUCF	1990		1995		2000		2005		2010		2011	
	CO2 eq (Gg)	%	CO2 eq (Gg)	%	CO2 eq (Gg)	%	CO2 eq (Gg)	%	CO2 eq (Gg)	%	CO2 eq (Gg)	%
CO_2 emissions excluding net CO_2 from LULUCF	203.10	88.18%	209.43	88.86%	227.56	89.27%	239.95	88.27%	199.56	85.24%	184.80	83.23%
CH_4 emissions excluding CH_4 from LULUCF	14.35	6.23%	13.36	5.67%	12.99	5.10%	14.62	5.38%	15.10	6.45%	15.39	6.45%
N_2O emissions excluding N_2O from LULUCF	12.87	5.59%	12.52	5.31%	11.95	4.69%	12.59	4.63%	12.71	5.43%	13.03	5.43%
HFCs	0.00	0.00%	0.38	0.16%	2.32	0.91%	4.38	1.61%	6.65	2.84%	8.73	2.84%
PFCs	NA,NO		NA,NO		0.00	0.00%	0.03	0.01%	0.07	0.03%	0.07	0.03%
SF_6	NA,NO		NA,NO		0.09	0.04%	0.27	0.10%	0.02	0.01%	0.01	0.01%
Total (excluding LULUCF)	**230.33**	**100%**	**235.70**	**100%**	**254.90**	**100%**	**271.84**	**100%**	**234.12**	**100%**	**222.04**	**100%**

The emission trends for individual gases are as follows (see Table 3-5 and Figure 3-5):

Total emissions excluding LULUCF Removals/Emissions decreased from 1990 to 2011 by 3.6 %.

Total emissions, including LULUCF, decreased by 2.7 %.

CO_2 emissions excluding net CO_2 emissions from LULUCF indicate a decrease between 2010 and 2011 of 7.4 %. Besides the increase of emissions in 2006 and 2008, caused by fuel price fluctuations, which resulted in changing stocking behaviour for fuel tanks, a continuous negative trend in CO_2 emissions can be observed since 2008.

CH_4 emissions, excluding CH_4 from LULUCF, increased by 1.9% in comparison to 2010. However, compared to the 1990 emissions, an increase of 7.2 % occurred. CH_4 emissions contribute to total national emissions of 6.9 % in 2011, which is slightly higher than in 1990, where the share was 6.2%.

Compared to 2010 N_2O emissions excluding N_2O from LULUCF have increased by 2 % and by 1.2 % when compared to 1990 levels. The contribution to the total national emissions increased from 5.6 % in 1990 to 5.9 % in 2011.

HFC emissions (mainly from 2F1 Refrigeration and Air Conditioning Equipment) increased due to their role as substitutes for CFCs. SF_6 emissions originate from electrical transformation stations and play a minor role for the total of synthetic gases. PFC emissions are occurring since 1997 and are increasing on a low level. The share of synthetic gases increased from 0.0 % (1990) to 3.9 % (2011).

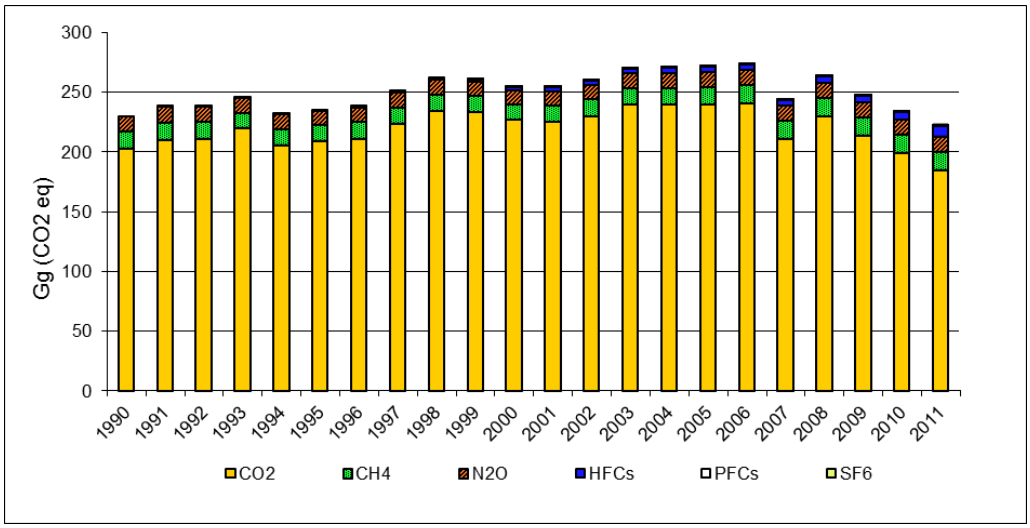

Figure 3-5 Trend of Liechtenstein's greenhouse gas emissions by gases1990–2011. CO_2, CH_4 and N_2O correspond to the respective total emissions excluding LULUCF.

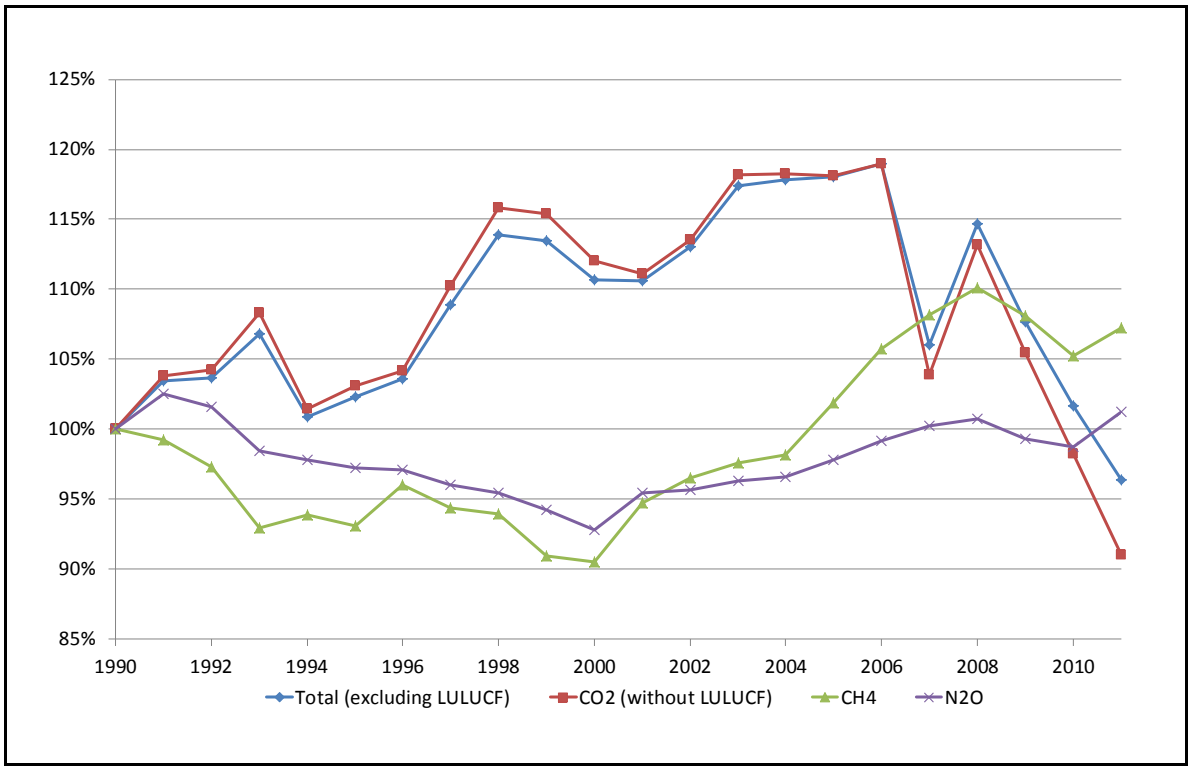

Figure 3-6 Relative trend of Liechtenstein's most important climate gases CO_2 CH_4 and N_2O and Total (all excl. LULUCF) 1990-2011.

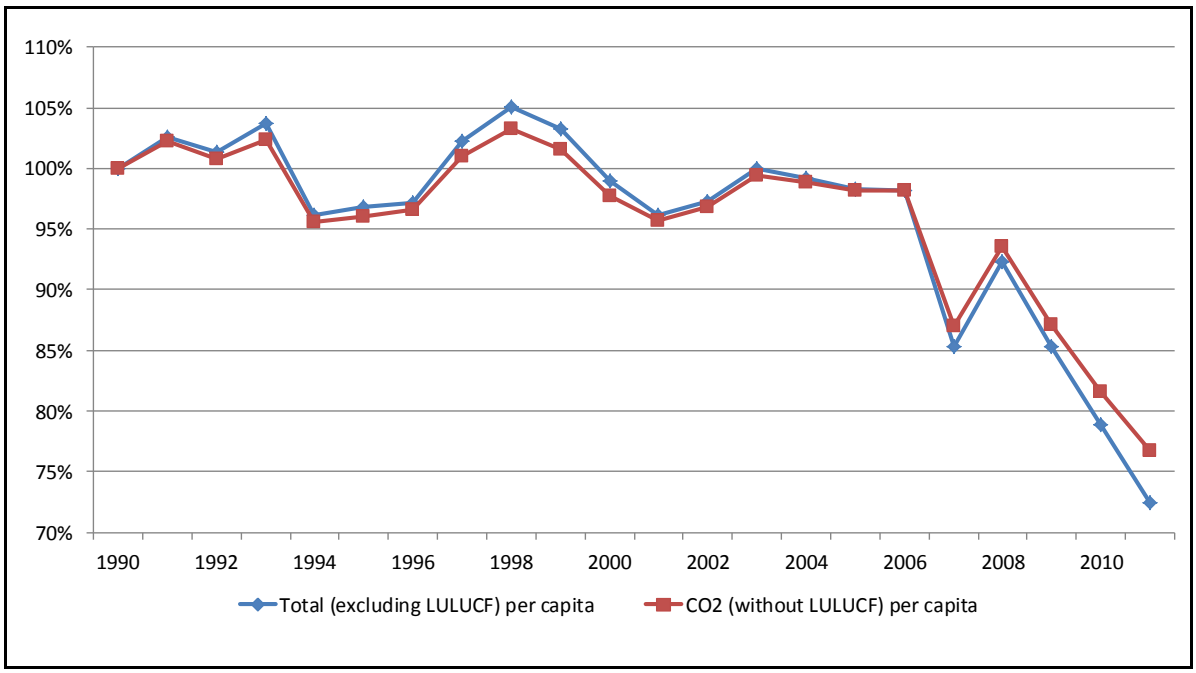

Figure 3-7 Relative CO_2 eq. emissions per capita (excl. LULUCF) and CO_2 emissions per capita (excl. LULUCF) between 1990 and 2011.

3.2.4 Emission trends by sources and sinks

Table 3-6 Summary of Liechtenstein's GHG emissions by source and sink categories in CO_2 equivalent (Gg), 1990–2011. The last column shows the percent change in emissions in 2011 as compared to the base year 1990.

Source and Sink Categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)									
1 Energy	**203.8**	**211.7**	**212.8**	**221.2**	**207.2**	**210.6**	**212.9**	**225.3**	**236.7**	**236.0**
1A1 Energy Industries	0.2	0.8	1.9	1.9	1.8	2.0	2.5	2.5	2.9	2.9
1A2 Manufacturing Industries and Construction	35.3	34.2	34.2	36.0	34.2	34.4	34.3	35.9	38.2	37.6
1A3 Transport	76.7	90.0	89.2	87.0	79.6	81.5	82.8	86.4	86.1	91.8
1A4 Other Sectors	88.9	83.4	84.2	93.3	88.8	89.9	90.3	97.4	105.9	99.8
1A5 Other (Offroad)	2.4	2.9	3.0	2.4	2.3	2.2	2.3	2.6	3.0	3.1
1B Fugitive emissions from oil and natural gas	0.3	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.7	0.7
2 Industrial Processes	**0.0**	**0.0**	**0.0**	**0.1**	**0.1**	**0.4**	**0.7**	**1.0**	**1.4**	**1.8**
3 Solvent and Other Product Use	**2.0**	**1.9**	**1.8**	**1.7**	**1.7**	**1.6**	**1.5**	**1.4**	**1.4**	**1.3**
4 Agriculture	**23.0**	**23.1**	**22.6**	**21.6**	**21.7**	**21.6**	**21.9**	**21.5**	**21.3**	**20.6**
6 Waste	**1.6**	**1.5**	**1.5**	**1.5**	**1.6**	**1.5**	**1.6**	**1.6**	**1.6**	**1.6**
Total (excluding LULUCF)	**230.3**	**238.3**	**238.8**	**246.1**	**232.3**	**235.7**	**238.6**	**250.9**	**262.4**	**261.3**
5 Land Use, Land-Use Change and Forestry	-9.5	-9.5	-9.5	-9.6	-9.6	-9.6	-9.7	-9.4	-9.1	-8.9
Total (including LULUCF)	220.9	228.8	229.2	236.5	222.7	226.1	228.9	241.5	253.2	252.5

Source and Sink Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	CO_2 equivalent (Gg)									
1 Energy	**229.5**	**227.4**	**232.4**	**242.0**	**242.2**	**242.1**	**243.8**	**213.2**	**232.3**	**216.5**
1A1 Energy Industries	2.7	2.9	2.5	2.8	2.9	3.1	2.8	2.5	2.9	2.9
1A2 Manufacturing Industries and Construction	34.3	34.6	35.7	38.3	37.4	36.2	37.4	30.9	33.0	23.8
1A3 Transport	95.8	92.2	87.7	87.3	86.1	85.6	82.6	86.7	91.1	85.0
1A4 Other Sectors	92.8	94.4	103.0	109.3	111.9	112.7	116.2	88.6	100.5	100.2
1A5 Other (Offroad)	3.0	2.6	2.8	3.5	3.1	3.5	3.7	3.4	3.6	3.7
1B Fugitive emissions from oil and natural gas	0.7	0.8	0.8	0.9	0.9	1.0	1.1	1.1	1.1	1.0
2 Industrial Processes	**2.4**	**3.2**	**3.5**	**4.0**	**4.6**	**4.7**	**4.5**	**4.8**	**5.5**	**5.5**
3 Solvent and Other Product Use	**1.2**	**1.2**	**1.1**	**1.1**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**
4 Agriculture	**20.1**	**21.3**	**21.5**	**21.6**	**21.7**	**22.1**	**23.0**	**23.3**	**23.4**	**23.2**
6 Waste	**1.7**	**1.6**	**1.7**	**1.8**	**1.7**	**1.9**	**1.8**	**1.9**	**2.0**	**1.8**
Total (excluding LULUCF)	**254.9**	**254.7**	**260.3**	**270.5**	**271.3**	**271.8**	**274.0**	**244.2**	**264.2**	**248.0**
5 Land Use, Land-Use Change and Forestry	-8.6	-8.3	-8.0	-7.9	-7.8	-7.7	-7.6	-7.5	-7.4	-7.2
Total (including LULUCF)	**246.3**	**246.4**	**252.2**	**262.5**	**263.5**	**264.1**	**266.4**	**236.7**	**256.8**	**240.8**

Source and Sink Categories	2010	2011	1990-2011
	CO2 equivalent (Gg)		%
1 Energy	**201.9**	**187.1**	**-8.2**
1A1 Energy Industries	3.2	3.0	1613.4
1A2 Manufacturing Industries and Construction	22.4	19.4	-45.2
1A3 Transport	80.5	79.5	3.7
1A4 Other Sectors	91.3	80.2	-9.8
1A5 Other (Offroad)	3.5	4.0	65.8
1B Fugitive emissions from oil and natural gas	1.1	1.0	223.1
2 Industrial Processes	**6.7**	**8.8**	**---**
3 Solvent and Other Product Use	**1.0**	**1.0**	**-50.7**
4 Agriculture	**22.7**	**23.4**	**1.8**
6 Waste	**1.8**	**1.8**	**13.2**
Total (excluding LULUCF)	**234.1**	**222.0**	**-3.6**
5 Land Use, Land-Use Change and Forestry	-7.1	-7.0	**-25.7**
Total (including LULUCF)	**227.0**	**215.0**	**-2.7**

Table 3-7 Emission trends for the sub-categories in the sector 1 Energy, 1990-2011.

Source and Sink Categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)									
1A1 Energy Industries	0.2	0.8	1.9	1.9	1.8	2.0	2.5	2.5	2.9	2.9
1A2 Manufacturing Industries and Construction	35.3	34.2	34.2	36.0	34.2	34.4	34.3	35.9	38.2	37.6
1A3 Transport	76.7	90.0	89.2	87.0	79.6	81.5	82.8	86.4	86.1	91.8
1A4 Other Sectors	88.9	83.4	84.2	93.3	88.8	89.9	90.3	97.4	105.9	99.8
1A5 Other (Offroad)	2.4	2.9	3.0	2.4	2.3	2.2	2.3	2.6	3.0	3.1
1B Fugitive emissions from oil and natural gas	0.3	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.7	0.7
1 Energy	**203.8**	**211.7**	**212.8**	**221.2**	**207.2**	**210.6**	**212.9**	**225.3**	**236.7**	**236.0**

Source and Sink Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	CO_2 equivalent (Gg)									
1A1 Energy Industries	2.7	2.9	2.5	2.8	2.9	3.1	2.8	2.5	2.9	2.9
1A2 Manufacturing Industries and Construction	34.3	34.6	35.7	38.3	37.4	36.2	37.4	30.9	33.0	23.8
1A3 Transport	95.8	92.2	87.7	87.3	86.1	85.6	82.6	86.7	91.1	85.0
1A4 Other Sectors	92.8	94.4	103.0	109.3	111.9	112.7	116.2	88.6	100.5	100.2
1A5 Other (Offroad)	3.0	2.6	2.8	3.5	3.1	3.5	3.7	3.4	3.6	3.7
1B Fugitive emissions from oil and natural gas	0.7	0.8	0.8	0.9	0.9	1.0	1.1	1.1	1.1	1.0
1 Energy	**229.5**	**227.4**	**232.4**	**242.0**	**242.2**	**242.1**	**243.8**	**213.2**	**232.3**	**216.5**

Source and Sink Categories	2010	2011	1990-2011
	CO2 equivalent (Gg)		%
1A1 Energy Industries	3.2	3.0	1613.4
1A2 Manufacturing Industries and Construction	22.4	19.4	-45.2
1A3 Transport	80.5	79.5	3.7
1A4 Other Sectors	91.3	80.2	-9.8
1A5 Other (Offroad)	3.5	4.0	65.8
1B Fugitive emissions from oil and natural gas	1.1	1.0	223.1
1 Energy	**201.9**	**187.1**	**-8.2**

Table 3-8 Liechtenstein's total gross GHG emissions in CO_2 eq. (excl. LULUCF) and the shares of individual source categories for selected years.

Source and Sink Categories	1990		1995		2000		2005		2010		2011	
	CO_2 eq (Gg)	%	CO_2 eq (Gg)	%	CO_2 eq (Gg)	%	CO_2 eq (Gg)	%	CO_2 eq (Gg)	%	CO_2 eq (Gg)	%
1 Energy	203.8	88.5%	210.6	89.3%	229.5	90.0%	242.1	89.1%	201.9	86.2%	187.1	84.3%
1A Fuel combustion	203.5	88.3%	210.0	89.1%	228.7	89.7%	241.1	88.7%	200.8	85.8%	186.0	83.8%
1B Fugitive emissions oil and natural gas	0.3	0.1%	0.5	0.2%	0.7	0.3%	1.0	0.4%	1.05	0.5%	1.0	0.5%
2 Industrial Processes	0.0	0.0%	0.4	0.2%	2.4	0.9%	4.7	1.7%	6.7	2.9%	8.8	4.0%
3 Solvent and Other Product Use	2.0	0.9%	1.6	0.7%	1.2	0.5%	1.0	0.4%	1.0	0.4%	1.0	0.4%
4 Agriculture	23.0	10.0%	21.6	9.2%	20.1	7.9%	22.1	8.1%	22.7	9.7%	23.4	10.5%
6 Waste	1.6	0.7%	1.5	0.6%	1.7	0.7%	1.9	0.7%	1.8	0.8%	1.8	0.8%
Total (excluding LULUCF)	230.3	100%	235.7	100%	254.9	100%	271.8	100%	234.1	100%	222.0	100%

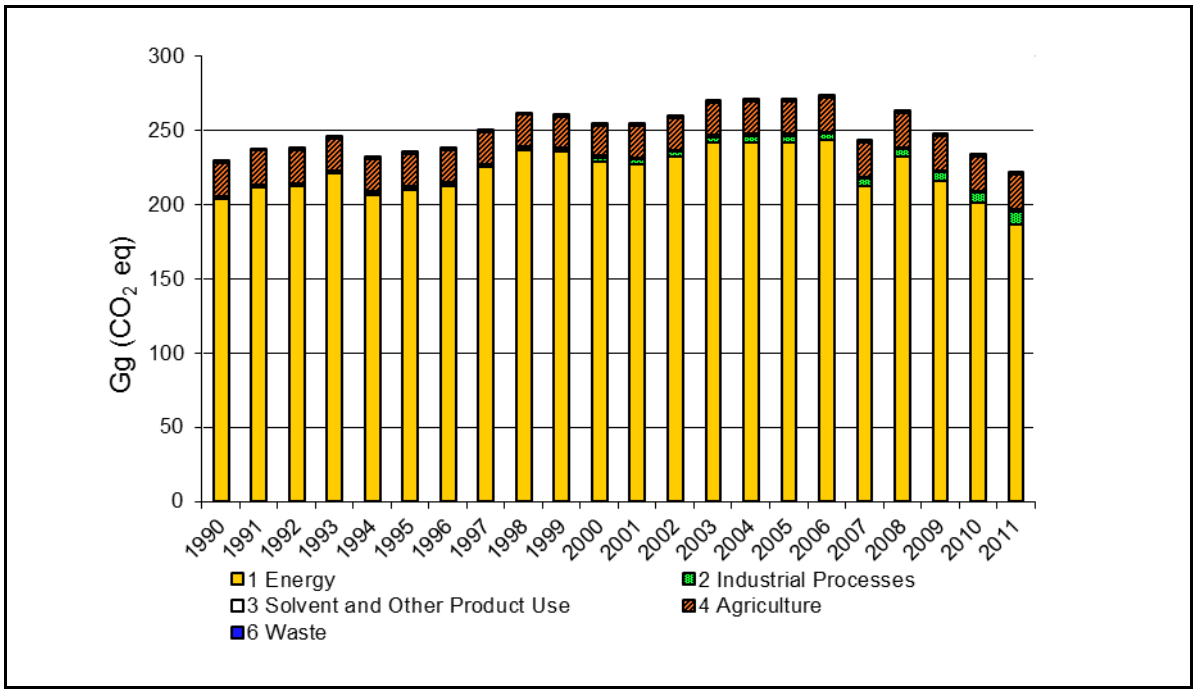

Figure 3-8 Emission trends of Liechtenstein's GHG emissions (excl. LULUCF) by main source categories, 1990-2011.

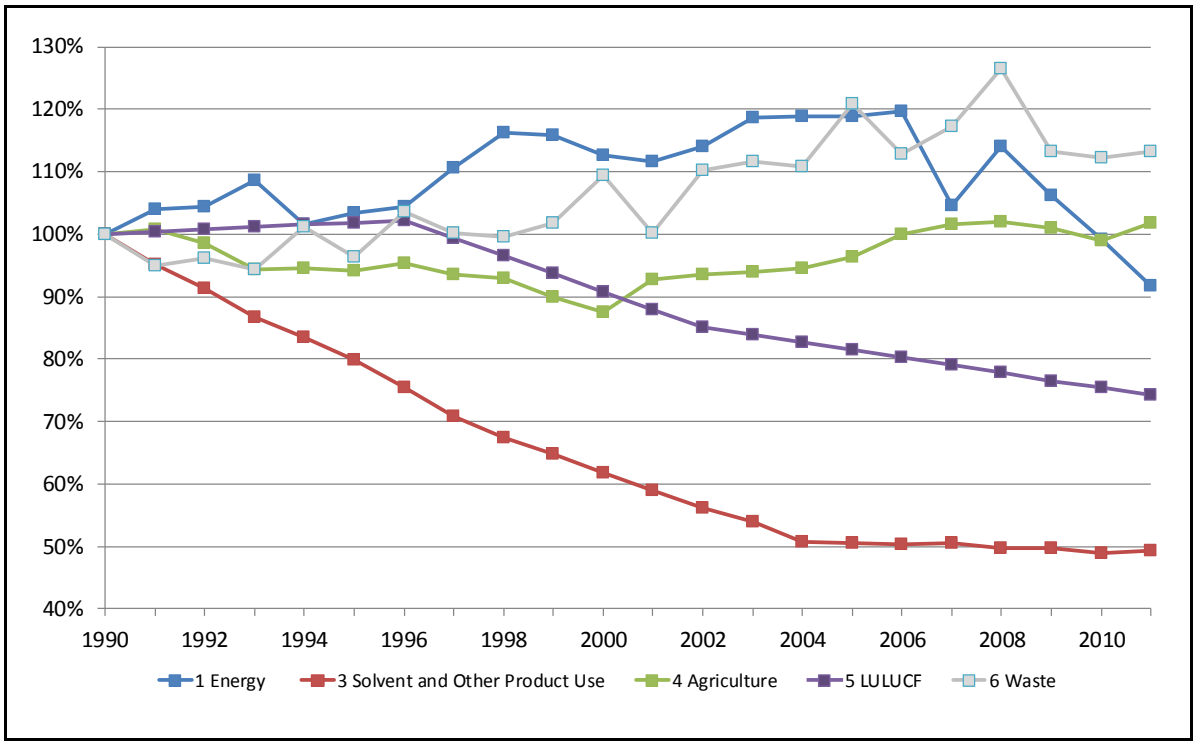

Figure 3-9 Relative emission trends of Liechtenstein's GHG emissions by main source categories 1990-2011.

Emission trends for the various sectors can be summarized as follows:

- 1 Energy: 84.3% (excluding LULUCF) of Liechtenstein's GHG emissions originate from the energy sector, which is 2.0% less than in 2010 and -8.2% in comparison to 1990.

The source categories show following trends between 1990 and 2011:

- 1A1: Since 1990 Liechtenstein's gas-grid has been extended and natural gas has replaced gas oil as the main heating fuel in buildings.
- 1A2: Since 1990 the emissions from this source category have decreased by 45.19% in total. The consumption of gaseous fuels by industries decreased by 37.2% and the use of liquid fuels decreased even more (-52.2%). Compared to 2010 the gaseous fuels consumption decreased by 14.4%.
- 1A3: In line with a general increase of road-vehicle kilometers of all vehicle categories, the fuel consumption and emissions have increased since 1990 by 3.7%. However, there is a decrease in transport emissions of 1.17% in comparison to 2010.
- 1A4: The number of Inhabitants increased by 25.7% whereas employment has increased by 84.3% in the past 20 years. This is reflected in a similar increase of energy consumption and GHG emissions by 19.63% until 2006 with several fluctuations caused by warm and cold winter periods. From 2006 to 2007 a pronounced sudden decline of almost one forth is observed due to high oil gas prices and warm winters. Both influenced the stocking behaviors for private residential fuel tank holders and caused higher apparent consumption in 2008, when fuel tanks were refilled. Since 2008 GHG emissions in 1A4 have constantly decreased to 80.2 Gg CO_2 eq. in 2011. This negative trend can partly be attributed to the installation of a district heating pipeline, providing heat from the waste incineration plant in Switzerland that was stepwise constructed in 2009 and 2010. Furthermore the various emission reduction measures in Liechtenstein, such as the increase of the CO_2 levy in 2010, might have resulted in a respective decrease. Also weather conditions have an important impact, as a comparison of the heating degree days in the period 1990–2011 reveals: from 2000 up to 2009 the correlation between fuel combustion and winter climatic conditions was relatively high (coefficient of determination of 0.6). Although correlation drops to 0.48 in 2011, weather conditions were clearly relevant for the residential sector.
- 1A5: The emissions reported under this category are all kind of vehicles from construction sites. The general construction activities have increased in Liechtenstein with a subsequent, fluctuating increase of diesel consumption and emissions (65.8% within 1990-2011).
- 1B: In parallel with the built-up of Liechtenstein's gas supply network since 1990, the fugitive emissions have strongly increased over the period 1990-2011 (223.1%).
- 2: Industrial Processes: Due to the lack of heavy industry within the borders of the (small!) state of Liechtenstein, only synthetic gases contribute to sector 2.
- 3: Solvent and other product use: Emissions have decreased in the period 1990- 2011 due to reduction measures for NMVOCs resulting from legal restrictions and the introduction of the VOC levy (-50.7%).
- 4: Agriculture: The emissions show a minimum around the year 2000 due to decreasing and increasing animal numbers. In 2011 the emissions are more or less on the same level as 1990 (increase of 1.8%).
- 5: LULUCF: Figure 2-6 shows the net removals (negative emissions) by sources and sinks from LULUCF categories in Liechtenstein. The dominant category when looking at the changes in net CO_2 removals are grassland and settlements. It can be observed that land-use conversions to grassland differ significantly between the three time periods 1990 to 1996, 1997 to 2002 and 2003 to 2011. In the period 1997 to 2002 a significant higher conversion from forest land to grassland leads to a reduction of net CO_2 removals. Other LULCUF categories than forest have a much smaller influence on the net removals.
- 6: Waste: In Liechtenstein only few emissions occur from the "Waste" sector, because all municipal solid waste is exported to a Swiss incineration plant. The increasing trend of the emissions compared to 1990 (13.16%) is determined by increasing composting activities and a slight increase in emissions from waste water handling.

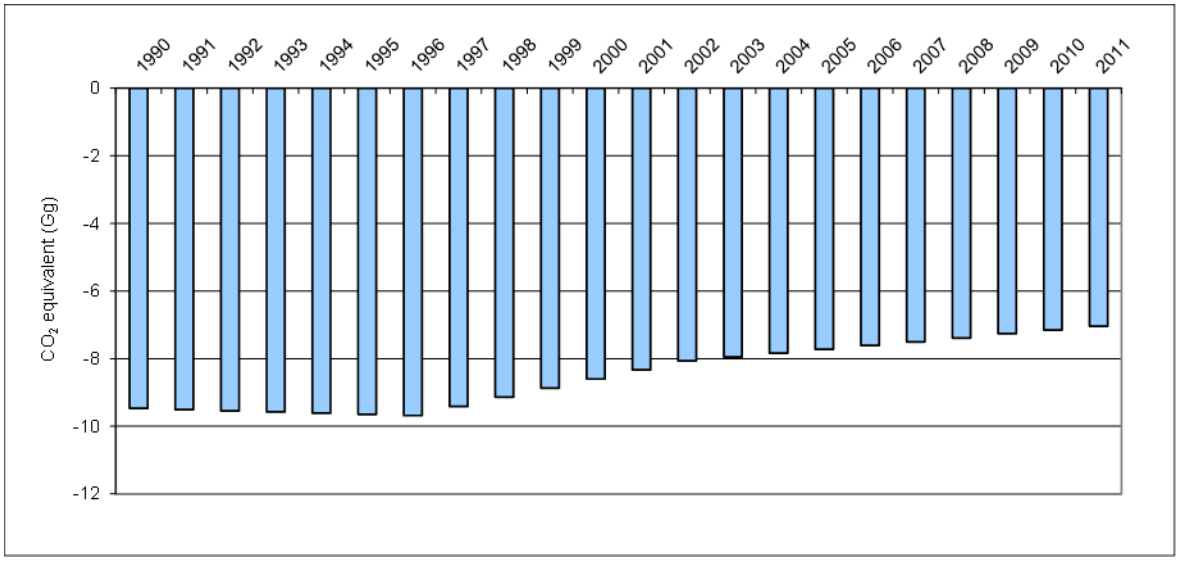

Figure 3-10 Liechtenstein's CO_2 emissions/removals of source category 5 LULUCF 1990–2011 in Gg CO_2 equivalent. Negative values refer to removals.

Table 3-9 presents the emissions of CO_2, CH_4 and N_2O of road transportation, including off-road vehicles, arising from the use of liquid fuels, gaseous fuels and biomass.

Fuel	Sales	Emissions in 2011 (in Gg)			Emissions in 2011 (in Gg CO_2 equivalent)		
	TJ	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
liquid fuels	1025.47	75.65	0.0050	0.0019	75.65	0.10	0.60
gaseous fuels	56.52	3.11	0.0028	0.0000	3.11	65.28	0.00
biomass	NO	NO	NO	NO	NO	NO	NO
Total	1'081.99	78.76	0.0078	0.0019	78.76	65.39	0.60

3.2.5 Emission trends for indirect greenhouse gases and SO_2

For the precursor substances NO_x, CO and NMVOC as well as for the gas SO_2, data from the submission for the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP) is used. The system boundaries for the transportation sector are not the same as under the UNFCCC Reporting since the CLRTAP uses the territorial principle. Thanks to the reduction of the sulfur content in diesel and heating oil, the SO_2 emissions decreased from 1990 to 2003, but at the same time, the fuel consumption has risen.

Liechtenstein is member to the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP) and submits data on air pollutants including indirect GHG. For the precursor substances NO_x, CO and NMVOC as well as for the gas SO_2, data from the 2013 submission is shown in Table 3-10 (OE 2013). Note that the system boundaries for the transportation sector are not the same as under the UNFCCC Reporting since the CLRTAP uses the territorial principle, which restricts the comparability of the two data sets.

Table 3-10 Development of the emissions of NOx, CO, NMVOC (in t) and SO_2 1990-2011.

Indirect Greenhouse Gasses and SO_2	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
	t (Mg)									
NO_x	766	796	786	736	710	688	679	698	722	725
CO	2'231	2'138	1'959	1'773	1'638	1'481	1'349	1'240	1'139	1'035
NMVOC	990	986	881	822	700	675	562	550	543	533
SO_x	71	66	64	62	47	44	43	47	52	49

Indirect Greenhouse Gasses and SO2	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
	t (Mg)									
NO_x	706	658	665	711	670	696	694	658	657	656
CO	983	827	754	737	683	665	627	650	622	653
NMVOC	525	448	438	439	425	425	419	415	413	413
SO_x	42	38	41	43	36	36	38	27	32	35

Indirect Greenhouse Gasses and SO2	**2010**	**2011**	***1990-2011 (%)***
	t (Mg)		
NO_x	633	652	*-15%*
CO	657	676	*-70%*
NMVOC	410	414	*-58%*
SO_x	31	30	*-58%*

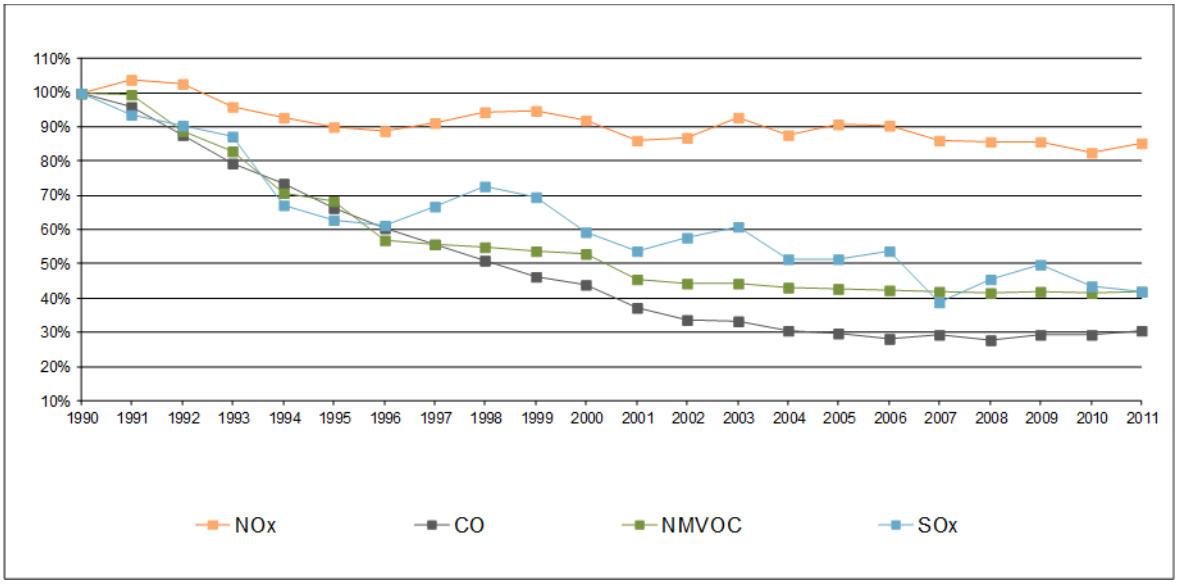

Figure 3-11 Emissions trends of NOx, CO, NMVOC and SO_2 1990-2011.

3.3 Data for activities under Article 3, Paragraph 3 and 4 of the Kyoto Protocol (KP-LULUCF)

Accounting periodicity for activities under Article 3, paragraph 3:

The information is provided in accordance with Decision 15/CP.10 (FCCC/CP/2004/10/Add.2) and based on the information given in Liechtenstein's Initial Report (OEP 2006a) and the Corrigendum to the Initial Report of 19 September 2007 (OEP 2007b).

Liechtenstein has chosen to account annually for emissions and removals from the KP-LULUCF sector (see Chapter 7 of the Initial Report OEP 2006a).The decision remains fixed for the entire first commitment period. Liechtenstein submits data for the fourth mandatory submission year 2011 in this submission.

Table 3-11 shows the activity coverage and the pools reported for the activities under Article 3, paragraph 3 and Forest Management under paragraph 4 of the Kyoto Protocol. The Area change between the previous and the current inventory year is shown in KP (LULUCF) NIR 2 - Land Transition Matrix 2011

Table 3-11 KP(LULUCF), Table NIR 2

Areas and changes in areas between the previous and the current inventory year [1], [2], [3]

To current inventory / From previous inventory year		Article 3.3 activities		Article 3.4 activities				Other [5]	Total area at the beginning of the current inventory year[6]
		Afforestation and Reforestation	Deforestation	Forest Management (if elected)	Cropland Management (if elected)	Grazing Land Management (if elected)	Revegetation (if elected)		
		(kha)							
Article 3.3 activities	Afforestation and Reforestation	0.03	NO						0.03
	Deforestation		0.02						0.02
Article 3.4 activities	Forest Management (if elected)		0.00	NA					0.00
	Cropland Management[4] (if elected)	NA	NA		NA	NA	NA		NA
	Grazing Land Management[4] (if	NA	NA		NA	NA	NA		NA
	Revegetation[4] (if elected)	NA			NA	NA	NA		NA
Other [5]		0.00	NA	NA	NA	NA	NA	NA	0.00
Total area at the end of the current inventory year		0.04	0.02	NA	NA	NA	NA	NA	0.06

[1] This table should be used to report land area and changes in land area subject to the various activities in the inventory year. For each activity it should be used to report area
change between the previous year and the current inventory year. For example, the total area of land subject to Forest Management in the year preceding the inventory year.

[2] Some of the transitions in the matrix are not possible and the cells concerned have been shaded.

[3] In accordance with section 4.2.3.2 of the IPCC good practice guidance for LULUCF, the value of the reported area subject to the various activities under Article 3.3 and 3.4 for the inventory year should be that on 31 December of that year.

[4] Lands subject to Cropland Management, Grazing Land Management or Revegetation which, after 2008, are subject to activities other than those under Article 3.3 and 3.4, should
still be tracked and reported under Cropland Management, Grazing Land Management or Revegetation, respectively.

[5] "Other" includes the total area of the country that has not been reported under an Article 3.3 or an elected Article 3.4 activity.

[6] The value in the cell of row "Total area at the end of the current inventory year" corresponds to the total land area of a country and is constant for all years.

The afforested area caused removals of -0.182 Gg CO_2 in 2011. Deforestation occurring during 1992-2011 emitted 0.393 Gg CO_2 in 2011. Therefore net emissions of 0.211 Gg CO_2 are resulting. In previous submissions net removals resulted from the calculations, but with the new methodological approach this has changed now.

Table 3-12 Summary table afforestation and deforestation. Numbers are taken from Table KP(5-I)A.1.1. and KP(5-I)A.2.

Activity	**Area** (cumulated 1990-2011) kha	**Net CO_2 emisson/removal** 2011 Gg CO_2
Afforestation	0.03	-0.18
Deforestation	0.02	0.39
Total net CO_2 emission/removal		**0.21**

3.4 Status of the National Inventory System

3.4.1 National entity

The Office of Environment (OE) is in charge of establishing emission inventories and is therefore also responsible for all aspects concerning the establishing of the National Inventory System (NIS) under the Kyoto Protocol. Its project manager is:

Dr. Heike Summer
Dr. Grass-Str. 12, P.O. Box 684, 9490 Vaduz, Principality of Liechtenstein
heike.summer@llv.li ; Tel.: +423 236 6196 Fax: +423 236 6144

3.4.2 Institutional, legal and procedural arrangements

The Office of Environment (OE) is in charge of compiling the emission data and bears overall responsibility for Liechtenstein's national greenhouse gas inventory. The Government mandated the realisation of the NIS to its Office for the Environment (OE). Please note that the Office for the Environment is reorganized since 2013. The Office of Agriculture (OA), the Office of Forest, Nature and Land Management (OFNLM) and the Office of Environmental Protection (OEP) have been merged to the Office for the Environment (OE).

In addition to the OE, the Office of Economic Affairs (OEA) and the Office of Land Use Planning (SLP) participate directly in the compilation of the inventory. Several other administrative and private institutions are involved in inventory preparation.

Liechtenstein is a small central European State in the Alpine region with a population of 36'476 inhabitants (OS 2011e) and with an area of 160 km^2. Liechtenstein and its neighbouring country Switzerland form a customs and monetary union governed by a customs treaty (Government, 1980). On the basis of this union, Liechtenstein is linked to Swiss foreign trade strategies, with few exceptions, such as trade with the European Economic Community: Liechtenstein – contrary to Switzerland – is a member of the European Economic Area. The Customs Union Treaty with Switzerland impacts greatly on environmental and fiscal strategies. Many Swiss levies and regulations for special goods, for example, environmental standards for motor vehicles and quality standards for fuels are also adapted and applied in Liechtenstein. For the determination of the GHG emissions, Liechtenstein appreciates having been authorised to adopt a number of Swiss methods and Swiss emission factors.

As part of a comprehensive project, the Government mandated its Office of Environment in 2005 to design and establish the NIS in order to ensure full compliance with the reporting requirements of the UNFCCC and its Kyoto Protocol. With regard to the provisions of Art. 5.1 of the Kyoto Protocol, the project encompasses the following elements:

- Collaboration and cooperation of the different offices involved in data collection,
- Upgrading and updating of central GHG emissions data base,
- Setting up a simplified QA/QC system,
- Official consideration and approval of the data.

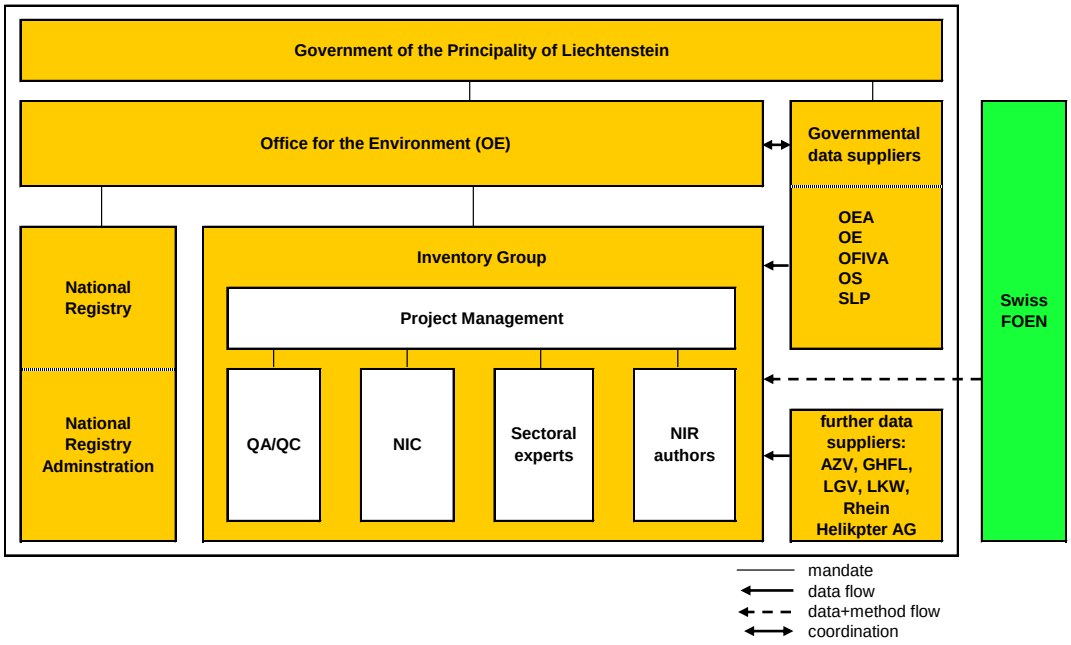

Figure 3-12 Schematic overview of the institutional setting of the process of inventory preparation within the NIS

The Office of Environment (OE) plays a major role in the National Inventory System and is acting as the National Registry Administrator. Its representative, the head of the OE, is the registered National Focal Point. He also coordinates in cooperation with the responsible head of the unit the data flow from the governmental data suppliers to the Inventory Group.

The Inventory group consists of the project manager, the person responsible for the QA/QC activities, the National Inventory Compiler (NIC) who is represented by the project manager and his assistant. Furthermore several external experts belong to the Inventory Group: Sectorial specialists for modelling the greenhouse gas emissions and removals and the NIR authors.

Among the governmental data suppliers there are

- Office of Economic Affairs (OEA)
- Office of Statistics (OS)
- Office of Land Use Planning (SLP)
- Office of Environment (OE)

Further data suppliers are

- Liechtenstein's Gas Utility / Liechtensteinische Gasversorgung (LGV)
- Electric power company / Liechtensteinische Kraftwerke (LKW)
- Abwasserzweckverband (AZV)
- Heliport Balzers (Rhein Helikopter AG and ROTEX HELICOPTER AG)

In former years, the cooperative society for the storage of gas oil in the Principality of Liechtenstein (Genossenschaft für Heizöl-Lagerhaltung im Fürstentum Liechtenstein, GHFL) delivered data about the annual storage of fuels. However, the cooperative society was closed in 2008.

Cooperation with the Swiss Federal Office for the Environment (FOEN)

The Swiss Federal Office for the Environment (FOEN) is the agency that has the lead within the Swiss federal administration regarding climate policy and its implementation. The FOEN and Liechtenstein's OE cooperate in the inventory preparation.

- Due to the Customs Union Treaty of the two states, the import statistics in the Swiss overall energy statistics (SFOE 2011) also includes the fossil fuel consumption of the Principality of Liechtenstein except for gas consumption of Liechtenstein which is excluded from SFOE (2011). FOEN therefore corrects its fuel consumption data by subtracting Liechtenstein's liquid fuel consumption from the data provided in the Swiss overall energy statistics. To that aim, OE calculates its energy consumption and provides FOEN with the data.
- FOEN, on the other hand, makes a number of methods and emission factors available to OE, mainly transportation, agriculture, LULUCF, synthetic gases, solvents. Liechtenstein has benefited to a large extend from the methodological support by the inventory core group within the FOEN and its readiness to share very openly data and spreadsheet-tools. Its kind support is herewith highly appreciated.

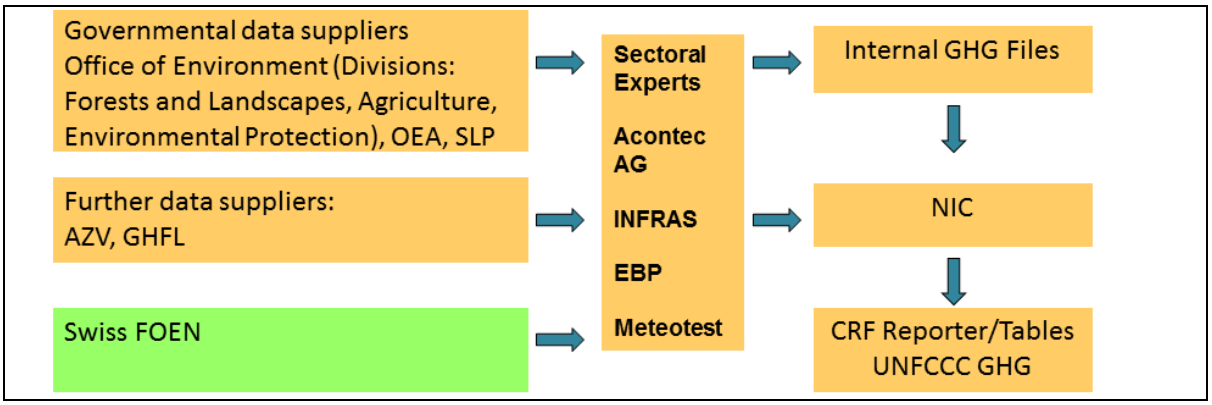

Figure 3-13 illustrates in a simplified manner the data flow leading to the CRF tables required for reporting under the UNFCCC and under the Kyoto Protocol.

3.4.3 Methodology

The emissions are calculated based on the standard methods and procedures of the Revised 1996 Intergovernmental Panel on Climate Change (IPCC), Guidelines for National Greenhouse Gas Inventories (IPCC 1997a, 1997b, 1997c) and IPCC Good Practice Guidances (IPCC 2000, IPCC 2003) as adopted by the UNFCCC.

The emissions are modelled by using country specific activity data. Country specific emissions factors are applied if available. A number of default emission factors from IPCC are used. For a majority of emission sources, however, emission factors are adopted from the Swiss GHG inventory after checking their applicability. In those cases, the emission factors are reported as country specific. It is noteworthy that there is a very close relationship between Liechtenstein and Switzerland based on the Customs Union Treaty between the two countries. The Customs Union Treaty with Switzerland has a significant impact on environmental and fiscal strategies. Many Swiss environmental provisions and climate-protection regulations are also applicable in Liechtenstein or are implemented into Liechtenstein law on the basis of specific international treaty rules. **Therefore, a number of emission factors are adopted from Switzerland assuming that the Swiss emission factors actually represent the emission standards more accurately than default emission factors**. This assumption especially holds for

- the sector Energy due to the same fuel quality standards and regulations standards for exhaust gases of combustion and motor vehicles,
- the emission of synthetic gases due to similar consumer's product and attitude,

- the sector Agriculture due to similar stock farming and cultivation of land,
- the sector LULUCF due to – again – similar geographic, meteorological and climatic circumstances for forestry.

In the following paragraph, a short summary of the methods used is given for each sector.

1 Energy

- Emissions from 1A Fuel Combustion Activities: Activity data is taken from the National Energy Statistics (including consistency modifications) and from census for the fuel sales of gasoline and diesel oil. The methods are country specific.
- Emissions from 1B Fugitive Emissions from Fuels: The Swiss method is applied corresponding to country specifics.

2 Industrial Processes

- HFC and PFC emissions from 2F1 Refrigeration and Air Conditioning Equipment are reported and are calculated with the rule of proportion applied on the Swiss emissions using country specific activity data as representative for the conversion (e.g. no. of inhabitants).
- SF_6 emissions from 2F8 Electrical Equipment are reported based on country specific data.
- CO and NMVOC emissions from 2A5 Asphalt Roofing and 2A6 Road Paving with Asphalt. The emissions are estimated from the Swiss emissions using the number of inhabitants as a reference value for the rough estimate of Liechtenstein's emissions. Other emissions from industrial processes (CO_2, CH_4, N_2O) are not occurring.

3 Solvent and Other Product Use

- Emissions 3A-3D: the emissions are estimated from the Swiss emissions using the number of inhabitants as a reference value for the rough estimate of Liechtenstein's emissions.

4 Agriculture

- Emissions are reported for 4A Enteric Fermentation, 4B Manure Management and 4D Agricultural Soils by applying Swiss methods (country specific) combined with Liechtenstein specific Activity Data as far as available.

5 LULUCF

- Emissions and removals are reported for 5A to 5F and 5(III). Most of the methods and the emission factors are adopted from Switzerland (country specific).

6 Waste

- Emissions are modelled by applying the following methods: 6A T2, 6B CS (CH_4) and D (N_2O), 6C T2 and 6D CS.

3.4.4 Key source identification

The key category analysis (KCA) is performed according to the IPCC Good Practice Guidance (IPCC 2000, Chapter 7) and the IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC 2003, Chapter 5.4). The used methodology is a Tier 1 level and trend assessment with the proposed threshold of 95%. The analysis is performed four times:

- Base year 1990 without LULUCF categories
- Base year 1990 with LULUCF categories
- Reporting year 2011 without LULUCF categories
- Reporting year 2011 with LULUCF categories

KCA without LULUCF categories

For 2011, among a total of 123 categories, 16 have been identified as key categories with an aggregated contribution of 95.7% of the national total emissions (see Table 3-13). 16 categories are key categories due to level assessment and 12 categories are due to trend assessment (seeTable 3-14).

From 16 key categories, 11 are from the energy sector, contributing 82.3% to total CO_2 equivalent emissions in 2011. The other key categories are from the sectors Industrial Processes (3.9%) and Agriculture (9.5%).

There are five major sources which contribute together 65.1% of the key sources:

- 1A3b Energy, Fuel Combustion, Road Transportation, Gasoline: CO_2, level contribution 20.0%.
- 1A3b Energy, Fuel Combustion, Road Transportation, Diesel: CO_2, level contribution 14.0%.
- 1A4a Energy, Fuel Combustion, Other Sectors, Commercial/Institutional, Liquid Fuels: CO_2, level contribution 12.2%.
- 1A4b Energy, Fuel Combustion, Other Sectors, Residential, Gaseous Fuels: CO_2, level contribution 10.3%.
- 1A4a Energy, Fuel Combustion, Other Sectors, Commercial/Institutional, Gaseous Fuels: CO_2, level contribution 8.6%.

Compared to the previous submission for the reporting year 2010, one additional category is key in 2011:

- 4B Agriculture Manure Management, CH_4

Further details are shown in Table 3-13.

For the base year 1990, the level analysis is given in Table 3-14. There are 13 level key categories. Compared to the previous submission, one additional category is key category in 1990:

- 4B Agriculture Manure Management, CH_4

Compared to the KCA analysis for 1990, three additional categories are key categories in the KCA analysis for 2011:

- 1A1 Energy, Fuel Combustion, Energy Industries, Gaseous Fuels, CO_2
- 1A3b Energy, Fuel combustion, Road Transportation, Gaseous Fuels, CO_2

Table 3-13 List of Liechtenstein's 12 key categories in 2011. Upper part sorted by NFR code (by category code), lower part sorted by contribution in level.

Key Category Analysis 2011 (without LULUCF) IPCC Source Categories (and fuels if applicable)					Direct GHG	Base Year 1990 Estimate	Year t Estimate	Level Assessment	Cumulative Total Column E-L	Result level assessment	Trend Assessment	% Contribution in Trend	Cumulative Total Col. F	Result level assessment	Result trend assessment
IPCC Source Categories (and fuels if applicable)					Direct GHG	Base Year 1990 Estimate	Year t Estimate	Level Assessment	Cumulative Total Column E-L	Result level assessment	Trend Assessment	% Contribution in Trend	Cumulative Total Col. F	Result level assessment	Result trend assessment
Sorted by NFR code						[Gg CO2eq]	[Gg CO2eq]								
1A1	1. Energy	A. Fuel Combustion	1. Energy Industries	Gaseous Fuels	CO2	0.12	2.89	1.3%	93.60%	KC Level	1.3%	2.0%	94.5%	KC level	KC Trend
1A2	1. Energy	A. Fuel Combustion	2. Manufacturing Industries and Construction	Liquid Fuels	CO2	18.74	8.96	4.0%	82.70%	KC Level	4.3%	6.7%	73.0%	KC level	KC Trend
1A2	1. Energy	A. Fuel Combustion	2. Manufacturing Industries and Construction	Gaseous Fuels	CO2	16.48	10.35	4.7%	74.62%	KC Level	2.6%	4.1%	90.2%	KC level	KC Trend
1A3b	1. Energy	A. Fuel Combustion	3. Transport; Road Transportation	Gaseous Fuels	CO2	0.00	3.11	1.4%	92.30%	KC Level	1.5%	2.3%	92.5%	KC level	KC Trend
1A3b	1. Energy	A. Fuel Combustion	3. Transport; Road Transportation	Diesel	CO2	14.77	31.17	14.0%	34.01%	KC Level	7.9%	12.5%	48.0%	KC level	KC Trend
1A3b	1. Energy	A. Fuel Combustion	3. Transport; Road Transportation	Gasoline	CO2	60.53	44.33	20.0%	19.97%	KC Level	6.5%	10.3%	58.3%	KC level	KC Trend
1A4a	1. Energy	A. Fuel Combustion	4. Other Sectors; Commercial/Institutional	Gaseous Fuels	CO2	8.70	19.17	8.6%	65.13%	KC Level	5.0%	7.9%	66.3%	KC level	KC Trend
1A4a	1. Energy	A. Fuel Combustion	4. Other Sectors; Commercial/Institutional	Liquid Fuels	CO2	57.10	27.15	12.2%	46.24%	KC Level	13.0%	20.5%	20.5%	KC level	KC Trend
1A4b	1. Energy	A. Fuel Combustion	4. Other Sectors; Residential	Liquid Fuels	CO2	18.74	8.97	4.0%	78.66%	KC Level	4.2%	6.7%	79.7%	KC level	KC Trend
1A4b	1. Energy	A. Fuel Combustion	4. Other Sectors; Residential	Gaseous Fuels	CO2	2.51	22.78	10.3%	56.50%	KC Level	9.5%	15.0%	35.5%	KC level	KC Trend
1A5	1. Energy	A. Fuel Combustion	5. Other	Liquid Fuels	CO2	2.36	3.92	1.8%	90.90%	KC Level	0.8%	1.2%	95.8%	KC level	KC Trend
2F	2. Industrial Proc.	F. Consumption of Halocarbons and SF6			HFC	0.00	8.73	3.9%	86.63%	KC Level	4.1%	6.4%	86.1%	KC level	KC Trend
4A	4. Agriculture	A. Enteric Fermentation			CH4	10.42	10.72	4.8%	69.96%	KC Level	0.3%	0.5%	97.4%	KC level	-
4B	4. Agriculture	B. Manure Management			CH4	2.16	2.02	0.9%	95.67%	KC Level	0.0%	0.0%	99.6%	KC level	-
4D1	4. Agriculture	D. Agricultural Soils; Direct Soil Emissions			N2O	5.45	5.56	2.5%	89.13%	KC Level	0.1%	0.2%	98.2%	KC level	-
4D3	4. Agriculture	D. Agricultural Soils; Indirect Emissions			N2O	2.72	2.59	1.2%	94.76%	KC Level	0.0%	0.0%	99.8%	KC level	-
Sorted by contribution in level															
1A3b	1. Energy	A. Fuel Combustion	3. Transport; Road Transportation	Gasoline	CO2	60.53	44.33	20.0%	19.97%	KC Level	6.5%	10.3%	58.3%	KC level	KC Trend
1A3b	1. Energy	A. Fuel Combustion	3. Transport; Road Transportation	Diesel	CO2	14.77	31.17	14.0%	34.01%	KC Level	7.9%	12.5%	48.0%	KC level	KC Trend
1A4a	1. Energy	A. Fuel Combustion	4. Other Sectors; Commercial/Institutional	Liquid Fuels	CO2	57.10	27.15	12.2%	46.24%	KC Level	13.0%	20.5%	20.5%	KC level	KC Trend
1A4b	1. Energy	A. Fuel Combustion	4. Other Sectors; Residential	Gaseous Fuels	CO2	2.51	22.78	10.3%	56.50%	KC Level	9.5%	15.0%	35.5%	KC level	KC Trend
1A4a	1. Energy	A. Fuel Combustion	4. Other Sectors; Commercial/Institutional	Gaseous Fuels	CO2	8.70	19.17	8.6%	65.13%	KC Level	5.0%	7.9%	66.3%	KC level	KC Trend
4A	4. Agriculture	A. Enteric Fermentation			CH4	10.42	10.72	4.8%	69.96%	KC Level	0.3%	0.5%	97.4%	KC level	-
1A2	1. Energy	A. Fuel Combustion	2. Manufacturing Industries and Construction	Gaseous Fuels	CO2	16.48	10.35	4.7%	74.62%	KC Level	2.6%	4.1%	90.2%	KC level	KC Trend
1A4b	1. Energy	A. Fuel Combustion	4. Other Sectors; Residential	Liquid Fuels	CO2	18.74	8.97	4.0%	78.66%	KC Level	4.2%	6.7%	79.7%	KC level	KC Trend
1A2	1. Energy	A. Fuel Combustion	2. Manufacturing Industries and Construction	Liquid Fuels	CO2	18.74	8.96	4.0%	82.70%	KC Level	4.3%	6.7%	73.0%	KC level	KC Trend
2F	2. Industrial Proc.	F. Consumption of Halocarbons and SF6			HFC	0.00	8.73	3.9%	86.63%	KC Level	4.1%	6.4%	86.1%	KC level	KC Trend
4D1	4. Agriculture	D. Agricultural Soils; Direct Soil Emissions			N2O	5.45	5.56	2.5%	89.13%	KC Level	0.1%	0.2%	98.2%	KC level	-
1A5	1. Energy	A. Fuel Combustion	5. Other	Liquid Fuels	CO2	2.36	3.92	1.8%	90.90%	KC Level	0.8%	1.2%	95.8%	KC level	KC Trend
1A3b	1. Energy	A. Fuel Combustion	3. Transport; Road Transportation	Gaseous Fuels	CO2	0.00	3.11	1.4%	92.30%	KC Level	1.5%	2.3%	92.5%	KC level	KC Trend
1A1	1. Energy	A. Fuel Combustion	1. Energy Industries	Gaseous Fuels	CO2	0.12	2.89	1.3%	93.60%	KC Level	1.3%	2.0%	94.5%	KC level	KC Trend
4D3	4. Agriculture	D. Agricultural Soils; Indirect Emissions			N2O	2.72	2.59	1.2%	94.76%	KC Level	0.0%	0.0%	99.8%	KC level	-
4B	4. Agriculture	B. Manure Management			CH4	2.16	2.02	0.9%	95.67%	KC Level	0.0%	0.0%	99.6%	KC level	-

Table 3-14 List of Liechtenstein's 12 key categories in 1990. Upper part sorted by NFR code (by category code), lower part sorted by contribution in level.

Key Category Analysis 1990 (without LULUCF) IPCC Source Categories (and fuels if applicable)					Direct GHG	Share of Total Emissions	Cumulative Total	Result of assessment
1A2	1. Energy	A. Fuel Combustion	2. Manufacturing Industries and Construction	Gaseous Fuels	CO2	7.2%	74.5%	KC Level
1A2	1. Energy	A. Fuel Combustion	2. Manufacturing Industries and Construction	Liquid Fuels	CO2	8.1%	59.2%	KC Level
1A3b	1. Energy	A. Fuel Combustion	3. Transport; Road Transportation	Diesel	CO2	6.4%	80.9%	KC Level
1A3b	1. Energy	A. Fuel Combustion	3. Transport; Road Transportation	Gasoline	CO2	26.3%	26.3%	KC Level
1A4a	1. Energy	A. Fuel Combustion	4. Other Sectors; Commercial/Institutional	Gaseous Fuels	CO2	3.8%	89.2%	KC Level
1A4a	1. Energy	A. Fuel Combustion	4. Other Sectors; Commercial/Institutional	Liquid Fuels	CO2	24.8%	51.1%	KC Level
1A4b	1. Energy	A. Fuel Combustion	4. Other Sectors; Residential	Gaseous Fuels	CO2	1.1%	93.9%	KC Level
1A4b	1. Energy	A. Fuel Combustion	4. Other Sectors; Residential	Liquid Fuels	CO2	8.1%	67.3%	KC Level
1A5	1. Energy	A. Fuel Combustion	5. Other	Liquid Fuels	CO2	1.0%	94.9%	KC Level
4A	4. Agriculture	A. Enteric Fermentation			CH4	4.5%	85.4%	KC Level
4B	4. Agriculture	B. Manure Management			CH4	0.9%	95.8%	KC Level
4D1	4. Agriculture	D. Agricultural Soils; Direct Soil Emissions			N2O	2.4%	91.6%	KC Level
4D3	4. Agriculture	D. Agricultural Soils; Indirect Emissions			N2O	1.2%	92.8%	KC Level
Sorted by contribution in level								
Key Category Analysis 1990 (without LULUCF) IPCC Source Categories (and fuels if applicable)					Direct GHG	Share of Total Emissions	Cumulative Total	Result of assessment
1A3b	1. Energy	A. Fuel Combustion	3. Transport; Road Transportation	Gasoline	CO2	26.3%	26.3%	KC Level
1A4a	1. Energy	A. Fuel Combustion	4. Other Sectors; Commercial/Institutional	Liquid Fuels	CO2	24.8%	51.1%	KC Level
1A2	1. Energy	A. Fuel Combustion	2. Manufacturing Industries and Construction	Liquid Fuels	CO2	8.1%	59.2%	KC Level
1A4b	1. Energy	A. Fuel Combustion	4. Other Sectors; Residential	Liquid Fuels	CO2	8.1%	67.3%	KC Level
1A2	1. Energy	A. Fuel Combustion	2. Manufacturing Industries and Construction	Gaseous Fuels	CO2	7.2%	74.5%	KC Level
1A3b	1. Energy	A. Fuel Combustion	3. Transport; Road Transportation	Diesel	CO2	6.4%	80.9%	KC Level
4A	4. Agriculture	A. Enteric Fermentation			CH4	4.5%	85.4%	KC Level
1A4a	1. Energy	A. Fuel Combustion	4. Other Sectors; Commercial/Institutional	Gaseous Fuels	CO2	3.8%	89.2%	KC Level
4D1	4. Agriculture	D. Agricultural Soils; Direct Soil Emissions			N2O	2.4%	91.6%	KC Level
4D3	4. Agriculture	D. Agricultural Soils; Indirect Emissions			N2O	1.2%	92.8%	KC Level
1A4b	1. Energy	A. Fuel Combustion	4. Other Sectors; Residential	Gaseous Fuels	CO2	1.1%	93.9%	KC Level
1A5	1. Energy	A. Fuel Combustion	5. Other	Liquid Fuels	CO2	1.0%	94.9%	KC Level
4B	4. Agriculture	B. Manure Management			CH4	0.9%	95.8%	KC Level

Combined KCA without and with LULUCF categories

According to IPCC Good Practice Guidance for LULUCF (IPCC 2003), Section 5.4.2, the set of key categories consists of all non-LULUCF key categories that result from the KCA without LULUCF combined with all LULUCF-key-categories that result from the KCA with LULUCF.

The KCA 2011 including LULUCF categories, consists of a total of 137 categories. 22 of them are key categories and six are from the LULUCF sector and contribute with a total of 12.2% to total emissions:

- 5A1 Forest Land remaining Forest Land, CO_2 (7.2%)
- 5A2 Forest Land, Land converted to Forest Land, CO_2 (0.6%)
- 5B1 Cropland remaining Cropland, CO_2 (1.7%)
- 5C2 Land converted to Grassland, CO_2 (0.8%)
- 5E2 Land converted to Settlements, CO_2 (1.4%)
- 5F2 Land converted to Other Land, CO_2 (0.5%)

Compared to the Key Category Analysis in the previous submission for the reporting year 2010, there is one LULUCF category which is not a key category any more:

- 5C1 Grassland remaining Grassland, CO_2.

Three categories are new key categories in 2011:

- 5A2 Forest Land, Land converted to Forest Land, CO_2
- 5C2 Land converted to Grassland, CO_2
- 5F2 Land converted to Other Land, CO_2

Further details are shown in Figure 3-15, and the complete Key Category Analysis is provided in Annex 1.2.

In the KCA 1990 including LULUCF categories, 17 categories appear as key categories. Four of the key categories are from the LULUCF sector. Compared to the KCA analysis 2010 for 1990 including LULUCF, one additional LULUCF category is a key category:

- 5A2 Forest Land, Land converted to Forest Land, CO_2.

Compared to the KCA analysis for 1990, two additional LULUCF categories are key categories in the KCA analysis for 2011:

- 5C2 Land converted to Grassland, CO_2
- 5F2 Land converted to Other Land, CO_2

Table 3-15 Liechtenstein's key categories in 2011 and in 1990 combined without and with LULUCF categories.

Key Category Analysis 2010 (including LULUCF) IPCC Source Categories (and fuels if applicable)					Direct GHG	Base Year 1990 Estimate	Current Year t Estimate	Level Assessment	Cumulative Total Column E-L	Trend Assessment	% Contribution in Trend	Result Level Assessment	Result Trend Assessment
Sorted by NRF Code						[Gg CO2eq]	[Gg CO2eq]						
1A1	1. Energy	A. Fuel Combustion	1. Energy Industries	Gaseous Fuels	CO2	0.12	2.89	1.1%	91.80%	1.1%	1.9%	KC Level	KC Trend
1A2	1. Energy	A. Fuel Combustion	2. Manufacturing Industries and Construction	Gaseous Fuels	CO2	16.48	10.35	4.1%	72.19%	2.3%	4.0%	KC Level	KC Trend
1A2	1. Energy	A. Fuel Combustion	2. Manufacturing Industries and Construction	Liquid Fuels	CO2	18.74	8.96	3.5%	79.22%	3.8%	6.6%	KC Level	KC Trend
1A3b	1. Energy	A. Fuel Combustion	3. Transport; Road Transportation	Gasoline	CO2	60.53	44.33	17.4%	17.39%	5.9%	10.4%	KC Level	KC Trend
1A3b	1. Energy	A. Fuel Combustion	3. Transport; Road Transportation	Diesel	CO2	14.77	31.17	12.2%	29.62%	6.7%	11.7%	KC Level	KC Trend
1A3b	1. Energy	A. Fuel Combustion	3. Transport; Road Transportation	Gaseous Fuels	CO2	0.00	3.11	1.2%	90.66%	1.2%	2.2%	KC Level	KC Trend
1A4a	1. Energy	A. Fuel Combustion	4. Other Sectors; Commercial/Institutional	Liquid Fuels	CO2	57.10	27.15	10.7%	40.27%	11.5%	20.1%	KC Level	KC Trend
1A4a	1. Energy	A. Fuel Combustion	4. Other Sectors; Commercial/Institutional	Gaseous Fuels	CO2	8.70	19.17	7.5%	56.73%	4.3%	7.5%	KC Level	KC Trend
1A4b	1. Energy	A. Fuel Combustion	4. Other Sectors; Residential	Gaseous Fuels	CO2	2.51	22.78	8.9%	49.21%	8.2%	14.3%	KC Level	KC Trend
1A4b	1. Energy	A. Fuel Combustion	4. Other Sectors; Residential	Liquid Fuels	CO2	18.74	8.97	3.5%	75.71%	3.8%	6.6%	KC Level	KC Trend
1A5	1. Energy	A. Fuel Combustion	5. Other	Liquid Fuels	CO2	2.36	3.92	1.5%	88.08%	0.6%	1.1%	KC Level	KC Trend
2F	2. Industrial Proc.	F. Consumption of Halocarbons and SF6			HFC	0.00	8.73	3.4%	82.64%	3.5%	6.1%	KC Level	KC Trend
4A	4. Agriculture	A. Enteric Fermentation			CH4	10.42	10.72	4.2%	68.13%	0.2%	0.4%	KC Level	-
4B	4. Agriculture	B. Manure Management			CH4	2.16	2.02	0.79%	94.41%	1.0%	0.1%	KC Level	-
4D1	4. Agriculture	D. Agricultural Soils; Direct Soil Emissions			N2O	5.45	5.56	2.18%	84.82%	0.8%	0.2%	KC Level	-
4D3	4. Agriculture	D. Agricultural Soils; Indirect Emissions			N2O	2.72	2.59	1.02%	92.81%	0.6%	0.0%	KC Level	-
5A1	5. LULUCF	A. Forest Land	1. Forest Land remaining Forest Land		CO2	17.89	18.34	7.19%	63.92%	0.4%	0.6%	KC Level	KC Trend
5A2	5. LULUCF	A. Forest Land	2. Land converted to Forest Land		CO2	2.10	1.62	0.64%	95.04%	0.2%	0.3%	KC Level	KC Trend
5B1	5. LULUCF	B. Cropland	1. Cropland remaining Cropland		CO2	4.10	4.37	1.72%	86.54%	0.0%	0.3%	KC Level	-
5C2	5. LULUCF	C. Grassland	2. Land converted to Grassland		CO2	0.30	2.05	0.81%	93.62%	-0.3%	1.2%	KC Level	KC Trend
5E2	5. LULUCF	E. Settlements	2. Land converted to Settlements		CO2	3.30	3.48	1.36%	89.44%	-0.5%	0.2%	KC Level	-
5F2	5. LULUCF	F. Other Land	2. Land converted to Other Land		CO2	0.44	1.15	0.45%	96.04%	-0.7%	0.5%	-	KC Trend

Key Category Analysis 1990 (including LULUCF) IPCC Source Categories (and fuels if applicable)					Direct GHG	Base Year 1990 Estimate	Year t Estimate	Level Assessment	Cumulative Total Column E-L			Result level assessment	
Sorted by NRF Code						[Gg CO2eq]	[Gg CO2eq]						
1A2	1. Energy	A. Fuel Combustion	2. Manufacturing Industries and Construction	Liquid Fuels	CO2	18.74	18.74	7.19%	7.19%			KC Level	
1A2	1. Energy	A. Fuel Combustion	2. Manufacturing Industries and Construction	Gaseous Fuels	CO2	16.48	16.48	6.32%	13.50%			KC Level	
1A3b	1. Energy	A. Fuel Combustion	3. Transport; Road Transportation	Gasoline	CO2	60.53	60.53	23.21%	36.71%			KC Level	
1A3b	1. Energy	A. Fuel Combustion	3. Transport; Road Transportation	Diesel	CO2	14.77	14.77	5.66%	42.37%			KC Level	
1A4a	1. Energy	A. Fuel Combustion	4. Other Sectors; Commercial/Institutional	Liquid Fuels	CO2	57.10	57.10	21.89%	64.26%			KC Level	
1A4a	1. Energy	A. Fuel Combustion	4. Other Sectors; Commercial/Institutional	Gaseous Fuels	CO2	8.70	8.70	3.34%	67.60%			KC Level	
1A4b	1. Energy	A. Fuel Combustion	4. Other Sectors; Residential	Liquid Fuels	CO2	18.74	18.74	7.19%	74.78%			KC Level	
1A4b	1. Energy	A. Fuel Combustion	4. Other Sectors; Residential	Gaseous Fuels	CO2	2.51	2.51	0.96%	75.74%			KC Level	
1A5	1. Energy	A. Fuel Combustion	5. Other	Liquid Fuels	CO2	2.36	2.36	0.91%	76.65%			KC Level	
4A	4. Agriculture	A. Enteric Fermentation			CH4	10.42	10.42	3.99%	80.64%			KC Level	
4B	4. Agriculture	B. Manure Management			CH4	2.16	2.16	0.83%	81.47%			KC Level	
4D1	4. Agriculture	D. Agricultural Soils; Direct Soil Emissions			N2O	5.45	5.45	2.09%	83.56%			KC Level	
4D3	4. Agriculture	D. Agricultural Soils; Indirect Emissions			N2O	2.72	2.72	1.04%	84.60%			KC Level	
5A1	5. LULUCF	A. Forest Land	1. Forest Land remaining Forest Land		CO2	17.89	17.89	6.86%	91.46%			KC Level	
5A2	5. LULUCF	A. Forest Land	2. Land converted to Forest Land		CO2	2.10	2.10	0.80%	92.27%			KC Level	
5B1	5. LULUCF	B. Cropland	1. Cropland remaining Cropland		CO2	4.10	4.10	1.57%	93.84%			KC Level	
5E2	5. LULUCF	E. Settlements	2. Land converted to Settlements		CO2	3.30	3.30	1.26%	95.10%			KC Level	

3.4.5 Recalculations

Recalculations: Some emissions have been recalculated due to updates in respective sectors. For the base year 1990 there is a slight decrease of 0.137% in the national total emissions excluding LULUCF. If emissions and removals from LULUCF are included, the decrease in the base year 1990 of the national total is 0.706%. The national total emissions of the year 2010 have been recalculated as well. There is a slight increase 0.407% without LULUCF and even a slight decrease of 0.086% with LULUCF activities in 2010.

1 Energy

- 1A: For 2010, the difference with respect to Submission 2011 is 0.25 Gg CO_2 eq (+0.12%). This is due to minor recalculations in the source categories 1A3b (Road Transport) and 1A4a-c (Other Sectors: Commercial/Industrial, Residential, Agriculture/Forestry/Fisheries).
- 1A3b: The N_2O emission factors for diesel and petrol were updated based on the new Swiss emission factors (FOEN 2012), which affects the time series from 1991 to 2009. For 2010, CH_4 and N_2O emission factors were updated based on the Swiss submission (FOEN 2012). For 1A4b/1A4c a more reliable consumption figure for 2011 was available; consequently the time series from 2001 to 2010 was linearly interpolated since otherwise a 44% increase from 2010 to 2011 would have resulted. This affected CO_2, CH_4 and N_2O emissions.

2 Industrial Processes

- 2A5/ 2A6/ 2F1: Preliminary data on the Swiss inhabitants for the year 2010 has been adjusted according to the definite data published in SFOE 2012.

3 Solvent and other Product Use

- 3D: The indirect CO_2 emissions due to atmospheric decomposition of NMVOC from source category 3 Solvent and Other Product Use was moved back from chapter 9 into chapter 5.

4 Agriculture

In all source categories of the Agriculture sector, recalculations were necessary due to updated activity data. 4A: For 2010, the difference is 0.03 Gg CO_2 eq (+0.27%) compared to the figure for the same year in Submission 2012. It is due to updated data on milk production per head of mature dairy cattle, which had been estimated based on 2009 data for the 2012 submission (since the data for 2010 were not yet available at the time).

- 4B: There is a difference in 2010 emissions of 0.21% or 0.007 Gg CO_2 eq. with regard to the figure for the same year in Submission 2012. This is due to updated data on milk production per head of mature dairy cattle, which had been estimated based on 2009 data for the 2012 submission (since the data for 2010 were not yet available at the time).
- 4D: There is a difference in 2010 emissions of +1.61% or 0.14 Gg CO_2 eq. with regard to the value for the same year in Submission 2011. This is due to updated land use data that was not yet available for submission 2011.

5 LULUCF

- 5: A conversion time of 20 years instead of 1 year was applied for all land-use changes. This improvement is a response to FCCC/ARR 2011, §65. For forests, this lead to a lower loss of carbon in living biomass (no harvesting on converted areas of 5A2). For grassland, the carbon loss due to land-use conversions from forest land to grassland 1997-2002 is smoothed and delayed.
- 5B, 5C: The areas and emissions of organic soils in 5B and 5C are now reported separately from mineral soils. This improvement is a response to FCCC/ARR 2011, §68, §70 and §74. Forests (5A) do not occur on organic soils.
- 5(III): An error in the formula for calculating the N_2O emissions as a result of the disturbance associated with land-use conversion to cropland (CRF Table 5(III)) was corrected. This correction lead to higher emissions.

6 Waste

- 6B2: Recalculations on CH_4 emissions have been done on the whole time series as the calculations, by mistake, were made on the density of waste water treatment gas (0.66 kg/m3) instead of the density of methane (1.03 kg/m3).
- 6B2: Recalculations on N_2O emissions have been done for the years 2007-2010 as the protein consumption as a mistake had been calculated with a constant intake for those years.
- 6C: Recalculations for fossil and biogenic CO_2 emissions have been done for the whole time series. The reason was a misinterpretation of the emission data from the Swiss NIR (FOEN 2012) which serves as basis for the emission factors for Liechtenstein with respect to illegal waste incineration.

7 Other

The indirect CO_2 emissions due to atmospheric decomposition of NMVOC from source category 3 Solvent and Other Product Use was moved back into chapter 5.

KP-LULUCF

A calculation error causing too high areas of afforestation was corrected. This lead to lower carbon sinks under A.1.1 in all years. This correction was already included in the response to the Saturday Paper (FCCC/ARR 2012) in November 2012.

3.4.6 QA / QC activities

QA /QC Procedures

According to the IPCC Good Practice Guidance (IPCC 2000) the major elements of a QA/QC system are:

- an inventory agency responsible for coordinating QA/QC activities;
- a QA/QC plan;
- QC procedures;
- QA review procedures;
- reporting, documentation, and archiving procedures.

The implementation status of these quality elements is described in the following chapters. One has to note that Liechtenstein's QA/QC system accounts for the **specific circumstances of the Principality of Liechtenstein**: Due to the smallness of the State, not every process, data flow and arrangement needs to be established by a formal agreement due to short "distances" within the administration and due to a high degree of acquaintance between the persons involved. Therefore, the National System manages with little number of written documents.

Objectives of the quality system

The quality management shall enable the party to principally fulfil the requirements of the articles 3, 5 and 7 of the Kyoto Protocol. Specifically, it shall ensure and improve the quality of GHG inventory that means a continuous improvement **of transparency, consistency, comparability, completeness and confidence**. In detail, it serves

- for providing checks to ensure data integrity, correctness and completeness;
- to identify errors and omissions,
- to reduce the uncertainties of the emission estimates,
- to document and archive inventory material.
-

Responsible agency for coordinating QA/QC activities

The QA/QC activities are coordinated by the quality manager of the GHG Inventory Group. The responsible person is Mr. Andreas Gstoehl, head of the unit Air Pollution Control, Noise and Climate (e-mail: andreas.gstoehl@llv.li, phone: +423 236 61 86) in the Office of Environment (OE). The QA/QC activities are organised within the Inventory Group, see National System represented in Figure 3-13.

Operational tasks are delegated to the lead NIR author. He distributes checklists to the project manager being also the National Inventory Compiler, to the sectoral experts, and to other NIR authors. They fill in the procedures that they carried out. The lists are then sent back to the quality manager, who confirms the performance of the QA/QC activities. The activities are documented in the NIR (see Annex 8).

QA/QC plan

Table 3-16 illustrates the annual cycle of inventory planning and preparation including the time-lines for the performance of QC activities. The current inventory for the submission April 2013 proceeded due to the general schedule shown in the table below.

Issue	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Meeting of Inventory group													
Meeting of Group Environment/Spatial Planning													
Consideration of UNFCCC Syn. & Ass. II													
Data collection													
Quality check of sectoral Data							energy		other sectors				
Calculation of emissions/removals													
Generation of CRF tables													
Quality checks of CRF tables													
Key Category Analysis incl. QC checks													
Uncertainty Analysis incl. QC checks													
Generation of NIR tables													
Compilation/Editing NIR													
QC: Proofread of NIR (correctness, transparency, etc)													
QC: Fill in checklist									energy	other issues			
QA activities									int. Review				
Official consideration and approval													
Submission to the UNFCCC secretariat													
Publication of NIR/CRF													
Archiving, storage of GHG inventory documents													

QC procedures

Quality control (QC) is defined by: “System of routine technical activities to measure and control the quality of the inventory as it is being developed.” (IPCC 2000).

Overall Activities

The following QC activities are carried out:

- The annual cycle for inventory preparation contains several meetings of the Inventory Group and several meetings of governmental and other data suppliers with the OE. In these meetings the activities, responsibilities and schedule for the inventory preparation process are being organized and determined.
- Regular meetings of the group “Umwelt und Raum” (environment and spatial planning). The group is formed by the heads of the OE, SLP and the minister for the environment. It prepares policy matters for the attention of the Government including climate affairs.
- The project manager, also operating as the national inventory compiler (NIC), the sectoral experts, and the NIR authors accomplish a number of QC activities:

The NIR authors check the emission results produced by the sectoral experts, for consistency of cross-cutting parameters, correctness of emissions aggregation, and completeness of the GHG inventory. They compare the methods used with IPCC Good Practice Guidance, check the correct compiling of the methods in the NIR, the correct transcription of CRF data into NIR data tables and figures, the consistency between data tables and text in the NIR, and the completeness of references in the NIR. Furthermore, they are responsible for the correctness of the key source and the uncertainty analysis.

The sectoral experts check the description of methods, numbers and figures in the NIR.

The NIC checks the integrity of the database files, the consistency of time series, the correct and complete inputs into the CRF Reporter.

Further staff members of the OE carry out a proof reading of single sectors.

The project manager executes an overall checking function for the GHG inventory and the NIR: he monitors the GHG emission modelling and the key category analysis. He checks the NIR for correctness, completeness, transparency and quality, checks for the complete archiving of documents, and the completeness of the CRF submission document.

The OE enlarged its staff of the Climate Protection unit in the beginning of 2007 by two more collaborators. They are responsible for emission modelling, GHG inventory, implementation of the emission trading system, national emissions trading registry, national allocation plan, Kyoto mechanisms (JI, CDM).

In order to provide an overview and to increase transparency, all authors, experts, and involved staff members of Liechtenstein's Government are listed in a separate table together with specific descriptions about their responsibilities. This table is available for the entire reporting period and helps to improve the QC management in general.

Specific activity

The CRF tables exported from the CRF Reporter software underwent an iterative quality control in a triple check:

- The results for 2011 were compared with the results 2010 within the current CRF,
- the results for 2010 were compared between the current CRF tables and the CRF tables of submission 2012,
- the results for the base year 1990 were compared between the current CRF tables and the CRF tables of submission 2012.

For each check, the CRF table cells were labelled in green if values were identical, in grey if they differed by no more than 20%, in orange if they differed by 20% to 50%, and in red if they differed by more than 50%. The findings were discussed among the core group members and the modelling specialists. All differences were investigated and the reasons for the differences sought. This procedure led to the identification of several errors, which were subsequently corrected before submission.

QA Review Procedures

Quality assurance (QA): System of activities that include a "system of review procedures conducted by personnel not directly involved in the inventory compilation development process, to verify that data quality objectives were met, ensure that the inventory represents the best possible estimate of emissions and sinks given the current state of scientific knowledge and data available, and support the effectiveness of the QC programme" (IPCC 2000).

Liechtenstein's NIS quality management system follows a Plan-Do-Check-Act-Cycle (PDCA-cycle), which is a generally accepted model for pursuing a systematic quality performance according to international standards. This approach is in accordance with procedures described in decision 19/CMP.1 and in the IPCC Good Practice Guidance.

Liechtenstein carries out the following QA activities:

- Internal review: The draft NIR is passing through an internal review. The project manager also being the NIC, the project manager assistant, two specialised staff members of the climate unit, and other staff member of the OE are proofreading the NIR or parts of it (personnel not directly involved in the preparation of a particular section of the inventory). They document their findings in checklists, which are sent back to the NIR authors (see Annex 8).
- The Swiss inventory management charges external experts for sectoral QA activities to review the Swiss GHG inventory. Since a number of Swiss methods and Swiss emission factors are used for the preparation of the Liechtenstein inventory, the results of the Swiss QA activities have to be checked and analysed by Liechtenstein's experts. Positive reviews may be interpreted as positive for Liechtenstein too, and problematic findings must not only be taken account for in Switzerland but also in Liechtenstein. The following sectors have already been reviewed:

A consulting group (not involved in the GHG emission modelling) was mandated to review the two sectors Energy and Industrial Processes with respect to methods, activity data, emission factors, CRF tables, NIR chapter (Eicher and Pauli 2006). The results were documented in a review report and communicated to Liechtenstein's Inventory Group. The consequences for the main findings have been evaluated for Liechtenstein's GHG inventory and for the NIR for submission December 2006.

The Swiss Federal Institute of Technology was mandated to review the methane emissions of agriculture with respect to methods, activity data and emission factors. The results were documented in two reports (Soliva 2006a, 2006b) and communicated to Liechtenstein's Inventory Group. The consequences for the main findings have been evaluated for Liechtenstein's GHG inventory and for the NIR for submission December 2006.

The waste sector of Switzerland was reviewed by a peer expert group in 2009. The reviewers conclude that waste related emissions are calculated in a plausible way and that results from the report are plausible. The emission factors as well as activity data are based on reliable and solid sources. For details see Rytec (2010).

An expert peer review of the LULUCF sector of the Swiss GHG inventory took place in 2010. The reviewers conclude that "LULUC sector of the Swiss green house gas inventory proved to be of superior quality, good applicatory characteristics and scientifically sound applied definitions and methodology". For details see VTI (2010).

For the Swiss NIR, an internal review takes place annually shortly before the submission. Every chapter of the NIR is being proofread by specialists not involved in the emission modelling or in the NIR editing. The internal review is organised by the quality officer and the results are compiled by the same person that is also compiling Liechtenstein's NIR (lead author J. Heldstab, INFRAS). The results of the Swiss review are therefore communicated to Liechtenstein's Inventory Group. Where methods and results are concerned that are relevant for Liechtenstein too, the consequences were taken into account. This procedure has been performed in the last and the current submissions (May and December 2006, May 2007, February 2008, April 2009, April 2010, April 2011, April 2012). It will also be repeated for future submissions.

- The applicability of Swiss methodologies and emission factors to Liechtenstein's GHG inventory was reviewed as well: Before Swiss methods were applied, they were discussed with the experts of Liechtenstein's administration. This process has taken place before the submission in December 2006 for the sectors Energy, Industrial Processes, Solvent and Other Product Use, Agriculture and Waste, for the sector LULUCF before the submission in February 2008. Since then, the issue is a permanent point on the agenda of the annual kick-off meetings of the Inventory Group: Potential modifications or updates of the Swiss emission factors are discussed and checked upon their abblicability for Liechtenstein's GHG inventory
- For the sector LULUCF a new external reviewer has been mandated in 2012. The entire LULUCF sector has been revised and brought in line with the IPCC methodology.

Archiving Procedures

The electronic files of Liechtenstein's GHG inventory are all saved by the backup system of Liechtenstein's administration.

Every computer belonging to the administration, including the computers of the Office of Environment, are connected to a central network. The data of the server systems, file-clusters and database servers, are being saved in a tape-library. Due to safety reasons, the tape-library is not in the computing centre but in a building of the National police: In case of a total lost of the computing centre, the data are still available.

There are several backups

- daily incremental saved up to one month (4 weeks)
- Weekly full backup saved up to two months
- Monthly full backup saved up to one year

The backup files are being initialised via scheduler of the master server. The data are written via network onto one of the LTO 2 Drives (tape). The master server manages the handling of the tapes. Backups are checked daily via Activity Monitor. If a backup is not carried out, it may be caught up manually. Since daily restores of user data is carried out, there is a guarantee for keeping the data readable.

For archiving reasons, the backup tapes are being doubled four times a year. The duplicates are not being overwritten during five years.

In addition to the administrational archiving system, the external experts of Acontec AG, who are mandated with the emission modelling and CRF generation, save all CRF and background tables yearly on CD ROM/DVD ROM. Also the data generated in the NIR compilation process such as QA/QC, KCA, uncertainty analysis, review documents are saved on DVD by INFRAS. The disks are stored in a bank safe of the Liechtensteinische Landesbank (Liechtenstein's National Bank).

The information exchange by email between all NIR participants is stored for the submission 2013 in the so-called PST format.

Therefore archiving practices are in line with paragraph 16(a) of the annex to decision 19/CMP.1.

3.5 National Registry

3.5.1 Registry administrator

The name and contact information of the registry administrator designated by the Party to maintain the national registry:

Registry Administrator	**Contacts**
Office of Environment (OE) P.O. Box 684 Dr. Grass-Strasse 12 9490 Vaduz Principality of Liechtenstein phone: +423 236 75 96 fax: +423 236 64 11 email: registry@llv.li website: http://www.llv.li/amtsstellen/llv-aus-emissionshandel_en.htm	Main Contact Dr. Heike Summer Email: heike.summer@llv.li Alternative Contact Andreas Gstöhl Email: andreas.gstoehl@llv.li Alternative Contact Dr. Helmut Kindle Email: helmut.kindle@llv.li

3.5.2 Consolidated system

The names of the other Parties with which the Party cooperates by maintaining the national registries in a consolidated system:

The consolidation of European national registries (including all EU Member States, Iceland, Liechtenstein and Norway) was a significant change to the system of registries. After certification of the consolidated System of EU registries on 1st June 2012, on 19 June 2012, 29 registries became operational under the

Consolidated System of European Union Registries (CSEUR). A detailed description is given in the EU Commission Regulation 920/2010. The complete description of the consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of the EU and all consolidating national registries. This description includes:

- Readiness questionnaire
- Application logging
- Change management procedure
- Disaster recovery
- Manual Intervention
- Operational Plan
- Roles and responsibilities
- Security Plan
- Time Validation Plan
- Version change Management

The required documents are confidential and accessible for assessors only. Therefore the documents which are mentioned are not available within this document. The documents above will be submitted separately as an appendix to the final NIR 2013 on April 15 2013 and **MUST NOT** be published in any form.

3.5.3 Database structure and capacity

For the purposes of meeting their obligations as KP Parties and under Article 6 of the European Union Decision No 280/2004/EC to ensure the accurate accounting of Kyoto units, each Member State and the Union operate a registry (hereinafter 'KP registry') in the form of a standardised electronic database that complies with the UNFCCC's requirements concerning registries, and in particular the functional and technical specifications for data exchange standards for registry systems under the Kyoto Protocol elaborated pursuant to Decision 12/CMP.1 of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol. The Union registry and every other KP registry conform to the functional and technical specifications for data exchange standards for registry systems under the Kyoto Protocol elaborated pursuant to Decision 12/CMP.1 and comply with the hardware, network and software and security requirements set out in the Data Exchange and Technical Specifications provided European Union Transaction Log (EUTL) is used as an independent transaction log that records and checks the issue, transfer and cancellations of allowances in the form of a standardised electronic database. The EUTL also serves to record all information relating to the holdings and transfers of Kyoto units made available.

The standardised and secured system of registries in the form of standardised electronic databases containing common data elements to track the issue, holding, transfer and cancellation of allowances, to provide for public access and confidentiality as appropriate and to ensure that there are no transfers which are incompatible with the obligations resulting from the Kyoto Protocol is drawn up.

The required documents are confidential and accessible for assessors only. Therefore the descriptions are not available within this document. The documents will be submitted separately as an appendix to the final NIR 2013 on April 15 2013 and **MUST NOT** be published in any form.

3.5.4 Conformity with Data Exchange Standards (DES)

In order to ensure that Kyoto units and allowances can be held on the same Union registry accounts, the Union registry must also conform to the functional and technical specifications for data exchange standards for registry systems under the Kyoto Protocol, adopted by Decision 12/CMP.1.

The EUTL is capable of checking and recording all processes referred to under Article 3(2), and is conform to the functional and technical specifications for data exchange standards for registry systems under the Kyoto Protocol elaborated pursuant to Decision 12/CMP.1 and comply with the hardware, network and software requirements set out in the Data Exchange and Technical Specifications. The Union registry and every other KP registry are conform to the functional and technical specifications for data exchange standards for registry systems under the Kyoto Protocol elaborated pursuant to Decision 12/CMP.1 and comply with the hardware, network and software and security requirements set out in the Data Exchange and Technical Specifications.

The required documents are confidential and accessible for assessors only. Therefore the descriptions are not available within this document. The documents will be submitted separately as an appendix to the final NIR 2013 on April 15 2013 and **MUST NOT** be published in any form.

3.5.5 Prevention of discrepancies

The Union registry and every other KP registry check input codes and check response codes to ensure the correct interpretation of information exchanged during each process. The check codes shall correspond to those contained in the Data Exchange and Technical Specifications. The consolidated system adopts the Data Exchange and Technical Specifications necessary for exchanging data between registries and transaction logs, including the identification codes, automated checks and response codes, as well as the testing procedures and security requirements necessary for the launching of data exchange. The Data Exchange and Technical Specifications shall be consistent with the functional and technical specifications for data exchange standards for registry systems under the Kyoto Protocol elaborated pursuant to Decision 12/CMP.1. Prior to and during the execution of all processes the Union registry shall conduct appropriate automated checks to ensure that discrepancies are detected and incorrect processes are terminated in advance of automated checks being conducted by the EUTL.In case of processes completed through the direct communication link between the Union registry and the EUTL referred to in Article 5(2) of the previous mentioned regulation, the EUTL terminates any processes where it identifies discrepancies upon conducting the automated checks referred to in Article 66(2) of the mentionend regulation, and informs thereof the Union registry and the administrator of the accounts involved in the terminated transaction by returning an automated check response code. The Union registry immediately informs the relevant account holders that the process has been terminated.

In case of transactions completed through the ITL referred to in Article 5(1) of the mentioned regulation, the ITL terminates any processes where discrepancies are identified either by the ITL or the EUTL upon conducting the automated checks referred to in Article 66(2) of the mentioned regulation. Following a termination by the ITL, the EUTL also terminates the transaction. The ITL informs the administrators of the registries involved of the termination of the transaction by returning an automated check response code. If one of the registries involved is the Union registry, the Union registry also informs the administrator of the Union registry accounts involved in the terminated transaction by returning an automated check response code. The Union registry immediately informs the relevant account holders that the process has been terminated.

The required documents are confidential and accessible for assessors only. Therefore the descriptions are not available within this document. The documents will be submitted separately as an appendix to the final NIR 2013 on April 15 2013 and **MUST NOT** be published in any form.

3.5.6 Determination of unauthorized manipulations

The identity of the Union registry is authenticated towards the EUTL with digital certificates and usernames and passwords as indicated in the Data Exchange and Technical Specifications.

The Member States and the Union use the digital certificates issued by the Secretariat to the UNFCCC, or an entity designated by it, to authenticate their registries to the ITL for the purposes of establishing the communication. Adequate and harmonised requirements on authentication and access rights are applied to

protect the security of information held in the integrated registries system and records concerning all processes, operators and persons in the registries system are kept.

Authentication of registries and the EUTL

- 1**.** The identity of the Union registry is authenticated towards the EUTL with digital certificates and usernames and passwords as indicated in the Data Exchange and Technical Specifications provided for in Article 71.
- 2. The Member States and the Union use the digital certificates issued by the Secretariat to the UNFCCC, or an entity designated by it, to authenticate their registries to the ITL for the purposes of establishing the communication link referred to in Article 5.

Accessing accounts in the Union registry

- 1. Account holders are able to access their accounts in the Union registry through the secure area of the Union registry. The Central administrator ensures that the secure area of the Union registry website is accessible through the Internet. The website of the Union registry is available in all languages of the European Union.
- 2. The Central administrator ensures that accounts in the Union registry where access through trading platforms in accordance with Article 19(3) is enabled and one authorized representative is also the authorized representative of a trading platform holding account are accessible to the trading platform operated by the holder of that trading platform holding account.
- 3. Communications between authorized representatives or trading platforms and the secure area of Union registry are encrypted in accordance with the security requirements set out in the Data Exchange and Technical Specifications provided for in Article 71.
- 4. The Central administrator takes all necessary steps to ensure that unauthorized access to the secure area of the Union registry website does not occur.
- 5. If the security of the credentials of an authorized representative or additional authorized representative has been compromised, the authorized representative or additional authorized representative shall immediately inform the administrator of the account thereof and request a replacement.

Authentication and authorization of authorized representatives in the Union registry

- 1. The Union registry issues each authorized representative and additional authorized representative with a username and password to authenticate them for the purposes of accessing the registry.
- 2. An authorized representative or additional authorized representative only have access to the accounts within the Union registry which he is authorized to access and only be able to request the initiation of processes which he is authorized to request pursuant to Article 19. That access or request takes place through a secure area of the website of the Union registry.
- 3. In addition to the username and password referred to in paragraph 1, national administrators provides secondary authentication to all accounts administered by them. The types of secondary authentication mechanisms that can be used to access the Union registry shall be set out in the Data Exchange and Technical Specifications provided for in Article 71.
- 4. The administrator of an account may assume that a user who was successfully authenticated by the Union registry is the authorized representative or additional authorized representative registered under the provided authentication credentials, unless the authorized representative or additional authorized representative informs the administrator of the account that the security of

his credentials has been compromised and requests a replacement, EN L 270/22 Official Journal of the European Union 14.10.2010.

Suspension of all access by authorized representatives due to a security breach

- 1. The Central Administrator may suspend access to the Union registry or the EUTL if there is a breach of security of the Union registry or the EUTL which threatens the integrity of the registries system, including the back-up facilities referred to in Article 59.
- 2. The administrator of a KP registry may suspend access by all users to its KP registry if there is a breach of security of the KP registry which threatens the integrity of the registries system, including the back-up facilities referred to in Article 59.
- 3. In the event of a breach of security that may lead to suspension of access, the administrator who becomes aware of the breach shall promptly inform the Central Administrator of any risks posed to other parts of the registries system. The Central Administrator shall then inform all other administrators.
- 4. If an administrator becomes aware of a situation that requires the suspension of all access to its system, it shall inform the Central Administrator and account holders with such prior notice of the suspension as is practicable. The Central Administrator will then inform all other administrators as soon as possible.
- 5. The notice referred to in paragraph 3 shall include the likely duration of the suspension and shall be clearly displayed on the public area of that KP registry's website or on the public area of the EUTL's website.

The required documents are confidential and accessible for assessors only. Therefore the descriptions are not available within this document. The documents will be submitted separately as an appendix to the final NIR 2013 on April 15 2013 and **MUST NOT** be published in any form.

In 2012 an additional security measure has been implemented. The third account representative has been set to mandatory as of February 2012. This representative fulfils the function to confirm transactions initiated by the first and second representative. This 4-eyes-priciple should restrain the possibility of transactions done by unauthorized persons who have hacked or stolen access data from representatives.

3.5.7 Public Reports

For each account the following reports are available on the public area of the national registry:

Pursuant to paragraphs 44 to 48 in section I.E of the annex to decision 13/CMP.1, Liechtenstein makes non-confidential information available to public using Registry Homepage and/or user interface. In Liechtenstein the following information is considered as non-confidential and publicly accessible on website: http://ec.europa.eu/environment/ets/ **.**

13/CMP.1 annex II paragraph 45 Account information	The requested information is publicly available for all accounts. The data of operator holding accounts can be viewed online at: **http://ec.europa.eu/environment/ets/** The data of all accounts can be viewed online at: http://ec.europa.eu/environment/ets/ Representative name and contact information is classified as confidential due to Article 83 paragraph 8 and 9 Registry Regulation No. 1193/2011.
13/CMP.1 annex II paragraph 46 Joint implemention project information	This is information is available on the website: http://www.llv.li/amtsstellen/llv-aus-emissionshandel_en/llv-aus-emissionshandelsregister_flexible_mechanismen_en/llv-aus-emissionshandel-genehmigte_projekte_en.htm
13/CMP.1 annex II paragraph 47 Unit holding and transaction information	The information requested in (a), (d), (f) and (l) is classified as confidential due to Article 83 paragraph 1 Registry Regulation No. 1193/2011 as well as national data protection law and therefore not publicly available. Transactions of units within the most recent five year period are also classified as confidential, therefore the transactions provided are only those completed more than five years in the past. The information requested in (b), (c), (e), (g), (h), (i), (j) and (k) is publicly available at (b) In 2012 there was no issuance of AAU. (c) In 2012 no ERUs were issued. (e) No RMU was issued in the reported year. (g) No RMU was cancelled on the basis of activities under Article 3, paragraph 3 and 4 in the reported year. (h) No ERU, CER, AAU and RMU were cancelled on the basis of activities under Article 3, paragraph 1 in the reported year. (i) In 2012, no AAU, no ERU and no CER were voluntary cancelled. No RMU was cancelled. (j) In 2012, no ERU, no CER, no AAU, and no RMU, tCER, lCER were retired. (k) There was no carry-over of ERU, CER, AAU or RMU from the previous commitment period.
13/CMP.1 annex II paragraph 48 Authorized legal entities information	The following legal entities are authorized by the Member State to hold Kyoto units:

	Legal entities authorised by Liechtenstein to hold units
AAU	Federal Gouvernement, TA
ERU	Each account holder of OHA, PHA, TA and NHA
CER	Each account holder of OHA, PHA, TA and NHA
RMU	Federal Government only, TA
tCER	Federal Government only, TA
lCER	Federal Government only, TA

OHA: Operator Holding Account (installation and aircraft)
PHA: Person Holding Account
TA: Trading Account
NHA: National Holding Account

3.5.8 Internet address

The URL of the interface for the national registry of Liechtenstein is:

www.emissionshandelsregister.li and alias www.emissionstradingregistry.li

3.5.9 Safeguard and Recovery Plan

The following measures taken to safeguard, maintain and recover data in the event of a disaster are implemented:

The Central Administrator of the CSEUR shall ensure that the Union registry and EUTL incorporate robust systems and procedures for the safeguarding of all data and the prompt recovery of all data and operations in the event of a disaster as stated in the new requirements of Commission Regulation 920/2010.

The required documents are confidential and accessible for assessors only. Therefore the documents which are mentioned are not available within this document. The documents above will be submitted separately as an appendix to the final NIR 2013 on April 15 2013 and **MUST NOT** be published in any form.

3.5.10 Test procedures

The accounting mechanisms are described in the COMMISSION REGULATION (EU) No 920/2010, Article 52. The described steps below refer to the commission regulation.

Minimum deposited quantity on the ETS AAU deposit account

- 1. The EUTL shall record a minimum deposited quantity for each Member State. In the case of Member States with KP registries, the EUTL will prevent transfers of Kyoto units from their ETS AAU deposit account that would result in Kyoto unit holdings on the ETS AAU deposit account that are below the minimum deposited quantity. In the case of Member States with no KP registry, the minimum deposited quantity is a value used in the clearing process.
- 2. The EUTL shall add a quantity to the minimum deposited quantity after an issue of Chapter III allowances has taken place in accordance with Article 39, where the addition shall be equal to the amount of Chapter III allowances issued.
- 3. The EUTL shall deduct a quantity from the minimum deposited quantity immediately after:
- (a) a transfer of Chapter III allowances to the Union allowance deletion account has taken place as a result of downwards correction of Chapter III allowances after their allocation in accordance with Article 37(3), where the deduction shall be equal to the amount of Chapter III allowances transferred;
- (b) a set-aside of Kyoto units against surrenders of Chapter III allowances by aircraft operators in accordance with Article 54 has taken place, where the deduction shall be equal to the amount set-aside; (c) a cancellation of Kyoto units against deletions of Chapter III allowances in accordance with Article 55(1) has taken place, where the deduction shall be equal to the quantity cancelled;
- (d) a deletion of allowances set out in Article 55(2) took place, where the deduction shall be equal to the quantity deleted.
- 4. The Central Administrator carries out a deduction of a quantity from the minimum deposited quantity recorded in the EUTL after the clearing transactions in accordance with Article 56 have taken place. The deduction shall equal the total amount of Chapter III allowances surrendered by user accounts administered by the national administrator of the Member State for the 2008-12 period; plus the clearing value calculated in accordance with Article 56(3).

The required documents are confidential and accessible for assessors only. Therefore the documents which are mentioned are not available within this document. The documents above will be submitted separately as an appendix to the final NIR 2013 on April 15 2013 and **MUST NOT** be published in any form.

3.5.11 Commitment period reserve (CPR)

According to the Annex of decision 11/CMP.1, each Party included in Annex I shall maintain, in its national registry, a commitment period reserve which should not drop below 90 per cent of the Party's assigned amount calculated pursuant to Article 3, paragraphs 7 and 8, of the Kyoto Protocol, or 100 per cent of five times its most recently reviewed inventory, whichever is lowest. In line with these specifications, Liechtenstein reported its commitment period reserve to be 950.061 Gg CO_2 eq based on the assigned amount, which is consistent with the initial review report 2006 (FCCC/IRR 2007).

Liechtenstein considers that the „most recently reviewed inventory" refers to the inventory 2007 presented in the current NIR.

In order to determine which of the two methods to calculate the commitment period reserve results in the lower value, the results of both methods are indicated in Table3-4.

Table 3-17 Calculation of Liechtenstein's commitment period reserve 2011.

Method 1		**Method 2**	
Assigned amount calculated pursuant to Art. 3, para. 7 and 8 of the Kyoto protocol (five times 92% of 1990 emissions), see OEP (2007b) [Gg CO_2 equivalent]	1'055.623	2011 emissions without LULUCF [Gg CO_2 equivalent]	222.00
90% of the assigned amount [Gg CO_2 equivalent]	950.061	100% of five times the 2011 emissions without LULUCF [Gg CO_2 equivalent]	1110.00

The CPR remains unchanged since method 1 still results in the lower value and is therefore used to calculate the minimum amount of the CPR. **The commitment period reserve of Liechtenstein should therefore not drop below 950.061 Gg CO_2 equivalent (0.950061 million tonnes CO_2 equivalent).**

References

FOEN (Swiss Federal Office for the Environment) 2013: Greenhouse Gas Inventory for Switzerland 1990-2011 Common Reporting Format (CRF) and National Inventory Report (NIR), Berne

IPCC 1997a: Greenhouse Gas Inventory Reference Manual. Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 1, Reporting Instructions, Intergovernmental Panel on Climate Change a.o., IPCC WG I Technical Support Unit, Bracknell, U.K.

IPCC 1997b: Greenhouse Gas Inventory Reference Manual, Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 2, Workbook, Intergovernmental Panel on Climate Change a.o., IPCC WG I Technical Support Unit, Bracknell, U.K.

IPCC 1997c: Greenhouse Gas Inventory Reference Manual, Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 3, Reference Manual, Intergovernmental Panel on Climate Change a.o., IPCC WG I Technical Support Unit, Bracknell, U.K.

http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm [19.02.2009]

IPCC 2000: Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC GPG) http://www.ipcc-nggip.iges.or.jp/public/gp/gpgaum.htm [19.02.2009]

IPCC 2003: Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC GPG LULUCF).

http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm [19.02.2009]

OEP (Office of Environmental Protection, Liechtenstein) 2013: Liechtenstein's Greenhouse Gas Inventory 1990 – 2011, National Inventory Report 2013

OEP 2006a: Liechtenstein's Initial Report under Article 7, paragraph 4 of the Kyoto Protocol. Office of Environmental Protection (OEP), Vaduz, 22 December 2006.

4. Policies and measures

4.1 Policy making process – general policy context

Liechtenstein endeavors to enshrine the principle of sustainability in its policies. This includes provident use of resources and maintenance of a high quality of life.

In 2010, Liechtenstein therefore introduced an indicator-based system for an annual assessment of the countries path towards a sustainable development. To this respect the Government has chosen to link the indicator-based assessment to the sustainability definition of the Brundtland Commission. According to that definition sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs." The system is comparable to the indicator-based assessment of the Swiss Federal Office of Statistics and the European system of Eurostat.

The assessment in Liechtenstein until today shows a mixed picture concerning sustainability. In the areas of international cooperation as well as education and culture the trends are going towards sustainability. The areas of employment, energy and climate as well as natural resources show a positive trend towards sustainability. The areas of living conditions, health and economy show no clear trend and the development must be assessed as neutral. In the areas of social cohesion and mobility, however, the developments are not going towards sustainability. The increasing motorisation rate and the decrease of the environmentally friendly passenger mobility lead to an unsustainable development in the area of mobility.

The assessment of the countries sustainable development also serves as an incentive for the development of respective policies and measures, especially in areas where an unsustainable development can be observed. To the extent possible, Liechtenstein also tries to make a contribution to the solution of global environmental problems. Climate protection enjoys a high political priority in this regard, constituting a primary field of action in Liechtenstein's environmental policy.

Liechtenstein has integrated its climate policy very strongly into the individual sectorial policies. The focus is on energy policy, environmental policy, transport policy, agricultural and forestry policy. All of these areas encompass measures that contribute to the reduction of climate gases. In order to ensure a coordinated implementation of climate policies within the various areas the Government passed a Climate Protection Strategy in 2007. The Strategy requires an interdisciplinary coordination in the fields of environment, energy, building, transportation, agriculture and forestry with respect to the development of climate policy measures. The strategy will be revised in the course of 2014. Liechtenstein’s Ministry of Environment and the Office of Environment are the coordinating authorities with respect to the execution of the Climate Protection Strategy.

Because of the small size of the country, however, cross-border cooperation plays an important role. Especially important is the relationship with Switzerland and cooperation among the countries in the Lake Constance area. Thanks to the Customs Treaty, cross-border measures and bilateral execution are simplified in many areas, since various Swiss enactments are directly applicable in Liechtenstein pursuant to the Treaty. In these cases, Liechtenstein executes the provisions similarly to a Swiss canton (e.g. mineral oil tax). Accordingly, most policy areas are very closely linked with Swiss policy, in terms of both content and execution.

Pursuant to the cross border cooperation with Switzerland Liechtenstein and Switzerland concluded “The bilateral Agreement between the Principality of Liechtenstein and the Swiss Confederation on Environmental Levies within the Principality of Liechtenstein” (2009). The agreement enables Liechtenstein to implement several environmental levies of Switzerland into national law while using the existing

infrastructure of the Swiss authorities for the execution of the respective national laws. The Ministry of Environment and the Office of Environment and the Office for Foreign Affairs are the competent authorities with respect to the execution of the bilateral agreement.

One of the core elements of Liechtenstein's Policies and Measures is the linkage to energy conservation throughout the various sectors. The envisaged reduction of fossil fuel use aims to that respect at a modification of longer-term trends in anthropogenic GHG emissions and thereby also serves the objective of the Climate Convention.

4.2 Domestic and regional programmes and/or legislative arrangements and enforcement and administrative procedures

Liechtenstein's legislative and administrative main arrangements to meet its commitments under the Kyoto Protocol are to be found in the Emissions Trading Act and the CO_2 Act.

The Emissions Trading Act (EHG) sets up the general framework for the fulfilment of Liechtenstein's reduction obligations originating from the respective ratification of the Kyoto Protocol. In 2012 the Government introduced a legally binding greenhouse gas reduction target from at least 20% compared to 1990 until 2020. In addition the EHG states that emission reductions are first and foremost to be reduced by domestic measures. If the reduction obligations cannot be fulfilled through domestic measures the government may participate in project activities abroad or in international emissions trading. Besides this the EHG implements Directive 2003/87/EC (Emissions Trading Directive) into national law and obliges two industrial installations (2013) to participate within the European Emissions Trading Scheme. Due to comprehensive amendments of Directive 2003/87/EC the EHG has been revised in 2012. The regulations of the EHG with respect to the participation of Liechtenstein in the Kyoto Protocols flexible mechanisms as well as with respect to domestic emissions trading are executed by the Office of Environment.

The CO_2 Act corresponds with the CO_2 Act of Switzerland (in force since 2008) and introduces a levy on the consumption of fossil fuel (oil and natural gas). In 2013 the CO_2 Act has been revised. Besides the levy on fossil fuel an obligation to compensate CO_2 emissions from the use of motor fuels (gasoline and diesel) as well as emission regulations for passenger cars has been introduced.

The CO_2 Act is part of "The bilateral Agreement between the Principality of Liechtenstein and the Swiss Confederation on Environmental Levies within the Principality of Liechtenstein", mentioned above.

In 2007 the Government notified its Designated National Authority as well as its Designated Focal Point to the UNFCCC secretariat and in 2008 the "National Guidelines for Approving Projects in Accordance with Article 6 and Article 12 of the Kyoto Protocol" were established.

Legislative arrangements, guidelines and further information on Liechtenstein's climate policy are available on the Office of Environment's homepage, www.au.llv.li.

4.3 Policies and measures and their effects

4.3.1 Cross Sectoral Policies

The deliberate decision was made not to establish superordinate environmental protection legislation; the relevant provisions are therefore to be found in the individual sectoral policies. However, the 2007 adopted Climate Protection Strategy requires a coordinated approach by the competent Ministries when drafting sectoral legislation. This approach will also form part of the revised Climate Protection Strategy which will be released in 2014.

Liechtenstein has implemented its climate related policies and measures strongly into individual sectoral policies. The responsibility of monitoring the effects of individual measures or policies are therefore beard by the respective administration offices that are in charge of the execution of the individual measure. These authorities provide an annual report of their activities (not only climate change related) which will be forwarded to the Liechtenstein Parliament. The reports are publicly available.

4.3.2 Environmental policy

Environmental Protection Act

In Liechtenstein environmental policies are framed within the so called Environmental Protection Act from 2008. The Act summarized a set of individual legislative measures in order to streamline procedures within environmental law. The Act is a legislative framework which governs the main aspects of environmental protection, eg. air pollution and waste treatment. It is comparable to the Swiss Federal Act on Protection of the Environment. The Act is the legal basis for further ordinances and regulations. It contains the following fundamental principles:

- precautionary principle: Environmental damages are to be limited at an early stage,
- polluter-pays-principle: Polluters of detrimental effects have to bear the costs for measures for the protection of the environment,
- principle of holistic approach: Environmental problems must be understood and tackled integrally and coherently,
- cooperation principle: Authorities and the economy collaborate as far as possible to achieve the goals of environmental protection.

With respect to climate and air quality related measures (see Air Quality Ordinance, Luftreinhalteverordnung) the Environmental Protection Act builds the legal basis for emission limits, for example combustion installation within industry and households. The principles applied within the Environmental Protection Act guarantee that the subsequent measures are linked to the most efficient and up-to-date technique requirements. As such the act governs the limitation of emissions for stationary installations, the maximum air pollution level, measures to be taken in the event emissions thresholds are exceeded, and the requirements on engine and heating fuel. An Important element is the obligation to provide information to the public. Requirements on petrol and diesel oil, but also thresholds for particulate matters in air are regulated by Ordinance on Air Pollution. To this regard the annual average for sulfur dioxide (threshold) is 20 micrograms/m^3. The sale of leaded supreme petrol is prohibited since 2000. The lead content in unleaded petrol is 0.005 g/l, and the share of carcinogenic benzene may not exceed 1%. The sulfur content in diesel and petrol may not exceed 0.01 g/kg.

With regard to waste treatment the Environmental Protection Act requires the separate disposal of different types of waste. At the level of an ordinance, the Government may require that certain waste be recycled, if such recycling improves the ecological balance. The requirements are also based on the polluter-pays-principle. All trash is incinerated in the waste incineration plant in Buchs, Switzerland and the energy generated is reused.

The Environmental Protection Act also provides the legal basis for the so called “Action Plan Air” a measure plan effective since 2007 in order to reduce all kind of emissions. The Action Plan Air itself is, however, not legally binding but provides proposals that have to be considered for future decisions by the Government.

Environmental Levies

The bilateral Agreement between the Principality of Liechtenstein and the Swiss Confederation on Environmental Levies within the Principality of Liechtenstein was concluded in 2010. The agreement enables Liechtenstein to implement several environmental levies of Switzerland into national law while using the existing infrastructure of the Swiss authorities for the execution of the respective national laws. The environmental levies are:

- Act on the tax for the rehabilitation of contaminated sites (ASAG)

- Act on the incentive tax on petrol and diesel oil with a sulphur content of more than 0.001 per cent (BDSG)
- Act on the incentive tax on “extra light” heating oil with a sulphur content of more than 0.1 per cent (HELG)
- Act on the incentive tax on volatile organic compounds (VOCG)
- CO_2 Act

Environmental levies on pollutants serve to "internalize" externalized costs, and to reduce the costs of pollution to society by increasing the proportion paid by polluters themselves.

4.3.3 Climate policy

In Liechtenstein, two laws substantially influence climate policy:

Emissions Trading Act

The Emissions Trading Act implements Directive 2003/87/EC (EU Emissions Trading Directive) and Directive 2004/101/EC. The Act obliges two industrial combustion installations (2013) to participate within the European Emissions Trading Scheme (EU ETS). Due to the revision of the underlying EU legislation 2008/2009 Liechtenstein was obliged to revise its Emissions Trading Act in 2012. After the period 2008 to 2012 Liechtenstein also participates from 2013 to 2020 in the EU ETS. In accordance with the new centralized allocation of the revised EU ETS scheme Liechtenstein submitted its so called “National Implementation Measures (NIM)” in 2011. The EFTA Surveillance Authority accepted Liechtenstein’s NIM’s in July 2013. Due to the new regulations only one of the two installations covered by the EU ETS will receive free European Union Allowances (EUA) until 2020.

As before the operators of both installations have to submit, by end of March of each period year, an amount of EUA’s that corresponds with the amount of CO_2 emitted the previous year. Therefore the emissions have to be monitored and verified according to Commission Regulation (EU) No. 601/2012.

With respect to the countries Kyoto-obligation the revised Emissions Trading Act for the first time established a concrete reduction target of at least 20% compared to 1990 levels. In addition to that a priority on national reduction measures before considering the Protocol’s flexible Mechanisms (CDM/JI/IET) was set. The concrete procedure has to be defined in a National Climate Protection Strategy which will be released in 2014.

CO_2 Act

With respect to Liechtenstein’s economy the CO_2-Act states the most comprehensive legislative measure. It envisages a contentious reduction of CO_2 emissions from the energy-related use of fossil energy sources until 2020. To achieve these reductions the CO_2 Act introduced a CO_2 levy on thermal fuels (oil, gas, coal) in 2008. The levy on fossil fuel consumption covers all the sectors of economy (except motor fuels such as petrol and diesel) as well as private households and is intended to promote the economical use of fossil fuels throughout Liechtenstein.

The Liechtenstein CO_2-Act is an integral part of the bilateral Agreement between the Principality of Liechtenstein and the Swiss Confederation on Environmental Levies within the Principality of Liechtenstein. Central elements of the levying system are executed by Swiss authorities, such as the levying through Swiss custom authorities or the granting of levy exemptions through the Swiss Federal Office of the Environment.

Due to a comprehensive revision of the Swiss CO_2-Act in 2011/2012 a respective adjustment within the Liechtenstein CO_2-Act became necessary and was introduced into national law in late 2013. The revision widened the scope and adjusted the incentive framework of the CO_2-Act.

To this respect the revised Act lead to:

- an increase of the CO_2 levy from 12 CHF per ton CO_2 (2008) to 36 CHF per ton CO_2 (2010) to 60 CHF per ton CO_2 (2014);
- an increased allocation of financial means towards environmental measures;
- the establishment of CO_2 emissions regulation for passenger cars (see 4.3.5); and
- the establishment of a compensation obligation for importers of motor fuels (see 4.3.5).

From 2014 on Liechtenstein will levy 60 CHF per ton CO_2, which corresponds to around 16 Rp per litre heating oil (until 2013 it was 36 CHF per ton CO_2 which corresponded to around 10 Rp per litre oil).

Around 2/3 of the levy revenues originating from the economy will be returned to the sector by granting subsidies to employers' obligations within the "Old Age and Survivors Insurance". 1/3 of the revenues are earmarked for environmental policy measures such as for example the feed-in tariffs for renewable energy production.

In addition and contrary to the CO_2 levy in Switzerland, the revenues originating from private households are not returned but will continue to be used for financing environmental measures. Besides the need for strong sources of financial means the decision to not reimburse the revenues levied from households was also taken on administrative grounds. An efficient reimbursement procedure is only possible by using subsidy grants within the compulsory health insurance (as it is the case in Switzerland). Since the health insurance system of Liechtenstein is already heavily subsided the originally intended steering effect would be too little to justify the respective bureaucratic efforts.

The approach of earmarking around 2/3 of the total CO_2 levy revenues from 2014 on for environmental purposes will strengthen the financial capabilities of the Government with respect to future measures within the national climate change framework.

Policies planned

In the course of 2015 the emissions regulation for passenger cars, established 2012 by the revised CO_2 Act will be adjusted in order to also cover light vehicles.

In 2014 the Government will also release a new National Climate Strategy which will substitute the Strategy from 2007.

Summary of policies and measures (N/A = not applicable)

Name of policy or measure[b]	Objective and/or activity affected	GHG affected	Type of instrument	Status[c]	Implementing entity or entities	Estimate of mitigation impact, by gas (for a particular year, not cumulative,in CO_2 eq.)[d]			
						2010	2015	2020	2030
Climate Protection Strategy	Definition of a clear and transparent strategy for climate policy in Liechtenstein with precise action fields and measures to fulfil the requirements of the 2nd commitment period of the Kyoto Protocol	all	Planning Measure	Implemented 2007 to be revised in 2014	Government of Liechtenstein	N/A	N/A	N/A	N/A
Environmental Protection Act	Legal basis for all regulations and ordinance, especially with respect to air pollution and waste treatment	all	Law	Implemented 2008	Office of Environment	N/A	N/A	N/A	N/A
Action Plan Air	Measure Plan according to air pollution control regulations within the Environmental Protection Act	All	Planning measure	In force since 2007	Office of Environment	N/A	N/A	N/A	N/A
Emissions regulations	Emissions regulations for stationary facilities (heating industry)	CO_2 , precursor gases	Law	Implemented 1987, Revised 1992 and 2005		N/A	N/A	N/A	N/A
Water Protection Act	Cap on maximum number of cattle per land area	CH_4, N_2O	Law	Implemented 2003	Office of Environment	N/A	N/A	N/A	N/A
Emissions Trading Act	Implementation of Directive 2003/87/EC, Directive 2004/101/EC and Directive 2009/20/EC	all	Law	Implemented 2008 and revised in 2012	Office of Environment	N/A	N/A	N/A	N/A
CO_2 Act	Implementation of ecological steering levy modelled by Switzerland, reduction of CO2 emissions from fossil fuels and inducement for an economical use of energy and renewable energies, Introduction of emissions regulations for new passenger cars, establishment of compensation requirements for emissions from mobile fuels	CO_2	Steering Levy, Law	Implemented 2008, revised in 2013	Office of Environment, Swiss Federal Office of the Environment	N/A	N/A	N/A	N/A
Steam Pipeline	Acquisition of Steam from waste incineration plant in neighbouring city of Buchs (Switzerland) in order to replace fossil fuels for manufacturing industry	CO_2	Infrastructure measure	In operation since 2009	Private	17.5* Gg CO_2	2.2* Gg CO_2	2.2* Gg CO_2	N/A
Deep Geothermal Energy	Use of geological heat from deep thermal aquifers for electric power and heating	CO_2	Planning measure	Geophysical investigation 2008 – 2010 analysis finalized 2011, evaluation of long-distance incineration plant Buchs to Schaan in process	Office of Environment				3.94 Gg CO_2 eq

Climate protection platform as part of the Environment Commission of the International Lake Constance Conference	Coordination, exchange of information	All	Data Collection	2005: Status Report on climate protection on Lake Constance with recommendations for activities 2005: Guidelines with practical examples 2007: Status Report on impact of climate change and potential adaptation strategies 2009: Status Report on renewable energies	Office of Environment	N/A	N/A	N/A	N/A
Elaboration of a hydro geological map as a basis for using near surface geothermal heat	Use of near surface geothermal energy for heating purposes	CO_2, precurs or gases	Data Collection	2005 Completion of Map, in force since March 2006, Revisions according to the state of knowledge		N/A	N/A	N/A	N/A

4.3.4 Energy policy

The commitment to saving energy was legally enshrined in the Energy Ordinance in 2008 and further consolidated in 2008. The focus is on the following elements:

- Target values for the insulation of buildings (heat insulation requirements), for devices such as heaters, air conditioners and ventilation systems and requirements for the maintenance of such devices. These measures are governed by the revised Construction Act and relevant ordinances.
- An Energy Commission advises the Government on energy policy and communicates its views on all fundamental questions of energy policy. The Energy Commission consists of experts from all relevant areas (architecture, energy industry, other industries, manufacturing and trades, administrative offices, environmental organizations).
- A Bureau of Energy Consumption and Conservation has been established within the Office of Economic Affairs. The Bureau advises municipalities and private parties on all areas of energy conservation, is responsible for the content and administration of subsidy applications, and elaborates and implements energy policy strategies. The Bureau provides information to the public through lectures, radio discussions, and personal talks.
- The promotion of energy conservation is a central concern of Liechtenstein's energy policy. Energy conservation in buildings is supported financially, especially with regard to renovation of old buildings, building services installations, block heating plants, and solar collectors.

The Energy Efficiency Act of 30. Mai 2008 and the relevant Ordinance of 30. Mai 2008 as well as the Energy Ordinance of 21. August 2007 on the Construction Act constitute the legal framework for the implementation of measures relating to buildings. A gratifying development is also that municipalities now supplement national Energy Conservation Act subsidies with their own funds. The Government intends to

promote the measures for implementing the objectives laid down in the energy strategy with financial resources and advice. The increase of energy efficiency and in particular the increased use of renewable energies are of central importance for the reduction of greenhouse gas emissions and accordingly for a long-term climate policy.

In 2012 the Government adopted ”The Energy Strategy 2020”. The strategy provides future-oriented impulses for the national energy policy. The focus areas of the concept are the promotion of efficient energy use, the use of renewable energies, and energy conservation. These goals correspond to the aims of the EU’s 20-20-20 climate package from 2008. Increase the share of renewable energy in total energy use from 8% to 20% by 2020. Increase the energy efficiency to 20% to stabilize the energy consumption on the level of 2008 by 2020 and 20% reduction of the CO_2 emission by 2020. The Energy Strategy 2020 also addressed the need to minimize adverse effects of its proposed measures as required by Art. 2 paragraph 3 of the Kyoto Protocol. The proposed set of measures has been checked against its compatibility with economic as well as social requirements.

In collaboration with the forestry sector, an increasing number of wood chip plants are used in public buildings to generate heat. The new Act and the Ordinance on the Liberalization of the Electricity Market provide mechanisms to support the conveyance of renewable energies. The Liechtenstein Power Authority also offers a "Green Electricity" label. All municipalities have received the “European energy award” by end of 2012.

The annual publication of Liechtenstein’s energy statistics, provided by the Office of Statistics, serves as a monitoring tool in order to evaluate the effect of the respective policies. Based on the Energy Strategy 2020 the Government has set up an administrative body that is responsible for the implementation and monitoring of measures set up by the Energy Strategy 2020. The detailed modalities and procedures that will lead the activities of that body are to be established in the course of 2014.

Policies implemented

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

- Renovation of old buildings:
  Many older buildings are insufficiently insulated against heat loss. Subsidies of up to 75,000 CHF may be granted for subsequent heat insulation.
- Promotion of the Minergie standard: The standard requires buildings to offer a high level of comfort, economic efficiently, and low energy consumption. Monitored ventilation systems also optimize air quality. In Liechtenstein, the standard is employed for all new administrative buildings.
- Residential technical installations:
  If the building shell already fulfills the requirements for modern insulation, then residential technical installations with low consumption or operating with renewable energy can further enhance conservation. State subsidies may be granted up to 20,000 CHF.
- Solar collectors:
  Thermal solar collectors can produce most of the warm water needed, thereby reducing heating oil and electricity consumption. The State subsidizes such collectors with a contribution of 350 CHF per square meter.
- Photovoltaic:
  Photovoltaic systems generating electricity are subsidized with a contribution of 650 CHF per installed output (kW). The maximum subsidy per system is CHF 200’000.-. The generated electricity can be fed into the public network. No price guarantee since 31.Mai 2013.
- Demonstration facilities:
  Liechtenstein law also provides for the promotion of demonstration facilities, with which public understanding of energy conservation is enhanced and the use of new technology and new technical possibilities is demonstrated.

- Finally, a hydrogeological map will be developed as a foundation for using near-surface geothermal energy for heating purposes.

In 2012, CHF 1’480’360 were contributed to the renovation of old buildings, CHF 587’282 to residential technical installations, CHF 414’688 to solar collector systems, CHF 3’054’522 to solar photovoltaic systems, CHF 620’767 to Minergie standard and CHF 443’985 to demonstration facilities. Almost all Liechtenstein municipalities provide additional funds to projects subsidized at the national level pursuant to the Energy Efficiency Act. In addition to these energy provisions, the Minergie standard is promoted and employed in public buildings. The reduction in heating energy consumption achieved by these measures entails that the relative share of energy consumption for heating water is rising. Covering this consumption through the use of solar energy is therefore becoming increasingly important.

Policies planned

From 2013 – 2014 the Energy Conservation Act will be reviewed and the majority of measures within the Energy Strategy 2020 shall be incorporated into the act.

Summary of policies and measures in energy sector (NO = not occurring, N/A = not applicable)

Name of policy or measure[b]	Objective and/or activity affected	GHG affected	Type of instrument	Status[c]	Implementing entity or entities	Estimate of mitigation impact, by gas (for a particular year, not cumulative,in CO_2 eq.)[d]			
						2010	2015	2020	2030
Energy Efficiency Act	Aims for the reduction of energy, the intelligent and economic use of energy as well as the promotion of renewable energies. Promotion of heat insulation (renovation of old buildings), residential technical installations (room heating and nonpotable water), solar energy (thermal solar collectors and photovoltaics) and demonstration facilities.	CO_2	Fiscal Measure (Subsidy)	Implemented 2008	Office of Economic Affairs	2.54 Gg CO_2 eq	2.89 Gg CO_2 eq	2.89 Gg CO_2 eq	-0.09 Gg CO_2 eq
Heated Regulations	Heated Outdoor areas and ramps, outdoor heating and warm air curtains, electric room heating and other stationary resistance heating of over 3KW are prohibited	CO_2	Law	Implemented 1993, Energy Ordinance, 2003	Building and Fire Authority	N/A	N/A	N/A	N/A
Heat insulation regulations	Buildings and installations must be planned as energy-efficient as possible (minimum insulation values), according to Ordinance / SIA Norm 380/1. If the building volume exceeds 2000 m3, the heating requirements may not exceed 80% of the SIA value.	CO_2	Regulation	Implemented 1993 New Energy Ordinance 2003	Building and Fire Authority	N/A	N/A	N/A	N/A
Minergy standard for State Buildings	Requirement that all new State buildings have to comply with the Minergy Standard; Energy savings of 30% per building	CO_2	Law	Implemented 2003	Building and Fire Authority	N/A	N/A	N/A	N/A
Supply requirements	Determination of energy supply areas with the aim to join a district heating network	CO_2	Planning measure			N/A	N/A	N/A	N/A
Liechtenstein Energy Strategy 2020	Governmental Strategy that ensures a sustainable energy supply	CO_2	Planning measure	Implemented 2012	Government of Liechtenstein / Office of Economic Affairs	NO	7.02 Gg CO_2 eq	6.89 Gg CO_2 eq	1.92 Gg CO_2 eq
Green electricity (LiStrom Öko)	Auditing (SQS) and certification of all domestic production sites according to “naturemade” product mixture of renewable energy sources (hydropower plant) and new renewable energy sources (photovoltaic systems)	CO_2	Promotion by Liechtenstein Power Authority (LPA)	Implemented 2004	LPA	N/A	N/A	N/A	N/A
Promotion of photovoltaic systems of private owner	Through the sale of green electricity, the LPA pays 80 cents / kWh for energy generated from photovoltaic systems certified as "naturemade star" from 2004-2009.	CO_2	Promotion by the LPA	Implemented 2004		N/A	N/A	N/A	N/A
Promotion of energy generated by systems for efficient	The conveyance price for the energy volume for own use may be waived in the case of production systems based on renewable energies or systems	CO_2	Electricity Market Act	Implemented 2002		N/A	N/A	N/A	N/A

energy production	for efficient energy use.								
Intelligent Energy Europe	Sustainable development in the field of energy, by making a balanced contribution to the attainment of the following general goals: energy supply security, competitiveness, and environmental protection.	CO_2	EU Program	Implemented 2003		N/A	N/A	N/A	N/A
Energy Star (labeling program for energy-saving office appliances)	The Energy Star label has already attained international significance. Appliances with the Energy Star label have a competitive advantage compared with non-labeled appliances. In a simple way, the label provides information to the consumer on the energy efficiency of the appliances. Reduction of CO_2 emissions by preventing unnecessary stand-by of electric appliances. Stand-by accounts for about 10% of energy use of appliances.	CO_2	Agreement between the US and the EU			N/A	N/A	N/A	N/A
Participation of municipalities in the Energy City label	Reduction of CO_2 emissions on the level of municipalities by increased use of renewable energies and high energy-efficient technologies for all premises. Since 2012 all 11 municipalities are certified with the Energy City Label.	CO_2, precursor gases	Labeling			N/A	N/A	N/A	N/A
Hydro Power	Extension of hydropower	CO_2	Planning measure	Planning phase for power plant Samina, Implemented in 2013	LPA	N/A	N/A	N/A	N/A

4.3.5 Transport policy

Transport policy in Liechtenstein takes into account the interests of society, the economy, and the environment. In 2008, a national transport policy (“Mobiles Liechtenstein 2015”) was approved by the Government, which includes a strategy for developing the transport sector in mid-term and long-tern. In this way, the Government has implemented or prepared a wide range of projects to promote public transportation and to reduce emissions arising from transport (expansion of the Liechtenstein Bus Authority, "Liechtenstein Takt" regional train schedule, preferential treatment of buses at traffic lights, subsidies of electric scooters and electric bicycles, tax exemptions for solar, hybrid, electronic, and natural gas vehicles, security measures along the way to school and in the area of pedestrian crossings, mobility campaigns and medium-term expansion of the railway offerings).

Goods transport policy also plays an important role. Liechtenstein introduced a Heavy Vehicle Fee, analogous to Switzerland. This fee is based on the polluter-pays-principle and is differentiated according to distance driven and the total weight of the vehicle. It increases productivity in road traffic, contributes to a large-scale shift of heavy goods traffic from road to rail, and in this way also eases the burden on roads in Liechtenstein.

Liechtenstein also supports the efforts of importers to reduce specific fuel consumption in accordance with Swiss rules, and Liechtenstein is also required to declare consumption in accordance with EU directives. Based on the data that has been collected so far, it now appears possible to undertake taxation of automobiles also with respect to specific CO_2 emissions. The Government is still examining this option.

Since emissions from **aviation** in Liechtenstein are of minor importance (with only 0.31% of national total, excl. LULUCF) no specific national policies exist to address these sources. The respective emissions stem from only one small heliport. **No** international **shipping** activities occur in Liechtenstein.

Policies implemented

Heavy Vehicle Fee

The Heavy Vehicle Fee was introduced on 1 January 2001 in parallel with Switzerland. It internalizes external costs. With the help of highly modern recording technology, the kilometers driven are measured. The fee applies to vehicles with a permissible total weight of 3.5 tons and above, and amounted to 1.6 cents per kilometer per ton of total weight in the first phase (2001 to 2005). In the second phase (since the beginning of 2005), the fee has been increased in multiple steps to 2.66 cents (at least 2.26 cents, at most 3.07 cents). It is graded according to emissions criteria (EURO norms). In this way, carriers are given an incentive to purchase the most modern vehicles and to use them efficiently and at full capacity. In addition, the measure increases the costs for goods transport on roads, which results in a movement of goods to the railways. One third of the revenue is earmarked for environment and transport issues. This amounts to approximately 3 million CHF.

Introduction of CO_2 emissions regulation for passenger cars

In 2012 Liechtenstein introduced CO_2 emissions regulations that apply to new passenger cars. The regulations were incorporated in the revised CO_2 Act in late 2013. Liechtenstein importers are required to reduce the level of CO_2 emissions from cars registered for the first time in Liechtenstein to an average of 130 grams per kilometre by 2015. If the CO_2 emissions per kilometre exceed the target level, a respective penalty applies.

Introduction of an obligation for importers of motor fuels to compensate the fuel-based emissions

According to the Swiss CO_2 Act producers and importers of fossil motor fuels are required to use domestic measures to compensate for 10% of the CO_2 emissions caused by the combustion of these fuels by 2020. The resulting surcharge required to finance respective compensations projects may not exceed 5 Rp. per liters. This framework basically also applies to importers of motor fuels in Liechtenstein. However, due to the high administrative workload such compensations system would cause for Liechtenstein authorities and the corresponding relatively low reduction potential of the country – in absolute terms – importers may pay the surcharge directly to the Government instead.

Promotion of green vehicles

Vehicles with environmentally friendly engines (solar, electric, and/or hybrid vehicles) are exempt from the motor vehicle tax. This relative discount creates greater incentives to purchase and use such vehicles.

As a member of the European Economic Area, Liechtenstein must also implement the EU regulations in this area. The focus is on the EURO norms (exhaust regulations) and on measures to promote energy-efficient vehicles, especially by introduction of a labeling system. The goal is to reduce CO_2 emissions, precursor substances and N_2O emissions.

Furthermore the Government considers a system of motor vehicle taxation which implements a bonus-malus system based on the energy efficiency and/or emissions of vehicles.

Promotion of public transport

Public transport enjoys a high priority in Liechtenstein. For this purpose, the public transport schedule has been significantly improved in recent years, especially in cross-border transport ("Liechtenstein Takt"). In 2006, a new public transport schedule was implemented, which entailed again significant improvements in frequency and attractiveness. In 2009 Liechtenstein, Austria and Austrian Railway signed a treaty to improve the railway infrastructure across Liechtenstein to establish a cross-border regional suburban train. At the moment the project is in its final planning phase and will be audited by the Office of Environment in the near future (2013/2014).

Summary of policies and measures in transport sector (N/A = not applicable)

Name of policy or measure[b]	Objective and/or activity affected	GHG affected	Type of instrument	Status[c]	Implementing entity or entities	Estimate of mitigation impact, by gas (for a particular year, not cumulative,in CO_2 eq.)[d]			
						2010	2015	2020	2030
Heavy Vehicle Fee	Relocation of goods transport from road to railways and reduction of transalpine road transport	CO_2 , Precursor gases	Fiscal measure	Implemented 2001	Finance Administration	N/A	N/A	N/A	N/A
Promotion of solar, electric, natural gas and/or hybrid vehicles	Vehicle tax waived for electric, natural gas and hybrid vehicles	CO_2 , Precursor gases	Fiscal Measure	Implemented 1999	Driver and Vehicle Licensing Office	N/A	N/A	N/A	N/A
Construction and operation of three public natural gas station	Infrastructure for providing fuel to private vehicles	CO_2	Investment measure, Infrastructure measure	Implented 2007, further evaluation in progress (2009)	Building and Fire Authority	N/A	N/A	N/A	N/A
Supply of Biogas into natural gas fueling station	Supply of CO_2-free fuel for the natural gas filing station	CO_2, precursors gases	Investment measures, Infrastructure measure	implemented in 2013	Building and Fire Authority, Bureau of Energy Consumption and Conservation; Office of Environment	N/A	N/A	N/A	N/A
ÂLPSTAR project: Promotion of public transport	Establishment of cooperative action of public transportation in Liechtenstein, Switzerland and Austria as well as private companies with a focus on daily commuters	CO_2, precursor gases	Institutional measures	Started in 2012	Office of Environment, Office of Civil Engineering	N/A	N/A	N/A	N/A
Exhaust regulations	Adoption of the European exhaust regulations (EURO norms) and fuel regulations, Continuous reduction of road traffic emissions	Precursor gases	Law	Implemented 1993	Driver and Vehicle Licensing Office	N/A	N/A	N/A	N/A
Promotion of slow transport	The bicycle and pedestrian network is being expanded continuously and made more attractive	CO_2, precursor gases	Institutional measures	Ongoing	Ministry of Transport and Telecommunications, Office of Civil Engineering	N/A	N/A	N/A	N/A
Zoning requirements	Limitation of the number of parking spaces for construction projects, where justified by municipal or national planning.	CO_2, precursor gases	Law	Implemented 2003	Building and Fire Authority	N/A	N/A	N/A	N/A
Internal Mobility Management for State Authority	Efficient and environmentally suitable improvement of traffic volume by increased usage of public transport and bicycle	CO_2, precursor gases	Institutional measure	Implemented 2008	Ministry of Transport and Telecommunications, Finance Administration	N/A	N/A	N/A	N/A
Promotion of public transport	Introduction of a extended regional train schedule by 2017	CO_2, precursor gases	Institutional measure, fiscal measure	Planning of the necessary railway infrastructure	Office of Civil Engineering	N/A	N/A	N/A	N/A

4.3.6 Agriculture

International challenges as well as the changing environment within agricultural policies require strong flexibility from Liechtenstein's farmers. The general demand for more efficient and sustainable farming

procedures is constantly growing. International liberalization of world markets has also led to certain deregulation measures in Liechtenstein. Besides that, the agricultural sector has to provide an increasing amount of services that are not remunerated by markets but required by public interests. The new Agricultural Law, adopted in 2008, addresses the above mentioned issues and promotes the trend toward greater ecological agriculture in Liechtenstein. In order to maintain soil fertility, the environmental impact is minimized by environmentally friendly forms of production, such as integrated production and organic farming. Landscape maintenance and conservation is also considered as a task of agriculture and its importance will continue to increase.

By means of the Agriculture Law Liechtenstein aims to promote environmental-friendly and animal-friendly agriculture as well as permanent pastures on swampy and mixed soils. In the case of wildflower meadows, the preservation of which is of particular interest to nature conservation, the demands on ecological cultivation are even higher. In parallel with Switzerland, the Ecological Performance Certificate was introduced for environmentally friendly cultivation and welfare oriented animal husbandry. All registered farms operated according to these principles. Direct payments are only paid if the cultivation corresponds to the provisions of the animal protection legislation and the environmental protection provisions. The use of agricultural aids (fertilizers, pesticides) is strictly regulated.

Since 2002, the promotion of farm animals consuming roughage is included in the Direct Payment System. Livestock has increased over the past five years, which can be explained with reference to structural changes and the switch to mother cow husbandry (Liechtenstein agriculture primarily relies on animal husbandry, which generates 70% of agricultural revenue.).

The Water Protection Act, which entered into force in 2003 and is comparable to the Swiss law, specifies the thresholds for animal husbandry per area unit.

With respect to the storage and distribution of manure, subsidies of open liquid manure containers have been abolished. As a temporal restricted measure (2006-2009) the Government subsidized flexible tube systems to distribute liquid manure.

Summary of policies and measures in Agriculture sector (N/A = not applicable)

Name of policy or measure[b]	Objective and/or activity affected	GHG affected	Type of instrument	Status[c]	Implementing entity or entities	Estimate of mitigation impact, by gas (for a particular year, not cumulative, in CO_2 eq.)[d]			
						2010	2015	2020	2030
Ecological equalization payments in agriculture	Product-independent contributions for conversions to ecological cultivation methods	CH_4, N_2O	Fiscal measure (direct payments)	Implemented 1996	Office of Environment	N/A	N/A	N/A	N/A
Preservation of soil for agricultural use	Agriculture: permanent protection of soil for agricultural use from misuse	CH_4, N_2O	Law	Implemented 1992	Office of Environment	N/A	N/A	N/A	N/A
Water Protection Act	Cap on maximum number of cattle per land area	CH_4, N_2O	Law	Implemented 2003	Office of Environment	N/A	N/A	N/A	N/A

4.3.7 Forestry

Covering an area of 6'900 ha (43% of the country's territory), forests play a significant role in Liechtenstein. For this reason, sustainability in forestry has been accorded great importance ever since the introduction of the Forestry Regulations in 1865. Important goals of the current Forestry Act (1991) include the qualitative and quantitative (prohibition of clearing) preservation of the forest stocks and the promotion of nature-friendly forest management. In addition to the Forestry Act, international agreements (such as the 1993 Helsinki Ministerial Conference on the Protection of Forests in Europe) provide the basis for modern forest management. The natural rejuvenation of forests with local tree species appropriate to the location, the promotion of graded forest stock structures, and the ecological improvement of the edges of forests are

examples of this. In general, the promotion of biological diversity in forests is becoming an increasingly important part of Liechtenstein forest management. Liechtenstein now maintains forest reserves to the extend 19% of the forest area (1'300 ha), where all forms of forestry activities are prohibited as well as special forest areas of about 560 ha (8%) to preserve old and traditional forms of forest management.

In June 2001, Liechtenstein published a National Forest Program. With the program, Liechtenstein reacted to international obligations to promote sustainable forest management. With a view to meeting sustainable development goals, the National Forest Program encompasses the following principles in particular: respect for national sovereignty and self-responsibility in the use of resources, compatibility with the domestic legal provisions, compliance with obligations arising from international conventions and agreements, establishment of partnerships and participation of all interested groups, use of a holistic approach to the preservation and cultivation of forests, and selection of a long-term and iterative planning, implementation, and monitoring process.

The entire Liechtenstein forest stock is certified according to the criteria of the Forest Stewardship Council (FSC, SGS-FM/COC-0764).

Summary of policies and measures in forestry sector (N/A = not applicable)

Name of policy or measure	**Objective and/or activity affected**	**GHG affected**	**Type of instrument**	**Status**[c]	**Implementing entity or entities**	**Estimate of mitigation impact, by gas (for a particular year, not cumulative,in CO_2 eq.)**[d]			
						2010	2015	2020	2030
Cultivation regulations in the Forestry Act	Sustainable cultivation of forests	CO_2 (sinks)	Law	Implemented 1991	Office of Environment	N/A	N/A	N/A	N/A
Ordinance on the Scope and benefits of compensation and financial aid in the framework of the Forestry Act	Performance target	CO_2 (sinks)	Law	Implemented 1995	Office of Environment	N/A	N/A	N/A	N/A
Ordinance on forest reserves and protected areas	Performance target	CO_2 (sinks)	Law	Implemented 2000	Office of Environment	N/A	N/A	N/A	N/A
Forest Inventory 1998 and National Forest Program (2002 – 2012)	Binding specifications for future use of forests; development of a Forest Inventory 2010	CO_2 (sinks)	Planning measures, Law	Implemented 2001	Office of Environment	N/A	N/A	N/A	N/A
FSC certification of the entire forest stock	Performance target	CO_2 (sinks)	Operational planning	Implemented 2001	Office of Environment	N/A	N/A	N/A	N/A

4.3.8 Waste Management

Policies implemented

In Liechtenstein the Ministry of Environment together with the Office of Environment is responsible for developing legislation and policies to ensure the recovery and environmentally sound disposal of waste, coordinating the planning of waste disposal facilities and for the implementation of the policy framework in close collaboration with the eleven communes. The basis for waste legislation in Liechtenstein is the Environmental Protection Act (2008), see also chapter 4.2.3.

Because of the customs union treaty with Switzerland the Swiss waste law is also applied in Liechtenstein and there is no custom control between Liechtenstein and Switzerland. The borders are controlled by Swiss authorities. The Swiss Federal Office for the Environment (FOEN) monitors the import, export and transit of wastes and hazardous wastes for Liechtenstein. Switzerland is a member of the OECD and the Basel Convention and therefore carries out these controls according to the OECD and the Basel Convention-Decisions. The authorities of Liechtenstein will be informed in every case and have the possibility to refuse unwanted exports, imports and transits of wastes under control.

Moreover the Ordinance on the Reduction of Risks relating to the Use of Certain Particularly Dangerous Substances, Preparations and Articles (Chemical Risk Reduction Ordinance, ORRChem) contains special regulations in terms of restrictions and bans of handling of chemicals of all sorts. It substitutes the old Ordinance on Dangerous Substances. Pursuant to the Customs Treaty, these new provisions are again applicable to Liechtenstein.

Registration, Evaluation, Authorization and restriction of Chemicals (REACH) is a European Union Regulation (2006). REACH addresses the production and use of chemical substances, and their potential impacts on both human health and the environment. It is the strictest law to date regulating chemical substances. REACH entered into force in 2008, with a phased implementation over the next decade**.**

The regulation and its related ordinances are also applicable in Liechtenstein.

Summary of policies and measures in waste management sector (N/A = not applicable)

Name of policy or measure[b]	**Objective and/or activity affected**	**GHG affected**	**Type of instrument**	**Status**[c]	**Implementing entity or entities**	**Estimate of mitigation impact, by gas (for a particular year, not cumulative,in CO_2 eq.)**[d]			
						2010	2015	2020	2030
Environmental Protection Act	Legal basis for all regulations and ordinance, especially with respect to air pollution and waste treatment	all	Law	Implemented 2008	Office of Environmental Protection	N/A	N/A	N/A	N/A
REACH	Manufacturers and importers are required to gather information on the properties of their chemical substances, which will allow their safe handling, and to register the information in a central database run by the European Chemicals Agency (ECHA)	all	Law	2007	Office of Environmental Protection	N/A	N/A	N/A	N/A
Technical ordinance on waste (TOW)	Interdiction of landfilling of combustible waste	CH_4, CO2	Law	implemented since 2000	Office of Environmental Protection	N/A	N/A	N/A	N/A

4.3.9 International cooperation

International cooperation is an important pillar of Liechtenstein's climate policy, given the small size of the country and its limited capacities. Liechtenstein ratified the Climate Convention on 22 June 1994 and the Kyoto Protocol on 3 December 2004, thereby taking on the obligation of reducing its greenhouse gas emissions during the period of 2008 – 2012 by 8% relative to 1990. In December 2012 the Government agreed to a 2nd commitment period under the Kyoto Protocol from 2013 2020. To this respect Liechtenstein will reduce its greenhouse gas emissions by at least 20% compared to 1990 until 2020.

Liechtenstein is also State party to several other environmental agreements. The following agreements more or less closely related to climate should be mentioned in this context:

- Vienna Convention for the Protection of the Ozone Layer;
- Montreal Protocol on Substances that Deplete the Ozone Layer;
- Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa;
- Convention on Environmental Impact Assessment in a Transboundary Context;
- Convention on the Protection of the Alps and its protocols on spatial planning and sustainable development, mountain farming, conservation of nature and landscape preservation, mountain forests, tourism, soil protection, energy, transport, and settlement of disputes;
- Member to the International Renewable Energy Agency (IRENA) since 2009.

Another climate related agreement is the Convention on Long-Range Transboundary Air Pollution. Liechtenstein has also ratified seven of the eight protocols, namely those concerning Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 percent, Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP), Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes, Further Reduction of Sulphur Emissions, Persistent Organic Pollutants (POPs), Heavy Metals and Control of Nitrogen Oxides or their Transboundary Fluxes. In 1999, Liechtenstein also signed the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone.

4.4 Policies and measures no longer in place

Until 2010 the Government supported private purchases of electric scooters and electric bicycles by up to 50% of the costs. This achieved an increased substitution of short automobile rides.

References

CO_2 Act 2013: Liechtenstein Law Gazette (814.065)

Emissions Trading Act (EHG), 2012: Liechtenstein Law Gazette (814.05)

Energy Efficiency Act, 2008; Liechtenstein Law Gazette (730.2)

Environmental Protection Act, 2008: Liechtenstein Law Gazette (814.01)

Forestry Act, 1991: Liechtenstein Law Gazette (921.0).

Government of the Principality of Liechtenstein, 2012: Energy Strategy 2020, http://www.regierung.li/fileadmin/dateien/downloads/Energiestrategie_Langfassung.pdfb

Government of the Principality of Liechtenstein, 2013: EU-ETS, National Implementation Measures 2013 – 2020

Government of the Principality of Liechtenstein, 2007: National Climate Protection Strategy, 2007, http://www.llv.li/pdf-llv-aus-nationale_klimaschutzstrategie_07.pdf

Government of the Principality of Liechtenstein, 2008: Opinion by the Government to the Parliament of the Principality of Liechtenstein on the Questions Arising during the First Reading of the Accomplishing a Law on Agriculture and Modifying other Laws.

Government of the Principality of Liechtenstein, 2008: Report of the Government to the Parliament of the Principality of Liechtenstein on the Accomplishment of a Law on Agriculture

Government of the Principality of Liechtenstein, 2009: The bilateral Agreement between the Principality of Liechtenstein and the Swiss Confederation on Environmental Levies within the Principality of Liechtenstein

Law on Agriculture, 2009: Liechtenstein Law Gazette (910.1)

Law on Compensation for Ecological and Animal-Friendly Practices in Agriculture (Compensation Act), 1996: Liechtenstein Law Gazette (910.2).

Law on Hardship Allowances for the Cultivation of the Mountain Regions and Alpine Slopes (Mountain Region and Alpine Slope Act), 1997: Liechtenstein Law Gazette (912.1).

Law on Income-supporting Direct Payments in Agriculture (Direct Payment Act), 1995: Liechtenstein Law Gazette (910.1).

Law on the Heavy Vehicle Fee (Heavy Vehicle Fee Act, HVFA), 2000: Liechtenstein Law Gazette (641.81).

Näscher, F., 2001: National Forest Program for the Liechtenstein Forests.

Office of Forests, Nature and Land Management, 2012: Liechtensteinisches Landeswaldinventar – Ergebnisse der dritten Erhebung 2010

Office of Statistics, 2012: Landwirtschaftsstatistik 2010

Office of Transport Coordination, 2001: Interim Report on the Overall Transport Strategy.

Ordinance on Air Pollution, 2008: Liechtenstein Law Gazette (813.301.1)

Ordinance on Energy, 2007: Liechtenstein Law Gazette (701.013)

Ordinance on forests reserves and protected areas, 2000, Liechtenstein Law Gazette (921.013)

Ordinance on Income-supporting Direct Payments (Direct Payment Ordinance), 1996: Liechtenstein Law Gazette (910.11).

Ordinance on the Mountain Region and Alpine Slope Act (Mountain Region and Alpine Slope Ordinance), 1998: Liechtenstein Law Gazette (912.11).

Ordinance on the Promotion of Energy Efficiency and Renewable Energy, 2008: Liechtenstein Law Gazette (730.21)

Ordinance on the Scope and Payment of Compensation and Financial Assistance in the Framework of the Forestry Act, 1995: Liechtenstein Law Gazette (921.012).

Peter, S., Hartmann, M., Weber, M., Lehmann, B. und Hediger, W. 2009: „THG 2020“ – Möglichkeiten und Grenzen zur Vermeidung landwirtschaftlicher Treibhausgase in der Schweiz. Schriftenreihe 2009/1 der Gruppe Agrar-, Lebensmittel und Umweltökonomie, ETH Zürich, Zürich.

5. Projections and the total effect of policies and measures

The structure of chapter 5 follows the annotated guidelines (UNFCCC, 1999): chapter 5.1 presents all projections from the scenarios WOM, WM, WAM. In chapter 5.2 they are further described on aggregated level for the scenario WM. Chapter 5.3 then refers to mechanisms under the articles 6, 12, 17 of the Kyoto Protocol.

5.1 Projections

5.1.1 Baseline scenario "Without Measures" (WOM)

A baseline scenario "Without Measures" (WOM) was already defined in Liechtenstein's 5th National Communication (OEP 2010). This scenario is also underlying Liechtenstein's Energy Strategy 2020 and its measures as outlined for the three energy scenarios (see chapter 5.1 of the Energy Strategy 2020). According to Liechtenstein's 5th National Communication, the WOM scenario predicts for Liechtenstein a total of greenhouse gas emissions of 262 Gg CO_2 equivalent by 2020. This would be more than 40% above the 184 Gg CO_2 equivalent as Liechtenstein aims at in the second commitment period (see also Figure 5-9).

5.1.2 Scenario "With Measures" (WM)

Legal basis

The legal basis for the scenario WM is described in chapter 4 on policies and measures. The following acts are directly impacting total greenhouse gas emissions in Liechtenstein:

- Environment: Environmental Protection Act
- Climate: Emissions Trading Act and the CO_2 Act
- Energy: Energy Efficiency Act
- Transport: HVF, promotion of public transport and green vehicles/fuels
- Forestry Act
- Waste: Environmental Protection Act, Technical ordinance on waste

Based on these acts a number of measures have already been or are currently planned to be implemented. This includes environmental levies, the package of energy related measures in the Energy Strategy 2020 and direct payments for agriculture. Further details are shown in subsequent sections (measures implemented and measures planned).

Quantification of the effects of measures by the Energy Strategy 2020

Note that the quantification of the impacts from measures in the Energy Strategy 2020 has not been performed for each greenhouse gas separately but for overall CO_2 equivalent. Respective factors within the Energy Strategy 2020 have been delineated for each fuel type (gas oil, natural gas, gasoline, diesel) in order to specify the total amounts of measures in CO_2 equivalent. The fuel-type-specific factors themselves have been weighted by its consumed amounts of fuel in order to realize a valid overall factor. This method had already been applied for the projections in Liechtenstein's 5th National Communication (see OEP 2008 and updated factors in OEP 2013).

As described in chapter 0 the projections of gas-specific emissions are based on a master projection (total greenhouse gas emissions in CO_2 equivalent, see chapter 5.2) from which the projections of the individual greenhouse gases such as CO_2, CH_4, N_2O and the F-Gases are calculated using individual scaling factors according to the shares given in Liechtenstein's greenhouse gas inventory 2011 (OEP 2013).

Effects of energy-related measures

In 2008, Liechtenstein introduced various measures to counter rising energy consumption under the Energy Efficiency Act (EEG 2008, see also Chapter 4.3.4). The most relevant measures in place are subsidies for the refurbishment of old buildings, solar collector systems and substitution of conventional heating to heat pumps and wood firing. In addition, municipalities in Liechtenstein individually complement these national measures. Further activities such as private energy savings initiatives (e.g. new heating) are not related to the EEG but also relevant for emission reductions.

Energy-related measures implemented in 2008–2011

Table 5-1 shows the expected reductions in CO_2 equivalent in 2012–2020 of the measures implemented between 2008 and 2011. The figures represent the cumulative effects of all policies and measures according to scenario 2 of the Energy Strategy 2020. Impacts can be expected in following sectors: 1A2 Manufacturing Industries and Construction and 1A4 Other Sectors and 1A1 Energy Industries.

For detailed information on the implemented measures see chapter 4.3.4 to 4.3.8.

Table 5-1 Cumulative emission reduction effect (in Gg CO_2eq) of implemented and adopted policies and measures according to the Energy Strategy 2020. The measure in sector 1A1 produces additional CO_2 equivalent and has therefore a negative prefix. Note that the numbers indicated in Table 5-1 are cumulative whereas the numbers in table "summary of policies and measures in the energy sector" in Chapter 4.3.4 hold for particular years (not cumulated).

Expected reductions according to implemented measures of the energy strategy 2020.
The amounts are cumulative between given years (2012-2015, 2016-2020, 2021-2025, 2026-2030).
in Gg CO_2 equivalent

		sector	measures	2012-2015	2016-2020	cumulative 2012-2020	2021-2025	2026-2030	cumulative 2021-2030	total
Measures implemented since 2008	*Energy Efficiency Act*	1A2/1A4	Renovation of old buildings	2.98	3.73	6.71	-	-	-	***6.71***
		1A2/1A4	Solar collectors	1.08	1.36	2.44	-	-	-	***2.44***
		1A2/1A4	Substitution to heat pumps	5.26	6.57	11.83	-	-	-	***11.83***
		1A2/1A4	Substitution to wood heatings	2.63	3.29	5.91	-	-	-	***5.91***
		1A1	Electricity generation with combined heat and power	-0.40	-0.50	-0.89	-0.50	-0.50	-0.99	***-1.88***
		Total		***11.55***	***14.44***	***25.99***	***-0.50***	***-0.50***	***-0.99***	***25.00***

In addition to the figures of Table 5-1, the measures implemented reduced the emissions between 2008 and 2011 approximately by 10.15 Gg CO_2 equivalent. Until 2020 measures will trigger additional emission reductions of about 26 Gg CO_2 equivalent. The reduction will mainly be achieved by substitution of old gas oil heaters with new heat pumps (11.8 Gg CO_2 equivalent) and wood firings (5.9 Gg CO_2 equivalent). Additionally, further reductions are expected due to refurbishment of buildings (6.7 Gg CO_2 equivalent) and the installation of solar collectors (2.4 Gg CO_2 equivalent). The in-country electricity production with combined heat power will reduce dependency of Liechtenstein from electricity imports. In turn, this will cause additional greenhouse gas emissions in the range of 0.99 Gg CO_2 equivalent.

The projections of the implemented measures in the sectors 1A2 (Energy Industry) and 1A4 (Energy Other Sectors) predict no additional reductions between 2020 - 2030. In total, the recently implemented measures will reduce greenhouse gas emissions by 25.0 Gg CO_2 equivalent between 2011 and 2030 (Table 5-1).

Note that the implementation of a steam pipeline between Switzerland and Liechtenstein in 2010 is not considered by the Energy Strategy 2020. In accordance with the Energy Strategy, the steam pipeline is thus not considered in projection scenario "With Measures". Through the acquisition of steam several Liechtenstein-based companies were able to substitute their corresponding oil and gas consumption. To this respect the steam pipeline achieves approximately 20 Gg CO_2 equivalent. It is expected that the steam pipeline will achieve further greenhouse gas reduction in the future.

Energy-related measures that are planned for implementation between 2012 and 2020

Between 2012 and 2020 further measures are planned to be implemented (see Table 5-2). These measures are needed in order to reach the target of the energy strategy scenario 2 (184 Gg CO_2 equivalent). Those measures further reduce total emissions of the sectors 1A2 Manufacturing Industries and Construction, 1A3 Transport and 1A4 Other Sectors approximately by 30.5 Gg CO_2 equivalent until 2020 and another 16.7 Gg CO_2 equivalent until 2030 (see also Energy Strategy 2020). The main reductions are expected to be achieved by: more electric vehicles, energy efficiency measures within industry and commerce, use of heat recovery in industry and development of heat districts, incentive systems for energy suppliers, rigid standard for new buildings, construction of a wood fired CHP plant in Balzers and geothermal energy used by households.

Table 5-2 Cumulative emission reduction effect (in Gg CO_2eq) of planned measures according to the Energy Strategy 2020. Note that the numbers indicated in Table 5-2 are cumulative whereas the numbers in table "summary of policies and measures in the energy sector" in Chapter 4.3.4 hold for particular years (not cumulated).

Expected reductions according to planned measures of the energy strategy 2020.
The amounts are cumulative between given years (2012-2015, 2016-2020, 2021-2025, 2026-2030).
in Gg CO_2 equivalent

		sector	measures	2012-2015	2016-2020	cumulative 2012-2020	2021-2025	2026-2030	cumulative 2021-2030	total
Projected measures	Measures according to the energy strategy 2020	1A4	New standards for new buildings	0.39	1.18	1.58	-	-	-	***1.58***
		1A3	Public transport	0.52	0.66	1.18	0.66	0.66	1.31	***2.49***
		1A3	Mobility management in companys	0.47	0.59	1.06	0.59	0.59	1.18	***2.24***
		1A3	Electric vehicles	1.46	4.39	5.85	6.15	8.07	14.22	***20.07***
		1A2	Use of all efficiency measures in industry and commerce	1.86	2.74	4.60	-	-	-	***4.60***
		1A2	Use of heat recovery in industry and development of heat distribution	0.88	1.10	1.97	-	-	-	***1.97***
		1A2	Incentive systems for energy supplier Industry	0.16	0.79	0.95	-	-	-	***0.95***
		1A4	Incentive systems for energy supplier Household	0.64	3.18	3.81	-	-	-	***3.81***
		1A2	Wood firing plant Malbun Industry	-	-	-	-	-	-	***-***
		1A4	Wood firing plant Malbun Household	1.10	-	1.10	-	-	-	***1.10***
		1A2	Wood firing plant Balzers Industry	2.19	-	2.19	-	-	-	***2.19***
		1A4	Wood firing plant Balzers Household	1.10	-	1.10	-	-	-	***1.10***
		1A2	Use of biogas in Industry	0.24	-	0.24	-	-	-	***0.24***
		1A4	Use of biogas in Houshold	0.96	-	0.96	-	-	-	***0.96***
		1A2	Geothermal energy use Industry	0.00	0.79	0.79	-	-	-	***0.79***
		1A4	Geothermal energy use Household	0.00	3.15	3.15	-	-	-	***3.15***
		Total		***11.97***	***18.57***	***30.53***	***7.39***	***9.31***	***16.71***	***47.24***

Already implemented (25.99 Gg CO_2 equivalent) and additional planned measures (30.53 Gg CO_2 equivalent) will reduce total emissions between 2012 and 2020 by 56.5 Gg CO_2 equivalent in total.

Considering all measures since 2008 (implemented 2008-2011 [10.15 Gg CO_2 equivalent], implemented 2012-2020 [25.99 Gg CO_2 equivalent] and planned measures 2012-2020 [30.53 Gg CO_2 equivalent]), they

would reduce greenhouse gas emissions in total by 66.7 Gg CO_2 equivalent. Nevertheless, the target of the Energy Strategy scenario 2 (total emissions of 184 Gg CO_2 equivalent) would be missed by about 12.3 Gg CO_2 equivalent (see Energy Strategy 2020).

For projections until 2030, the effects of the measures outlined in the Energy Strategy 2020 are assumed to continue steadily, except for source categories 1A2 (Energy Industry) and 1A4 (Energy Other Sectors) where no further reductions are expected. Respective figures are therefore linearly extrapolated or assumed as constant values. Note that within the Energy Strategy 2020 the maximum utilisation of existing potentials for each measure is assumed. Effects of measures which would reach their maximum theoretical potential before 2030 were trimmed towards less impact on the reductions, thus the maximum potential of all measures will only be reached in 2030.

Emissions in other energy-related source categories such as 1A5 Other (Off road) and 1B Fugitive Emissions were extrapolated linearly for the period 2012-2030 based on figures of the years 2008-2011.

Effect of non-energy related measure

Industrial Processes

The only greenhouse gas emissions from sector 2 Industrial Processes originate from F-gas use in the industry. The handling of F-gases has increased within the last years to 8.8 Gg CO_2 equivalent in 2011. The scenario WM follows Switzerland's projections of sector 2 Industrial processes emissions (see 5.3.2). Based on these projections, Liechtenstein's sector 2 emissions will slightly decrease by around 3% until 2020 compared to 2011 emissions. Until 2030, a further reduction towards 6.9 Gg CO_2 equivalent is expected.

Solvent and other Product Use

Emissions from Solvents and other Product use are projected analogously to trends in Switzerland's Solvent and other Product sector between 2012 and 2030 (see 5.3.2). Based on Switzerland's projections, Liechtenstein's sector 3 Solvents and Other Product Use emissions are expected to decrease by 0.04 Gg CO_2 equivalent between 2011 and 2020 and 0.17 Gg CO_2 equivalent between 2020 and 2030.

Agriculture

Emissions from sector Agriculture are also projected analogously to Switzerland's projection of sector 4 Agriculture (see 5.3.2). The emissions are expected to decrease by 1.27 Gg CO_2 equivalent till 2020. Afterwards total greenhouse gas emissions in CO_2 equivalent from sector 4 Agriculture are expected to remain constant.

LULUCF Forests and harvested wood products

Projections until 2020 and 2030 are based on extrapolations of data for the period 2008-2011 (see 5.3.2). It is expected that the LULUCFT sector remains a net CO_2 sink until 2030, however its sink potential is decreasing over time. In total the sink from this sector is projected to reduce overall emissions by 1.04 Gg CO_2 equivalent by 2020 and 1.14 Gg CO_2 equivalent by 2030.

Waste

Total emissions (in CO_2 equivalent) originating in the waste sector are projected according to Liechtenstein's development of waste production (see Liechtensteiner Abfallplanung 2012-2070). Total emissions (in CO_2 equivalent) are projected to increase by 0.55 Gg until 2020. According to the study a further increase of 0.41 Gg CO_2 equivalent is projected by 2030.

Projection of CO_2 emissions for the scenario WM

Figure 5-1 and Table 5-3 show the development of CO_2 emissions between 1990 and 2030. From 1990 to 2011 CO_2 emissions decreased by 9%. It is expected that CO_2 emissions increase slightly by 0.7 Gg until 2015 and then will decrease. The contribution of the respective sectors are described below (Projection of total GHG emissions in CO_2 equivalent, chapter 5.2). The scenario projects total emission levels of 158.23 Gg CO_2 by 2020 and 142.52 Gg CO_2 by 2030.

Table 5-3 CO2 emissions by sector from 1990 to 2030 for the scenario WM. The numbers 1990-2011 are taken from the inventory submitted in April 2013 (OEP 2013). The numbers 2015-2030 are projected.

	CO_2 in Gg										
				Inventories					**Projections**		
IPCC	**Source/Sink Categories**	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2015**	**2020**	**2025**	**2030**
Total	**Emissions without LULUCF WM**	**202.95**	**209.11**	**227.33**	**239.35**	**199.42**	**184.80**	**185.49**	**158.23**	**151.33**	**142.52**
1	**All Energy**	**201.45**	**207.90**	**226.39**	**238.56**	**198.67**	**184.04**	**184.74**	**157.49**	**150.65**	**141.90**
1A	Fuel Combustion	201.45	207.90	226.39	238.56	198.67	184.04	184.74	157.49	150.65	141.90
	1 Energy/Transformation	0.169	1.966	2.618	2.962	3.083	2.891	3.526	4.147	4.624	5.101
	2 Industry	35.23	34.26	34.24	36.09	22.33	19.31	18.28	15.44	15.44	15.44
	3 Transport	75.95	80.76	94.91	84.75	79.69	78.76	84.78	81.54	74.22	64.99
	4 Other Sectors	87.74	88.73	91.65	111.26	90.10	79.16	74.04	52.42	52.42	52.42
	5 Other (Off road)	2.36	2.19	2.97	3.50	3.47	3.92	4.11	3.95	3.95	3.95
1B	Fugitive Emissions	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
	1 Solid fuels	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
	2 Oil/Natural Gas	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
2	**Industrial Processes**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
3	**Solvent Use**	**1.48**	**1.18**	**0.91**	**0.75**	**0.72**	**0.73**	**0.72**	**0.70**	**0.64**	**0.57**
4	**Agriculture**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
5	**LULUCF**	**-9.48**	**-9.66**	**-8.61**	**-7.73**	**-7.16**	**-7.04**	**-6.58**	**-6.01**	**-5.43**	**-4.86**
6	**Waste**	**0.03**	**0.03**	**0.03**	**0.04**	**0.03**	**0.03**	**0.04**	**0.04**	**0.05**	**0.05**
1A3 ai	**International Bunkers**	**0.43**	**0.43**	**0.49**	**0.48**	**0.78**	**0.83**	**0.89**	**0.97**	**1.05**	**1.13**

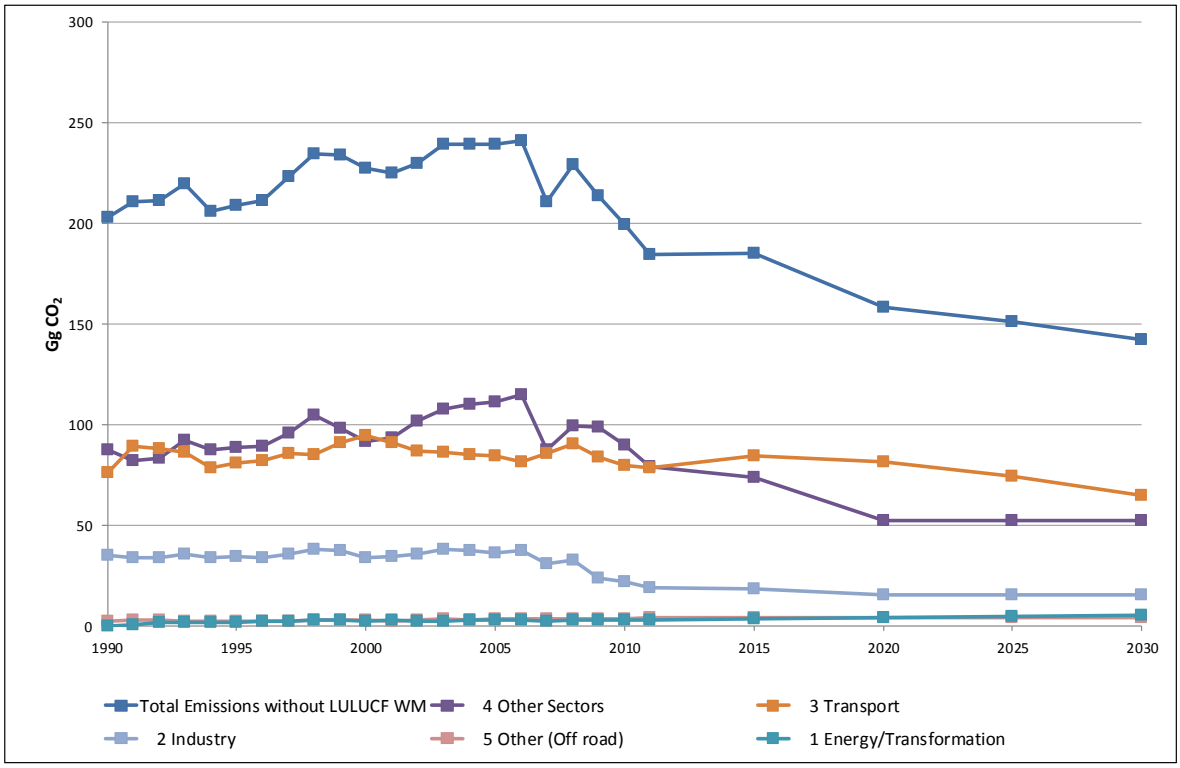

Figure 5-1 CO_2 emissions by sector (excl. LULUCF) from 1990 to 2030 for the scenario WM.

Projection of CH_4 emissions for the scenario WM

Figure 5-2 and Table 5-4 show the development of CH_4 emissions between 1990 and 2030. Between 1990 and 2011 CH_4 emissions decreased by 7%. The scenario predicts that CH_4 emissions will decrease slightly by 0.3 Gg (in CO_2 equivalent) by 2015 and will further decrease until 2030. Total emissions might reach levels of 14.53 Gg CH_4 (in CO_2 equivalent) by 2020 and 14.51 by 2030.

Table 5-4 CH_4 emissions by sector from 1990 to 2030 for the scenario WM. The numbers 1990-2011 are taken from the inventory submitted in April 2013 (OEP 2013). The numbers 2015-2030 are projected.

	CH_4 in Gg CO_2 equivalent										
		Inventories						Projections			
IPCC	**Source/Sink Categories**	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2015**	**2020**	**2025**	**2030**
Total	**Emissions without LULUCF WM**	**14.44**	**13.94**	**13.43**	**15.08**	**15.17**	**15.39**	**15.10**	**14.53**	**14.52**	**14.51**
1	**All Energy**	**1.34**	**1.59**	**1.85**	**2.31**	**2.12**	**1.99**	**1.90**	**1.62**	**1.53**	**1.44**
1A	Fuel Combustion	1.02	1.06	1.12	1.29	1.06	0.96	0.93	0.72	0.71	0.70
	1 Energy/Transformation	0.002	0.021	0.028	0.031	0.032	0.030	0.037	0.044	0.049	0.054
	2 Industry	0.05	0.05	0.05	0.05	0.03	0.03	0.02	0.02	0.02	0.02
	3 Transport	0.16	0.17	0.20	0.18	0.17	0.16	0.18	0.17	0.15	0.14
	4 Other Sectors	0.81	0.82	0.85	1.03	0.84	0.73	0.69	0.49	0.49	0.49
	5 Other (Off road)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1B	Fugitive Emissions	0.32	0.53	0.73	1.02	1.05	1.03	0.97	0.89	0.82	0.74
	1 Solid fuels	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
	2 Oil/Natural Gas	0.32	0.53	0.73	1.02	1.05	1.03	0.97	0.89	0.82	0.74
2	**Industrial Processes**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
3	**Solvent Use**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
4	**Agriculture**	**12.51**	**11.79**	**10.94**	**12.06**	**12.39**	**12.74**	**12.43**	**12.05**	**12.05**	**12.05**
5	**LULUCF**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
6	**Waste**	**0.59**	**0.56**	**0.64**	**0.71**	**0.66**	**0.66**	**0.77**	**0.86**	**0.94**	**1.02**
1A3 ai	**International Bunkers**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

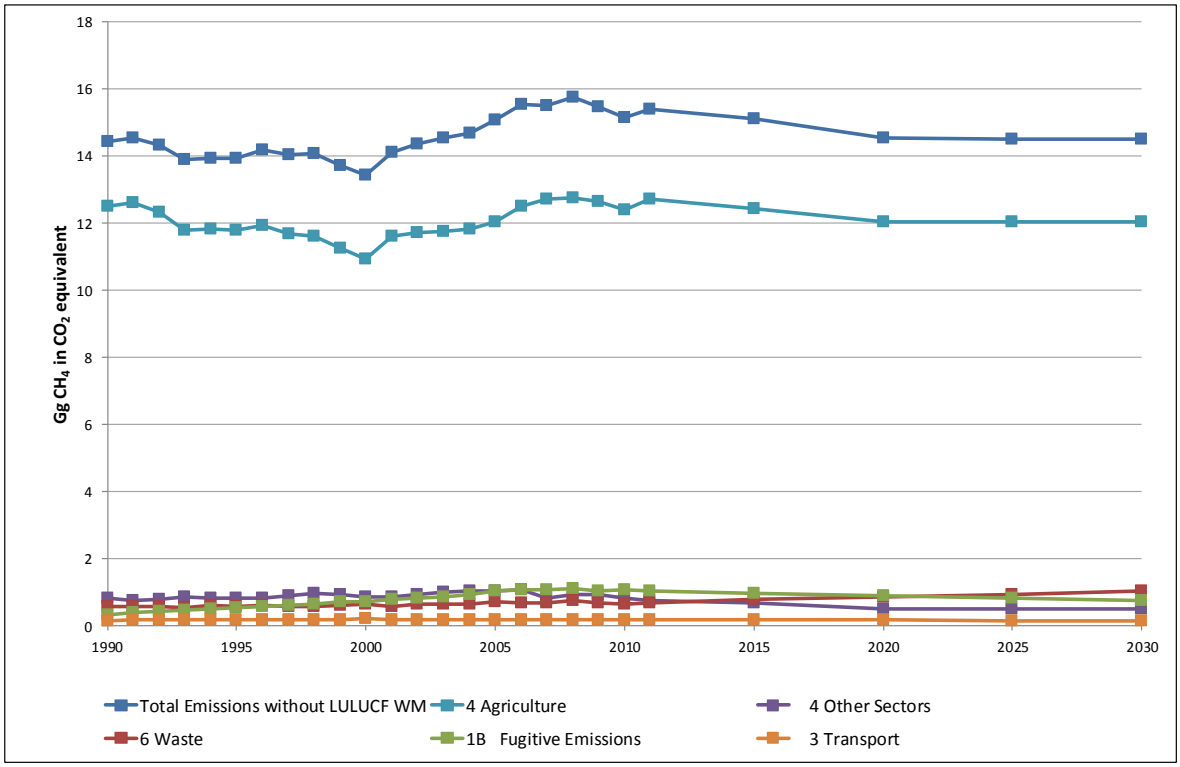

Figure 5-2 CH_4 emissions by sector (excl. LULUCF) from 1990 to 2030 for the scenario WM.

Projection of N_2O emissions for the scenario WM

Figure 5-3 and Table 5-5 show the development of N_2O emissions between 1990 and 2030. From 1990 to 2011 N_2O emissions decreased by 1%. It is expected that N_2O emissions remain on a level of approximately 13 Gg (in CO_2 equivalent) until 2015. Emissions then reach levels of 12.73 Gg N_2O (in CO_2 equivalent) by 2020 and 12.84 by 2030 respectively.

Table 5-5 N_2O emissions by sector from 1990 to 2030 for the scenario WM. The numbers 1990-2011 are taken from the inventory submitted in April 2013 (OEP 2013). The numbers 2015-2030 are projected.

	N_2O in Gg CO_2 equivalent										
		Inventories						Projections			
IPCC	Source/Sink Categories	1990	1995	2000	2005	2010	2011	2015	2020	2025	2030
Total	**Emissions without LULUCF WM**	**12.93**	**12.27**	**11.73**	**12.73**	**12.78**	**13.03**	**13.00**	**12.73**	**12.79**	**12.84**
1	**All Energy**	**0.99**	**1.08**	**1.22**	**1.23**	**1.10**	**1.05**	**1.09**	**1.00**	**0.96**	**0.90**
1A	Fuel Combustion	0.99	1.08	1.22	1.23	1.10	1.05	1.09	1.00	0.96	0.90
	1 Energy/Transformation	0.00	0.05	0.07	0.08	0.08	0.08	0.10	0.11	0.13	0.14
	2 Industry	0.05	0.05	0.05	0.05	0.03	0.03	0.03	0.02	0.02	0.02
	3 Transport	0.58	0.62	0.72	0.65	0.61	0.60	0.65	0.62	0.57	0.50
	4 Other Sectors	0.32	0.33	0.34	0.41	0.33	0.29	0.27	0.19	0.19	0.19
	5 Other (Off road)	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05
1B	Fugitive Emissions	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
	1 Solid fuels	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
	2 Oil/Natural Gas	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
2	**Industrial Processes**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
3	**Solvent Use**	**0.54**	**0.43**	**0.33**	**0.27**	**0.26**	**0.27**	**0.26**	**0.26**	**0.23**	**0.21**
4	**Agriculture**	**10.44**	**9.84**	**9.13**	**10.06**	**10.34**	**10.63**	**10.37**	**10.05**	**10.05**	**10.05**
5	**LULUCF**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
6	**Waste**	**0.96**	**0.93**	**1.05**	**1.16**	**1.08**	**1.09**	**1.27**	**1.42**	**1.55**	**1.67**
1A3 ai	**International Bunkers**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**

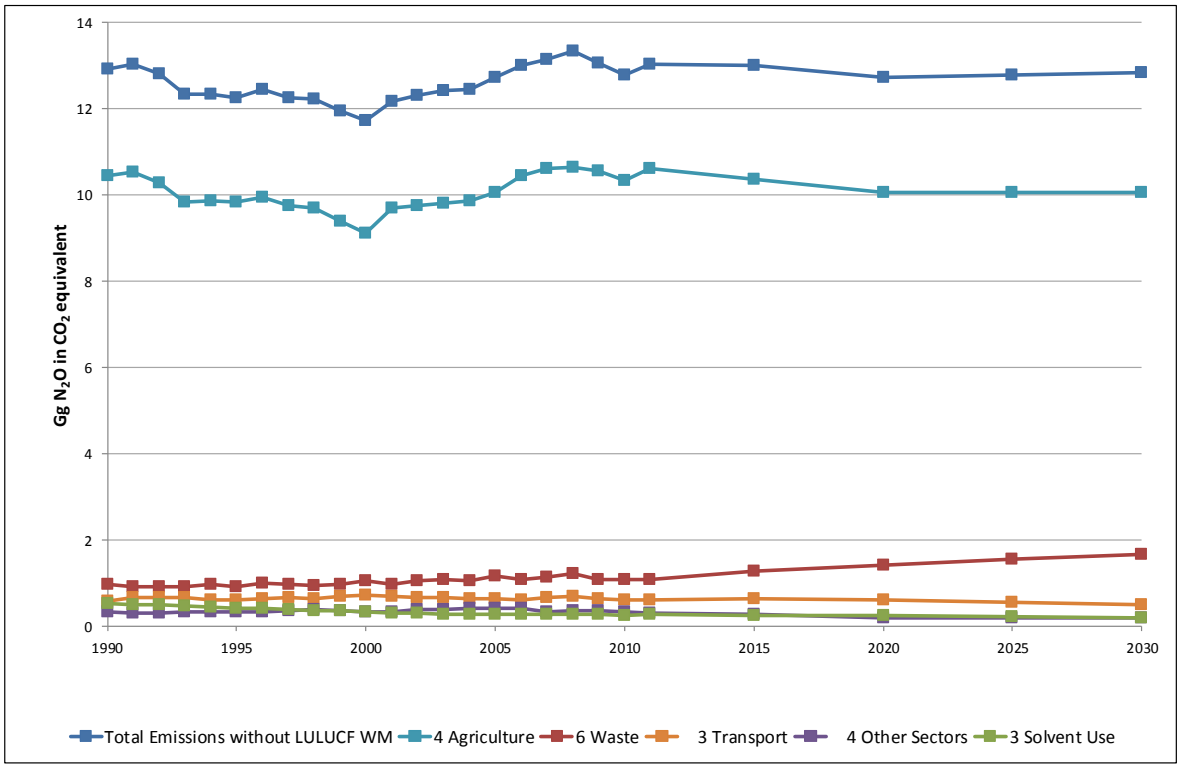

Figure 5-3 N_2O emissions by sector (excl. LULUCF) from 1990 to 2030 for the scenario WM.

Projection of Other GHG emissions (HFC's, PFC's, SF_6) for the scenario WM

Figure 5-4 and Table 5-6 show the development of F-gases between 1990 and 2030. From 1990 to 2011 emissions from F-Gases increased rapidly. However emissions should decrease to levels of 8.67 Gg (in CO_2 equivalent) until 2015. It is further projected that emission levels decrease to 8.49 Gg total HFC, PFC and SF_6 (in CO_2 equivalent) by 2020 and 6.93 Gg by 2030.

Table 5-6 HFC, PFC and SF_6 emissions by sector from 1990 to 2030 for the scenario WM. The numbers 1990-2011 are taken from the inventory submitted in April 2013 (OEP 2013). The numbers 2015-2030 are projected.

	HFC, PFC and SF_6 in Gg CO_2 equivalent										
				Inventories				**Projections**			
IPCC	**Source/Sink Categories**	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2015**	**2020**	**2025**	**2030**
Total	**Emissions without LULUCF WM**	**0.00**	**0.38**	**2.41**	**4.68**	**6.75**	**8.81**	**8.67**	**8.49**	**7.71**	**6.93**
2	**Industrial Processes**	**0.00**	**0.38**	**2.41**	**4.68**	**6.75**	**8.81**	**8.67**	**8.49**	**7.71**	**6.93**
2F	Halocarbons and SF_6	0.00	0.38	2.41	4.68	6.75	8.81	8.67	8.49	7.71	6.93
	HFC	0.00	0.38	2.39	4.63	6.68	8.73	8.59	8.41	7.64	6.86
	PFC	0.00	0.00	0.02	0.04	0.05	0.07	0.07	0.07	0.06	0.06
	SF_6	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01

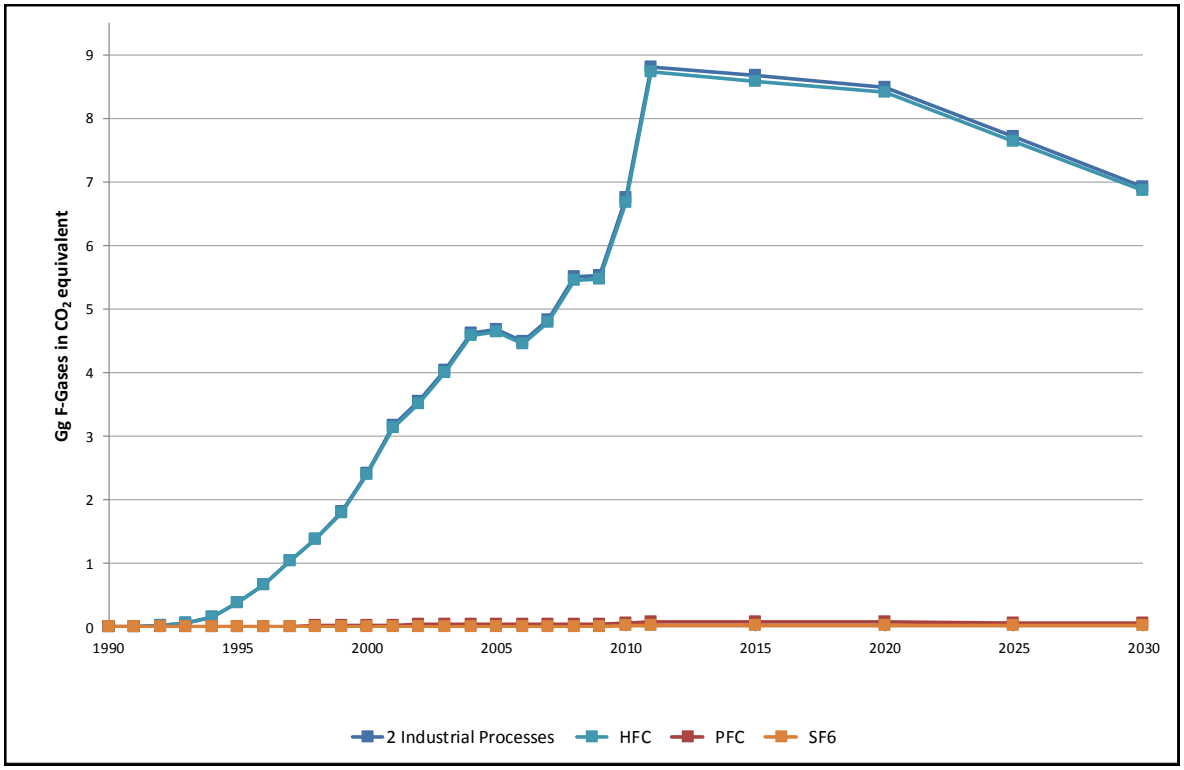

Figure 5-4 HFC, PFC and SF_6 emissions by sector (excl. LULUCF) from 1990 to 2030 for the scenario WM.

Precursors and SO_2

No projections for precursor gases and SO_2 are available for Liechtenstein.

5.1.3 Projections with additional measures (WAM)

According to the energy scenario 3 of the Energy Strategy 2020 (see chapter 5.3.1) a scenario "with additional measures" (WAM) was modeled. The scenario "with measures" (WM) (see 5.1.2) was used as basis for the "with additional measure" scenario. The numbers of the WM scenario were multiplied by a factor of 1.56, in consideration of the theoretical potentials of each individual measure, in order to fulfill the Energy Strategy 2020 scenario 3 targets for the scenario WAM.

Projection of CO_2 emissions for the scenario WAM

Figure 5-5 and Table 5-7 show the development of CO_2 emissions between 1990 and 2030 for the WAM scenario. The scenario projects total emission levels of 125.80 Gg CO_2 by 2020 and 110.49 Gg CO_2 by 2030.

Table 5-7 CO_2 emissions by sector from 1990 to 2030 for the scenario WAM. The numbers 1990-2011 are taken from the inventory submitted in April 2013 (OEP 2013). The numbers 2015-2030 are projected.

	CO_2 in Gg										
		Inventories						Projections			
IPCC	Source/Sink Categories	1990	1995	2000	2005	2010	2011	2015	2020	2025	2030
Total	Emissions without LULUCF WAM	202.95	209.11	227.33	239.35	199.42	184.80	173.36	125.80	118.05	110.49
1	All Energy	201.45	207.90	226.39	238.56	198.67	184.04	172.61	125.08	117.40	109.93
1A	Fuel Combustion	201.45	207.90	226.39	238.56	198.67	184.04	172.61	125.08	117.40	109.93
	1 Energy/Transformation	0.169	1.966	2.618	2.962	3.083	2.891	4.036	5.463	5.364	5.463
	2 Industry	35.23	34.26	34.24	36.09	22.33	19.31	16.57	10.71	10.71	10.71
	3 Transport	75.95	80.76	94.91	84.75	79.69	78.76	82.60	77.29	69.71	62.14
	4 Other Sectors	87.74	88.73	91.65	111.26	90.10	79.16	65.29	27.65	27.65	27.65
	5 Other (Off road)	2.36	2.19	2.97	3.50	3.47	3.92	4.12	3.96	3.96	3.96
1B	Fugitive Emissions	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
	1 Solid fuels	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
	2 Oil/Natural Gas	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
2	Industrial Processes	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3	Solvent Use	1.48	1.18	0.91	0.75	0.72	0.73	0.71	0.68	0.60	0.52
4	Agriculture	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	LULUCF	-9.48	-9.66	-8.61	-7.73	-7.16	-7.04	-6.58	-6.01	-5.43	-4.86
6	Waste	0.03	0.03	0.03	0.04	0.03	0.03	0.04	0.04	0.05	0.05
1A3 ai	International Bunkers	0.43	0.43	0.49	0.48	0.78	0.83	0.89	0.97	1.05	1.13

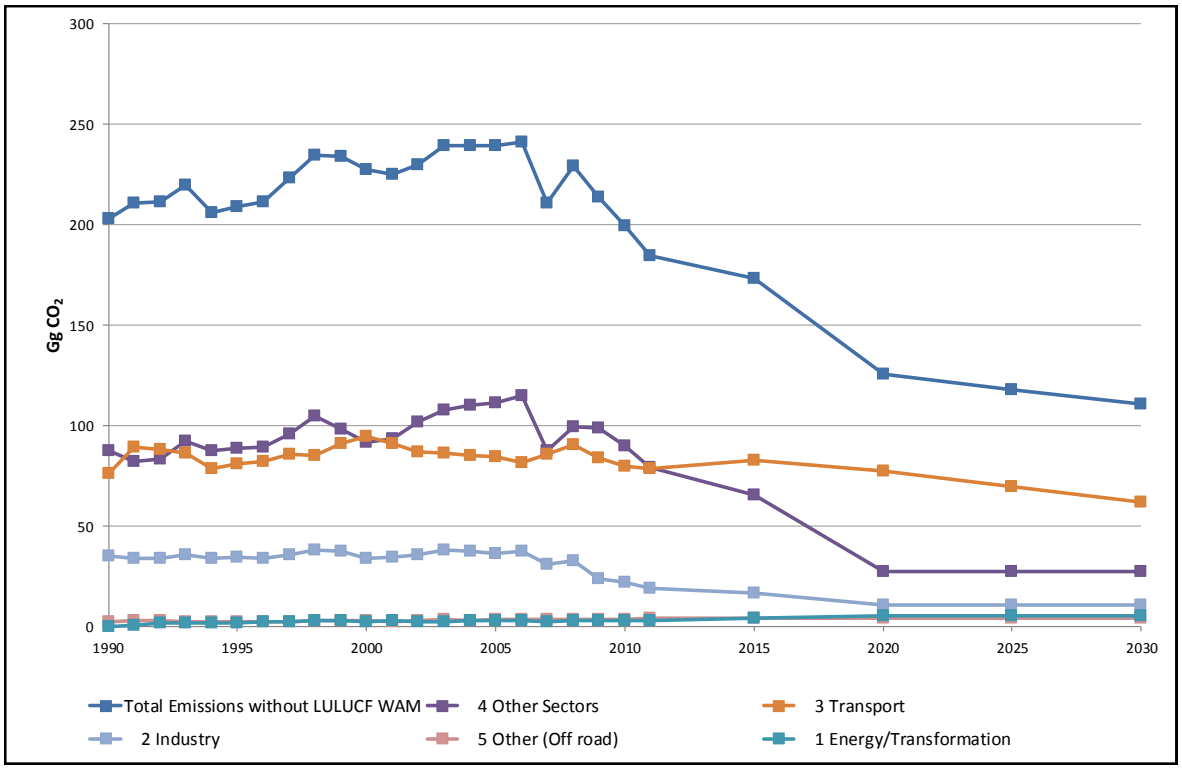

Figure 5-5 CO_2 emissions by sector (excl. LULUCF) from 1990 to 2030 for the scenario WAM.

Projection of CH_4 emissions for the scenario WAM

Figure 5-6 and Table 5-8 show the development of CH_4 emissions between 1990 and 2030 for the WAM scenario. Total emissions might reach levels of 14.30 Gg CH_4 (in CO_2 equivalent) by 2020 and 12.68 by 2030.

Table 5-8 CH_4 emissions by sector from 1990 to 2030 for the scenario WAM. The numbers 1990-2011 are taken from the inventory submitted in April 2013 (OEP 2013). The numbers 2015-2030 are projected.

	CH_4 in Gg CO_2 equivalent										
		Inventories						Projections			
IPCC	Source/Sink Categories	1990	1995	2000	2005	2010	2011	2015	2020	2025	2030
Total	**Emissions without LULUCF WAM**	**14.44**	**13.94**	**13.43**	**15.08**	**15.17**	**15.39**	**15.02**	**14.30**	**13.49**	**12.68**
1	**All Energy**	**1.34**	**1.59**	**1.85**	**2.31**	**2.12**	**1.99**	**1.81**	**1.39**	**1.29**	**1.20**
1A	Fuel Combustion	1.02	1.06	1.12	1.29	1.06	0.96	0.84	0.49	0.47	0.46
	1 Energy/Transformation	0.002	0.021	0.028	0.031	0.032	0.030	0.042	0.057	0.056	0.057
	2 Industry	0.05	0.05	0.05	0.05	0.03	0.03	0.02	0.01	0.01	0.01
	3 Transport	0.16	0.17	0.20	0.18	0.17	0.16	0.17	0.16	0.15	0.13
	4 Other Sectors	0.81	0.82	0.85	1.03	0.84	0.73	0.61	0.26	0.26	0.26
	5 Other (Off road)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1B	Fugitive Emissions	0.32	0.53	0.73	1.02	1.05	1.03	0.97	0.89	0.82	0.74
	1 Solid fuels	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
	2 Oil/Natural Gas	0.32	0.53	0.73	1.02	1.05	1.03	0.97	0.89	0.82	0.74
2	**Industrial Processes**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
3	**Solvent Use**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
4	**Agriculture**	**12.51**	**11.79**	**10.94**	**12.06**	**12.39**	**12.74**	**12.43**	**12.05**	**11.25**	**10.46**
5	**LULUCF**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
6	**Waste**	**0.59**	**0.56**	**0.64**	**0.71**	**0.66**	**0.66**	**0.77**	**0.86**	**0.94**	**1.02**
1A3 ai	**International Bunkers**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

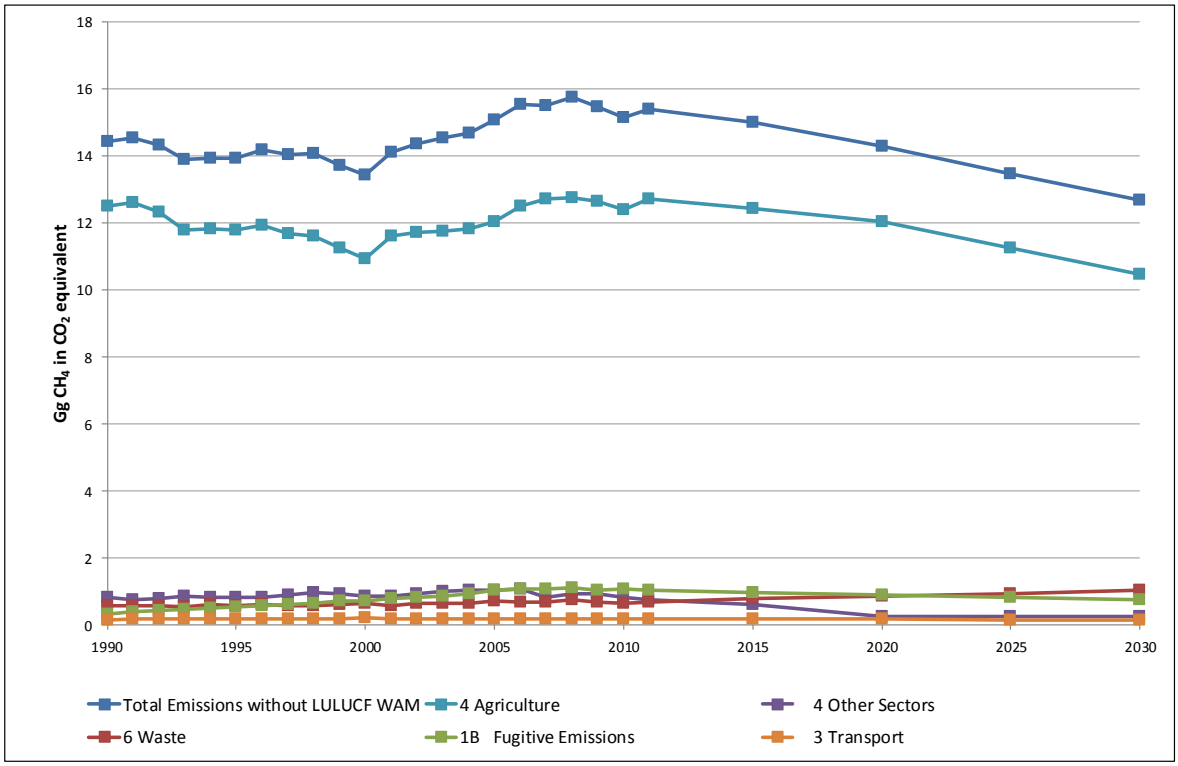

Figure 5-6 CH_4 emissions by sector (excl. LULUCF) from 1990 to 2030 for the scenario WAM.

Projection of N_2O emissions for the scenario WAM

Figure 5-7 and Table 5-9 show the development of N_2O emissions between 1990 and 2030 for the WAM scenario. Emissions are projected to reach levels of 12.63 Gg N_2O (in CO_2 equivalent) by 2020 and 11.38 by 2030 respectively.

Table 5-9 N_2O emissions by sector from 1990 to 2030 for the scenario WAM. The numbers 1990-2011 are taken from the inventory submitted in April 2013 (OEP 2013). The numbers 2015-2030 are projected.

	N_2O in Gg CO_2 equivalent										
		Inventories						Projections			
IPCC	Source/Sink Categories	1990	1995	2000	2005	2010	2011	2015	2020	2025	2030
Total	Emissions without LULUCF WAM	12.93	12.27	11.73	12.73	12.78	13.03	12.96	12.63	12.00	11.38
1	All Energy	0.99	1.08	1.22	1.23	1.10	1.05	1.06	0.90	0.84	0.79
1A	Fuel Combustion	0.99	1.08	1.22	1.23	1.10	1.05	1.06	0.90	0.84	0.79
	1 Energy/Transformation	0.00	0.05	0.07	0.08	0.08	0.08	0.11	0.15	0.15	0.15
	2 Industry	0.05	0.05	0.05	0.05	0.03	0.03	0.02	0.02	0.02	0.02
	3 Transport	0.58	0.62	0.72	0.65	0.61	0.60	0.63	0.59	0.53	0.47
	4 Other Sectors	0.32	0.33	0.34	0.41	0.33	0.29	0.24	0.10	0.10	0.10
	5 Other (Off road)	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05
1B	Fugitive Emissions	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
	1 Solid fuels	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
	2 Oil/Natural Gas	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
2	Industrial Processes	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3	Solvent Use	0.54	0.43	0.33	0.27	0.26	0.27	0.26	0.25	0.22	0.19
4	Agriculture	10.44	9.84	9.13	10.06	10.34	10.63	10.37	10.05	9.39	8.73
5	LULUCF	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01
6	Waste	0.96	0.93	1.05	1.16	1.08	1.09	1.27	1.42	1.55	1.67
1A3 ai	International Bunkers	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01

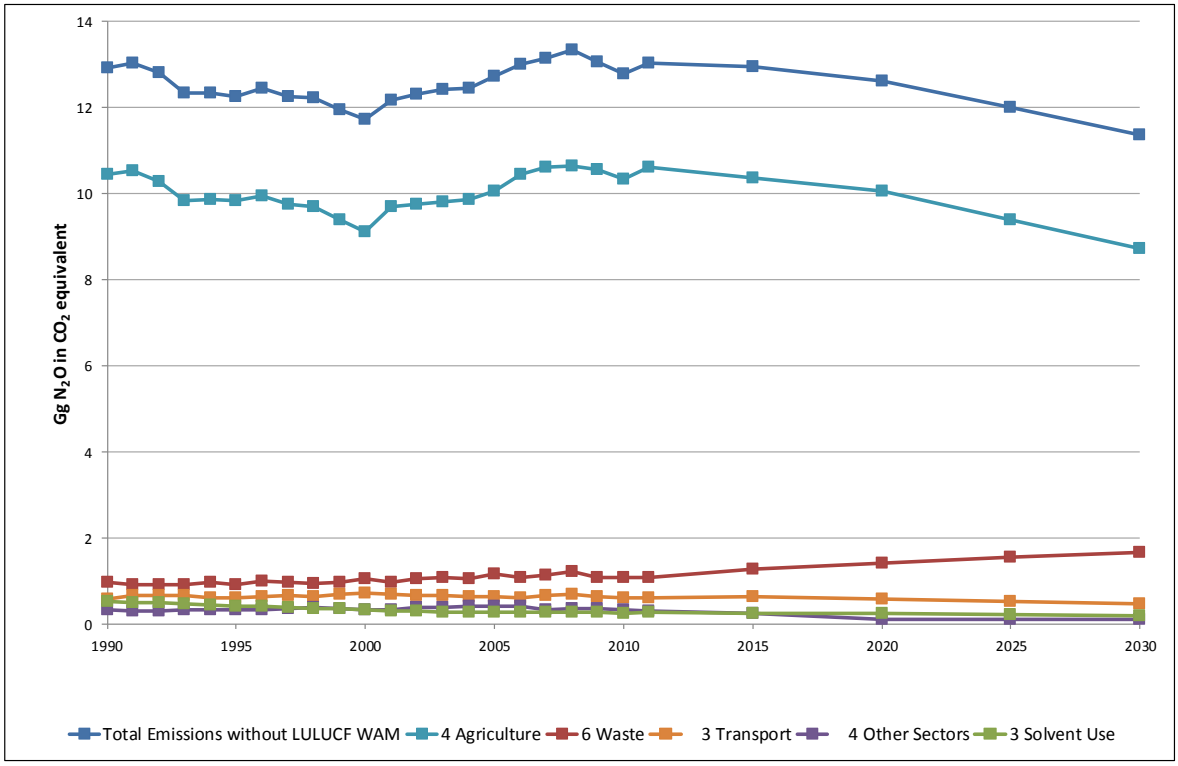

Figure 5-7 N_2O emissions by sector (excl. LULUCF) from 1990 to 2030 for the scenario WAM.

Projection of Other GHG emissions (HFC's, PFC's, SF_6) for the scenario WAM

Figure 5-8 and Table Table 5-10 show the development of F-gases between 1990 and 2030 for the WAM scenario. It is projected that emission levels decrease to 8.27 Gg total HFC, PFC and SF_6 (in CO_2 equivalent) by 2020 and 6.26 Gg by 2030.

Table 5-10 HFC, PFC and SF_6 emissions by sector from 1990 to 2030 for the scenario WAM. The numbers 1990-2011 are taken from the inventory submitted in April 2013 (OEP 2013). The numbers 2015-2030 are projected.

	HFC, PFC and SF_6 in Gg CO_2 equivalent										
					Inventories					Projections	
IPCC	**Source/Sink Categories**	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2015**	**2020**	**2025**	**2030**
Total	**Emissions without LULUCF WAM**	**0.00**	**0.38**	**2.41**	**4.68**	**6.75**	**8.81**	**8.57**	**8.27**	**7.27**	**6.26**
2	**Industrial Processes**	**0.00**	**0.38**	**2.41**	**4.68**	**6.75**	**8.81**	**8.57**	**8.27**	**7.27**	**6.26**
2F	Halocarbons and SF_6	0.00	0.38	2.41	4.68	6.75	8.81	8.57	8.27	7.27	6.26
	HFC	0.00	0.38	2.39	4.63	6.68	8.73	8.49	8.19	7.19	6.20
	PFC	0.00	0.00	0.02	0.04	0.05	0.07	0.07	0.07	0.06	0.05
	SF_6	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01

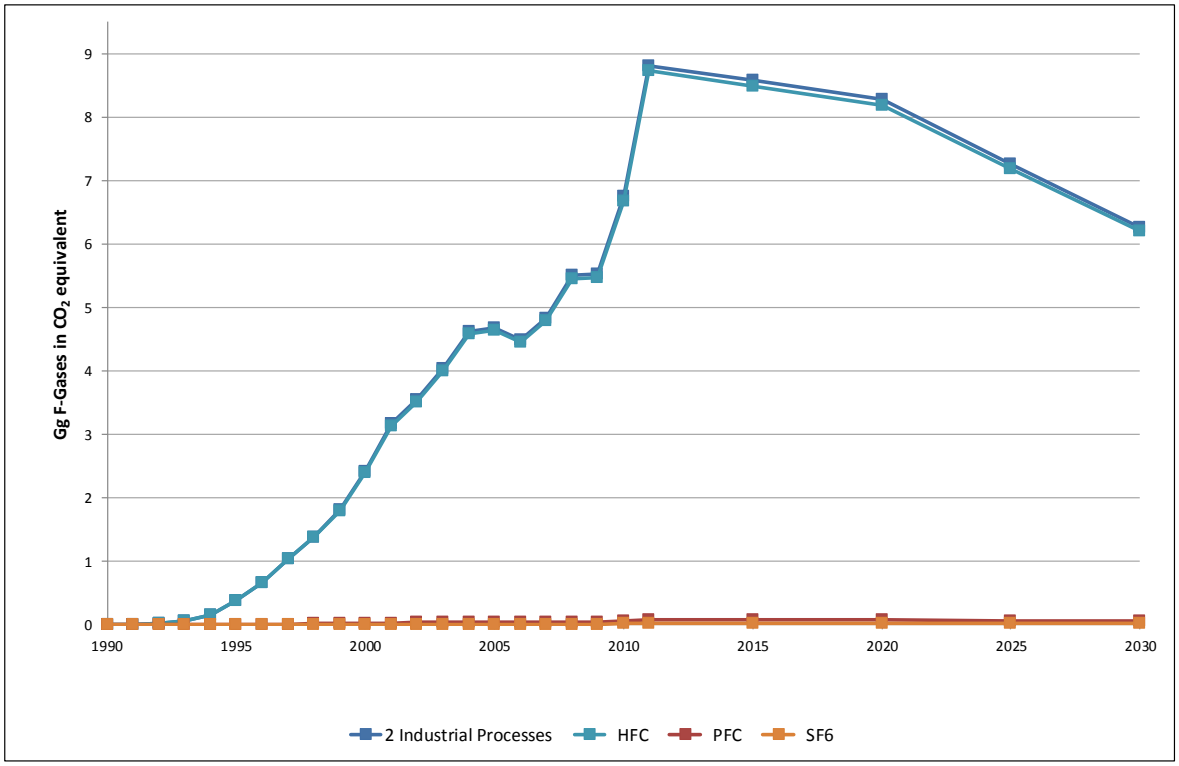

Figure 5-8 HFC, PFC and SF_6 emissions by sector (excl. LULUCF) from 1990 to 2030 for the scenario WAM.

Precursors and SO_2

No projections for precursor gases and SO_2 are available for Liechtenstein.

5.2 Aggregated projection

Projection of total GHG emissions in CO_2 equivalent for the scenarios WM and WOM

Figure 5-9 and Table 5-11 show the development of total GHG emissions in CO_2 equivalent between 1990 and 2030. From 1990 to 2011 total emissions decreased by 4%. It is expected that the total GHG emissions (in CO_2 equivalent) remain constant until approximately 2015 due to technical related reasons when combining inventory numbers with measures defined in the Energy Strategy 2020. After 2015 total GHG emissions start to decrease. Given the results from emission modeling for the period 2012-2020, Liechtenstein will not fully reach its emission target of total GHG emissions of 184 Gg CO_2 equivalent. The deviation from this target accounts for approximately 10 Gg CO_2 equivalent.

Table 5-11 Total GHG emissions in CO_2 equivalent by sector from 1990 to 2030 "with measures implemented". The numbers 1990-2011 are taken from the inventory submitted in April 2013 (OEP 2013). The numbers 2015-2030 are projected.

	CO_2 in Gg CO_2 equivalent										
		Inventories						Projections			
IPCC	**Source/Sink Categories**	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2015**	**2020**	**2025**	**2030**
Total	**Emissions without LULUCF WM**	**230.33**	**235.70**	**254.90**	**271.84**	**234.12**	**222.04**	**222.26**	**193.99**	**186.35**	**176.80**
1	**All Energy**	**203.78**	**210.56**	**229.46**	**242.11**	**201.89**	**187.08**	**187.73**	**160.11**	**153.13**	**144.24**
1A	Fuel Combustion	203.46	210.04	228.73	241.09	200.83	186.05	186.76	159.21	152.31	143.50
	1 Energy/Transformation	0.18	2.04	2.72	3.07	3.20	3.00	3.66	4.30	4.80	5.29
	2 Industry	35.33	34.35	34.34	36.20	22.39	19.36	18.33	15.48	15.48	15.48
	3 Transport	76.69	81.55	95.84	85.57	80.47	79.53	85.61	82.33	74.94	65.63
	4 Other Sectors	88.87	89.88	92.84	112.70	91.27	80.19	75.00	53.10	53.10	53.10
	5 Other (Off road)	2.39	2.22	3.00	3.54	3.51	3.97	4.16	4.00	4.00	4.00
1B	Fugitive Emissions	0.32	0.53	0.73	1.02	1.05	1.03	0.97	0.89	0.82	0.74
	1 Solid fuels	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
	2 Oil/Natural Gas	0.32	0.53	0.73	1.02	1.05	1.03	0.97	0.89	0.82	0.74
2	**Industrial Processes**	**0.00**	**0.38**	**2.41**	**4.68**	**6.75**	**8.81**	**8.67**	**8.49**	**7.71**	**6.93**
3	**Solvent Use**	**2.02**	**1.61**	**1.24**	**1.02**	**0.99**	**0.99**	**0.98**	**0.95**	**0.87**	**0.78**
4	**Agriculture**	**22.96**	**21.62**	**20.07**	**22.12**	**22.73**	**23.37**	**22.81**	**22.10**	**22.10**	**22.10**
5	**LULUCF**	**-9.46**	**-9.64**	**-8.59**	**-7.71**	**-7.14**	**-7.03**	**-6.57**	**-5.99**	**-5.42**	**-4.85**
6	**Waste**	**1.58**	**1.52**	**1.72**	**1.91**	**1.77**	**1.78**	**2.08**	**2.33**	**2.54**	**2.74**
1A3 ai	**International Bunkers**	**0.43**	**0.43**	**0.49**	**0.48**	**0.78**	**0.84**	**0.90**	**0.98**	**1.06**	**1.14**

Figure 5-9 illustrates the comparison of the two scenarios "with measures" (WM) and "without measures" (WOM). The WOM projection was defined in Liechtenstein's 5th National Communication (OEP 2010) and was adopted from there. The WOM scenario predicts total greenhouse gas emissions of 262 Gg CO_2 equivalent in 2020. It was assumed that greenhouse gas emissions remain constant between 2020 and 2030.

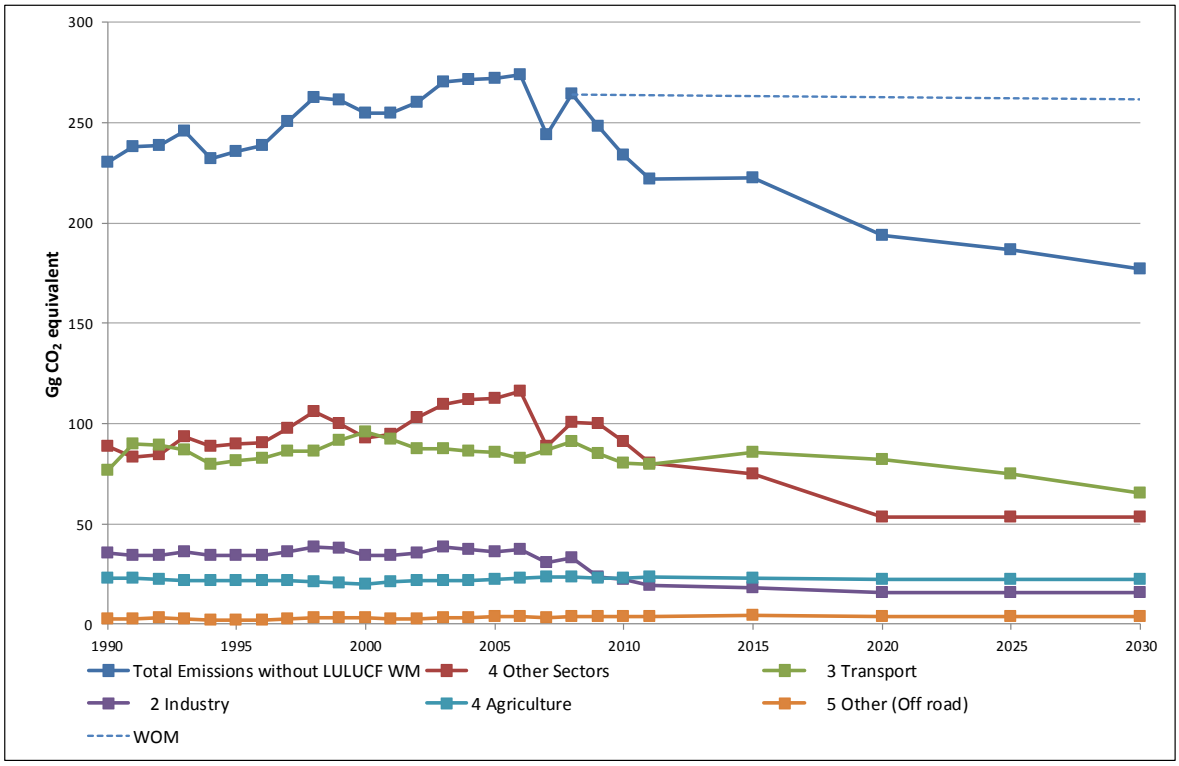

Figure 5-9 Total GHG emissions in CO_2 equivalent by sector (excl. LULUCF) from 1990 to 2030 "with measures implemented" (main sectors) and "without measures" (only total emissions). For the Energy sector only the two most relevant contributors to total emissions from this sector are displayed, namely 1A3 Transport and 1A4 Other Sectors.

Projection of total GHG emissions in CO_2 equivalent for the scenario WAM and WOM

Figure 5-10 and Table 5-12 show the development of total GHG emissions in CO_2 equivalent between 1990 and 2030 for the WAM scenario. Given the results from emission modeling for the year 2020, Liechtenstein will reach total GHG emissions of approximately 161.00 Gg CO_2 equivalent. The projected value for 2030 is 140.81 Gg CO_2 equivalent.

Table 5-12 Total GHG emissions in CO_2 equivalent by sector from 1990 to 2030 "with additional measures". The numbers 1990-2011 are taken from the inventory submitted in April 2013 (OEP 2013). The numbers 2015-2030 are projected.

	CO_2 in Gg CO_2 equivalent										
		Inventories						**Projections**			
IPCC	**Source/Sink Categories**	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2015**	**2020**	**2025**	**2030**
Total	**Emissions without LULUCF WAM**	**230.33**	**235.70**	**254.90**	**271.84**	**234.12**	**222.04**	**209.91**	**161.00**	**150.80**	**140.81**
1	**All Energy**	**203.78**	**210.56**	**229.46**	**242.11**	**201.89**	**187.08**	**175.48**	**127.37**	**119.54**	**111.92**
1A	Fuel Combustion	203.46	210.04	228.73	241.09	200.83	186.05	174.51	126.47	118.72	111.18
	1 Energy/Transformation	0.18	2.04	2.72	3.07	3.20	3.00	4.19	5.67	5.57	5.67
	2 Industry	35.33	34.35	34.34	36.20	22.39	19.36	16.61	10.74	10.74	10.74
	3 Transport	76.69	81.55	95.84	85.57	80.47	79.53	83.40	78.04	70.39	62.74
	4 Other Sectors	88.87	89.88	92.84	112.70	91.27	80.19	66.14	28.01	28.01	28.01
	5 Other (Off road)	2.39	2.22	3.00	3.54	3.51	3.97	4.17	4.01	4.01	4.01
1B	Fugitive Emissions	0.32	0.53	0.73	1.02	1.05	1.03	0.97	0.89	0.82	0.74
	1 Solid fuels	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
	2 Oil/Natural Gas	0.32	0.53	0.73	1.02	1.05	1.03	0.97	0.89	0.82	0.74
2	**Industrial Processes**	**0.00**	**0.38**	**2.41**	**4.68**	**6.75**	**8.81**	**8.57**	**8.27**	**7.27**	**6.26**
3	**Solvent Use**	**2.02**	**1.61**	**1.24**	**1.02**	**0.99**	**0.99**	**0.97**	**0.93**	**0.82**	**0.70**
4	**Agriculture**	**22.96**	**21.62**	**20.07**	**22.12**	**22.73**	**23.37**	**22.81**	**22.10**	**20.64**	**19.18**
5	**LULUCF**	**-9.46**	**-9.64**	**-8.59**	**-7.71**	**-7.14**	**-7.03**	**-6.57**	**-5.99**	**-5.42**	**-4.85**
6	**Waste**	**1.58**	**1.52**	**1.72**	**1.91**	**1.77**	**1.78**	**2.08**	**2.33**	**2.54**	**2.74**
1A3 ai	**International Bunkers**	**0.43**	**0.43**	**0.49**	**0.48**	**0.78**	**0.84**	**0.90**	**0.98**	**1.06**	**1.14**

Figure 5-10 illustrates the comparison of the two scenarios "with additional measures" (WAM) and "without measures" (WOM). The WOM projection was defined in Liechtenstein's 5th National Communication (OEP 2010) and was adopted from there. The WOM scenario predicts total greenhouse gas emissions of 262 Gg CO_2 equivalent in 2020. It was assumed that greenhouse gas emissions remain constant between 2020 and 2030.

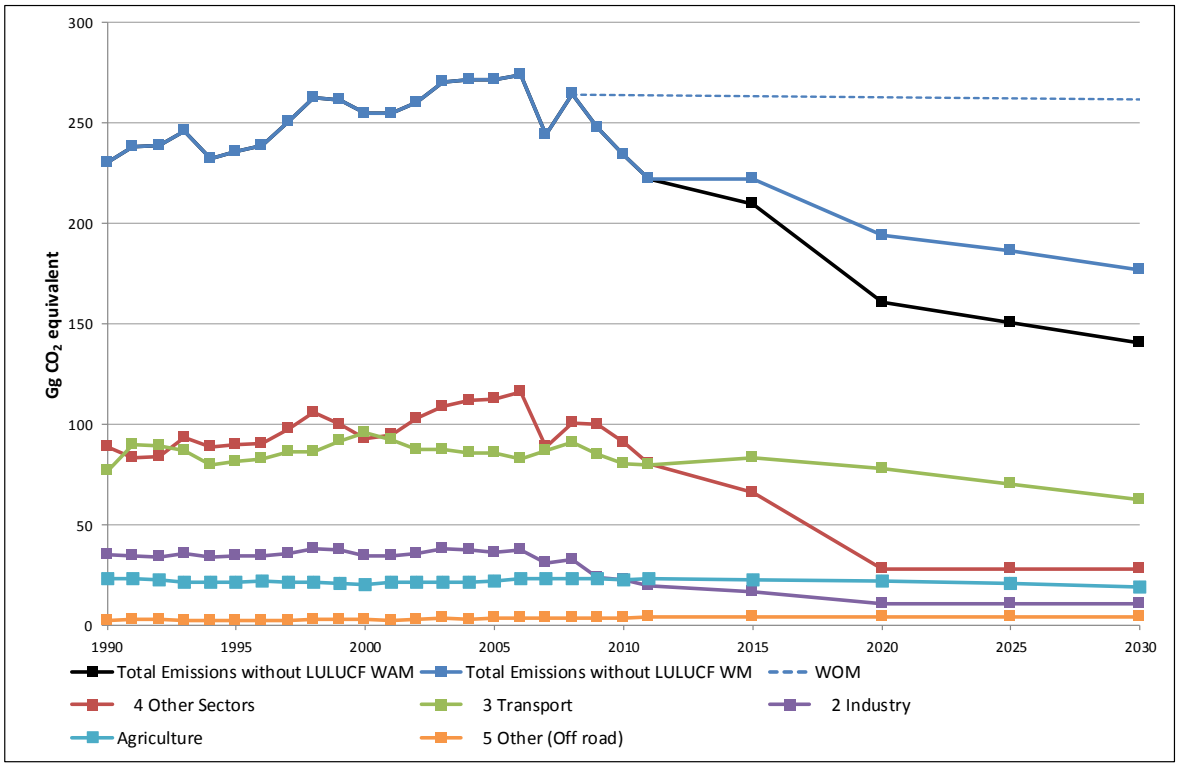

Figure 5-10 Total GHG emissions in CO_2 equivalent by sector (excl. LULUCF) from 1990 to 2030 "with additional measures" (main sectors), "without measures" and "with measures" (only total emissions).

5.3 Supplementary relating to mechanisms under Article 6, 12 and 17, of the Kyoto Protocol

First commitment period 2008-2012

In order to fulfill its obligation to lower GHG emissions 8 % below emissions of 1990 the government used the flexible mechanism of the Kyoto Protocol. To ensure that the use of flexible mechanisms is supplemental to domestic action, the Parliament has incorporated a respective regulation within the Emissions Trading Act in 2007.

The article ensured that the main focus of reduction measures is on domestic actions. Only if calculations reveal that the reduction potential of all possible domestic actions is not sufficient, with respect to the reduction obligation, the purchase of project-based reduction credits will be allowed.

Domestic actions are a crucial element of the efforts made to meet the quantified limitation and reduction commitments of Liechtenstein. These commitments have an important impact within several policy fields, such as energy, finance, transport, environment and forestry. For example, subsidies and taxes are or will soon be linked to CO_2 figures. The promotion of renewable energy or sustainable forestry management is a further example of existing domestic actions.

In this context and with respect to the administrative complexity as well as the financial means that are involved within domestic actions, the use of project based measures abroad are only considered as a supplemental climate policy aspect of Liechtenstein.

Relating to the first commitment period of the Kyoto Protocol the assigned amount of Liechtenstein was published in the Initial Report (OEP 2006a) and the Corrigendum to the Initial Report of 19 September 2007 (OEP 2007b). Under the Kyoto Protocol Liechtenstein's target for CO_2 eq. GHG emissions in the first commitment period (2008-2012) is 211.99 Gg CO_2 equivalent per year which is a reduction of 8% below 1990 levels (229.48 Gg CO_2 eq.). Liechtenstein decided not to account for Art. 3.4. of the Kyoto Protocol. In

2007 the government decided to make use of the flexible mechanism and purchased about 230 Gg CO_2 eq. within the period of 2008 – 2012. The respective investments helped to realize climate protection projects that show ecological benefits and social-ethical acceptability for the host country population. In order to ensure these quality standards, Liechtenstein's National Climate Protection Strategy focused at the acquisition of such emission reductions that are certified by additional quality labels (e.g. Gold Standard). The Strategy further excluded the purchase of Assigned Amount Units for the propose of Liechtenstein's Kyoto Compliance – unless a "Green Investment Scheme" has been defined by the respective host country. Emission reductions from HFC-23 and carbon capture storage projects will not be purchased.

The total greenhouse gas emissions of 2011 (see OEP 2011) show a 3.6 % decrease by 2011 compared to 1990 emissions (excluding LULUCF). This means that Liechtenstein's Kyoto target of the first commitment period will not be achieved by domestic action only.

Second commitment period 2013-2020

With respect to the second commitment period (2013-2020) Liechtenstein's target of total GHG emissions (in CO_2 equivalent) is 20% below 1990 levels (which corresponds to 184 Gg CO_2 eq in 2020).

Regarding the achievement of the abovementioned target, the priority remains on implementing domestic measures. The legal framework ensuring the focus on domestic reduction measures has been transferred into the new Emissions Trading Act in September 2012.

Article 4 paragraph 1 states:

"The emissions of GHG have to be reduced by 20 % compared to the year 1990 until 2020. In accordance with international obligations the Government may increase its reduction target by 40 %. The Government informs the Parliament about any increase of the target.

Article 4 paragraph 2 states:

"The reduction of GHG emissions shall be achieved through respective domestic measures, in particular through policy measures within the field of energy, transportation, environment, forestry, agriculture, economy and finance."

Article 4 paragraph 3 states:

"Only these GHG emissions which cannot be reduced by domestic measures, in order to fulfill the reduction obligation according to paragraph 1, may be reduced by using project based mechanisms abroad or international emissions trading."

Under current projections it seems – however – unlikely that Liechtenstein will achieve its reduction target within the second commitment period under the Kyoto Protocol solely by domestic measures. The projections of average annual emissions from 2013 to 2020 lead to a shortage of around 22'400 CO_2 eq. This number is based on annual emission estimates of 193.99 Gg CO_2.

Regarding to fill the gap, Liechtenstein envisages taking the option of continuing its engagement within the Kyoto Protocol's flexible mechanism. This engagement will be guided by the National Climate Strategy, which will be revised in the course of 2014. The Government will most likely keep the 2007 established focus on projects with high quality standards. With respect to the potential use of AAUs within the second commitment period, Liechtenstein declared 2012 during COP 18 in Doha, Qatar that it will "not acquire and use surplus assigned amount units carried over from the first commitment period to comply with its commitments in the second commitment period, except for any units that are associated with carry over in the European Emissions Trading Scheme (FCCC/KP/CMP/2012/L.9)." This declaration will also be considered during the consultation process regarding the revised National Climate Strategy in 2014.

Table 5-13 and Table 5-14 display the respective Kyoto targets, projected total emissions, the amount of Kyoto mechanisms intended to be used and the net GHG emissions in commitment period 2008-2012 and 2013-2020 respectively. However the two tables must not be compared since diverging underlying concepts for the Kyoto targets exist for the two commitment periods.

Table 5-13 Kyoto Target 2008-2012

Gross and net GHG emissions during the commitment periode 2008-2012	
Kyoto protocol emissions (Gg CO_2 eq.)	
Kyoto target (assigned amount units per year, average 2008-2012)	211.99
Total projected gross GHG emissions WM (projection for 2010)	232.05
Use of Kyoto mechanisms (CDM), annually	46
Net GHG emissions	186.05

Table 5-14 Kyoto Target 2013-2020

Gross and net GHG emissions during the commitment periode 2013-2020	
Kyoto protocol emissions (Gg CO_2 eq.)	
Kyoto target 2020 (-20% to 1990 levels (as of submission 2013))	184.26
Total projected gross GHG emissions WM (projection for 2020)	193.99
Use of Kyoto mechanisms (CDM), annually	22
Net GHG emissions	171.58

Methodology for GHG emission projections

The starting point for Liechtenstein's projections is the Energy Strategy 2020. The strategy describes three different energy scenarios until 2020. Two of them have been used in order to define Liechtenstein's emission scenarios "with measures" and "with additional measures" within the energy-related sectors (see 5.3.1). For non-energy related sectors other studies and methods have been used (5.3.2).

5.3.1 Emissions from energy related sectors

The energy scenarios are provided by Liechtenstein's Energy Strategy 2020. The strategy outlines three scenarios until 2020:

Scenario 1 assumes a "Business as Usual" proceeding, where already implemented measures induced to the Energy Efficiency Act (EEG 2008) would be continued. No further adaptation of the measures or even additional measures would be conducted. Existing subsidies by the government would be continued. The authors of the Energy Strategy 2020 assume that the -20% target according to Liechtenstein's 2nd commitment period (see 4.3.9) will not be reached under the energy scenario 1.

Scenario 2 is characterized by stabilization of the energy consumption, enhancement of renewable energy sources and reduction of the CO_2 emissions. With this scenario Liechtenstein achieves its greenhouse gas target 2020 (-20% below 1990's greenhouse gas emissions) in the second commitment period. In addition, renewable energy production within Liechtenstein is expected to rise towards a share of 20%. Table 5-15 provides an overview of the energy demand, the share of renewable energies and the greenhouse gas emissions 2020 in comparison with the 2008 figures.

According to scenario 2, a package of additional measures, implemented stepwise by 2020, was defined by the Energy Strategy 2020 in order to reach the -20% greenhouse gas emission target of the second commitment period. Those new measures will be implemented additionally to the measures in force since 2008 as induced by the Energy Efficiency Act (EEG 2008). However, the Scenario 2 target (See Table 5-15) will probably not be accomplished without introducing those new additional measures within the next few years.

Table 5-15 Target values according to the scenario 2 of Liechtenstein's Energy Strategy 2020.

	2008	**2020**
Energy demand	1390 GWh	1390 GWh (+/-0%)
Share of renewable and domestic energy sources	8.2%	20%
Greenhouse gas emissions	263 Gg CO_2eq	184 Gg CO_2eq

Scenario 3 is more ambitious than scenario 1 and 2. The aim in scenario 3 is that energy supply in Liechtenstein is as independent as possible. Total energy consumption should be decreased by 20% compared to 1990 levels. The share of renewable energies should increase to 40% until 2020. Greenhouse gas emissions should decrease by 30% to 161 Gg CO_2 equivalent compared to 1990 emissions. This target contains the aim of Liechtenstein's government to reduce the greenhouse gas emissions by -30% (compared to 1990) if other developed and emerging economics would define similar targets. This target can only be fulfilled by using all possible potentials to reduce greenhouse gas emissions. Thereby, all potential additional measures must be implemented. Table 5-16 illustrates the potential changes of the energy demand, shares of the renewable domestic energy production and the CO_2 equivalent target by 2020.

Table 5-16 Target values according to the scenario 3 of Liechtenstein's Energy Strategy 2020.

	2008	**2020**
Energy demand	1390 GWh	1112 GWh (-20%)
Share of renewable and domestic energy sources	8.2%	40%
Greenhouse gas emissions	263 Gg CO_2 eq	161 Gg CO_2 eq

Liechtenstein decided to follow the outlined framework of scenario 2 (see above). **Therefore, energy scenario 2 forms the bottom line for the projection "with measures" (WM). Liechtenstein's energy scenario 3 (in accordance to the Energy Strategy 2020) is the basis of the projected scenario "with additional measures" (WAM).**

Specific measures defined by the Energy Strategy 2020 are described and explained in detail in the context of the projection "with measures" (WM) in chapter 5.1.2.

Extrapolation of measures defined by the Energy Strategy 2020 for projections 2030

In order to project the emissions until 2030, effects of some of the measures defined in the Energy Strategy 2020 were extrapolated until 2030. In these cases it was considered that the theoretical reduction potential will not be exceeded before 2030 and therefore, measures were trimmed towards less impact on the reductions, thus the maximum potential of all measures will only be reached in 2030. Please note that no emission reductions from wood heating plants, use of biogas in households and geothermal energy were considered for the period 2020-2030, due to missing knowledge about the potential emission reductions and the potential uncertainty involved when implementing those measures. The measures of the source categories 1A2 (Energy Industries) and 1A4 (Energy Other Sectors) were not extrapolated beyond 2020 due to compensating effects of the economic growth and expected lower substitution rates of wood heating. The total emissions within these sectors are therefore assumed as constant between 2020 and 2030.

5.3.2 Emissions from non-energy related sectors

Industrial Processes

No bottom-up modeling of F-gases exists for Liechtenstein. The emissions of F-gases reported to the UNFCCC have so far been modeled by using adequate rules of proportion applied to Switzerland's F-gas emissions. Therefore, Liechtenstein's projections for 2020 and 2030 follow the development of Switzerland's emissions of F-gases (see FOEN 2014). By doing so, total emissions in CO_2 equivalent are expected to decrease by 4% until 2020 and another 18% between 2020 and 2030, mainly based on a gradual replacement of fluorinated refrigerants.

Solvent and other Product Use

The method for estimating the emissions of F-gases are also adopted for the modeling of the emissions from the sector Solvents and other Product Use. This means, they are projected proportionally to Switzerland's emissions from Solvent and other Product Use 2012-2030. According to the WEM scenario of Switzerland's sixth national communication (see FOEN 2014), a reduction of 4% is expected until 2020 and another 18% until 2030.

Agriculture

There are no country-specific projections for GHG emissions of the agricultural sector in Liechtenstein. No further measures other than the ones mentioned in Chapter 4.3.6 are planned. They are in-line with measures envisaged by Switzerland. Therefore, the emissions are also projected analogously to Switzerland's projections for sector 4 Agriculture. According to the WEM scenario of Switzerland's sixth national communication (see FOEN 2014), a reduction of 5% is expected until 2020. Afterwards the emissions in CO_2 equivalent remain constant. The main reasons are declining animal populations, change in crop cultures and decreasing use of fertilizers.

LULUCF Forests and harvested wood products

Projections until 2020 and 2030 are based on extrapolation of the data of the period 2008-2011. Therefore, the LULUCF sector remains a sink but the reduction rate per year is decreasing.

Waste

Total emissions (in CO_2 equivalent) from the waste sector are projected according to Liechtenstein's development of waste production (see Liechtensteiner Abfallplanung 2012-2070). Thus, source category 6A Solid Waste Disposal on Land was extrapolated based on inventory figures. Source categories 6B Waste-Water Handling, 6C Illegal Waste Incineration and 6D Other were projected according to activity data contained in the study above. Emissions from source category Waste are small compared to total emissions in Liechtenstein. Trends within this sector are of minor importance.

Technical implementation of CO_2 equivalent and gas-specific emissions

Since projections are only based on total emissions (in CO_2 equivalent), a master projection for total emissions (in CO_2 equivalent) was modeled in a first step. In a second step, projections for specific greenhouse gases such as CO_2, CH_4, N_2O and F-Gases were derived from this master projection using specific factors for each gas considered as well as for every individual source category. The gas-specific factors are derived as ratios of the total emissions (in CO_2 equivalent) using the ratios given by Liechtenstein's greenhouse gas inventory 2011 (see OEP 2013). In a third step, those shares were multiplied with the master projection. Therefore, all sources and assumptions described above are valid for every single greenhouse gas projection because the specific projections of the different greenhouse gases are simply scaled by its specific share of total emissions (in CO_2 equivalent). The shares of gas-specific emissions relative to the total CO_2 equivalents are provided in Table 5-17 (CO_2, CH_4 and N_2O) and Table 5-18 (F-gases).

Table 5-17 Shares of gas-specific emissions (CO_2, CH_4 and N_2O in CO_2 equivalent) relative to the national total CO_2 equivalents for each source category based on Liechtenstein's recent GHG inventory report (OEP 2013).

IPCC	Source/Sink Categories	CO_2 ratio in respect to total GHG emissions in CO_2 equivalents	CH_4 ratio in respect to total GHG emissions in CO_2 equivalents	N_2O ratio in respect to total GHG emissions in CO_2 equivalents	sum of all ratios in respect to total GHG emissions in CO_2 equivalents
1	**All Energy**				
1A	**Fuel Combustion**				
	1 Energy/Transformation	0.964	0.010	0.026	1.000
	2 Industry	0.997	0.001	0.001	1.000
	3 Transport	0.990	0.002	0.008	1.000
	4 Other Sectors	0.987	0.009	0.004	1.000
	5 Other (Off road)	0.988	0.000	0.012	1.000
1B	**Fugitive Emissions**				
	1 Solid fuels	NA,NO	NA,NO	NA,NO	NA,NO
	2 Oil/Natural Gas	NA,NO	1.000	NA,NO	1.000
2	**Industrial Processes**	NO	NO	NO	0.000
3	**Solvent Use**	0.733	0.000	0.267	1.000
4	**Agriculture**	0.000	0.545	0.455	1.000
5	**LULUCF**	1.002	NO	-0.002	1.000
6	**Waste**	0.019	0.372	0.610	1.000
1A3 ai	**International Bunkers**	0.990	0.000	0.010	1.000

Table 5-18 Shares of F-gas emissions (in CO_2 equivalent) relative to the national total CO_2 equivalents for each source category based on Liechtenstein's recent GHG inventory report (OEP 2013).

IPCC	Source/Sink Categories	Ratio in respect to total GHG emissions in CO_2 equivalents
2	**Industrial Processes**	
2F	**Consumption of Halocarbons and SF_6**	
	HFC	0.990
	PFC	0.008
	SF_6	0.002

References

EEG 2008: Gesetz vom 24. April 2008 über die Förderung der Energieeffizienz und der erneuerbaren Energien (Energy Efficiency Act).

FOEN (Federal Office for the Environment), 2014: Switzerland's Sixth National Communication under the UNFCCC, Berne.

Government of the Principality of Liechtenstein, 2012: Energy Strategy 2020, http://www.regierung.li/fileadmin/dateien/downloads/Energiestrategie_Langfassung.pdfb

Government of the Principality of Liechtenstein, 2011: Liechtensteiner Abfallplanung 2012-2070 - Teil 1: Analyse Ist-Zustand.

OEP (Office of Environmental Protection, Liechtenstein) 2013: Liechtenstein's Greenhouse Gas Inventory 1990 – 2011, National Inventory Report 2013.

OEP (Office of Environmental Protection, Liechtenstein) 2010: Liechtenstein's Fifth National Communication under the UNFCCC and the Kyoto Protocol. Office of Environmental Protection (project management).

OEP 2007b: Liechtenstein's Initial Report under Article 7, paragraph 4 of the Kyoto Protocol. Corrigendum, 19 September 2007. Office of Environmental Protection (OEP), Vaduz.

OEP 2006a: Liechtenstein's Initial Report under Article 7, paragraph 4 of the Kyoto Protocol. Office of Environmental Protection (OEP), Vaduz, 22 December 2006.

UNFCCC 1999: UNFCCC Reporting Guidelines of National Communications by Parties included in Annex I to the Convention

6. Vulnerability assessment, climate change impacts and adaptation measures

In recent years, various research programs on the effects of global climate warming in the Alpine region have been conducted. The developments so far, as well as the projections indicate that noticeable effects are to be expected. Changes to the permafrost boundary and water drainages will play a central role in this regard. Liechtenstein is also affected by these developments.

The expected impacts of climate change have primarily been studied in Switzerland and are mainly based on the Swiss Climate Change Scenarios 2011 (CH2011 2011).

Regarding observed trends in climate variability, climate extremes and climate change, the Federal Office of Meteorology and Climatology of Switzerland (MeteoSwiss) operates a high resolution atmospheric observation network and provides homogenized temperature and precipitation data meeting international monitoring and quality standards. This network also includes a measurement center in Vaduz. The collected network data form the basis for assessing extent and impacts of changes in climatic parameters to date.

6.1 Observed and expected impacts of climate change

6.1.1 Climate Change scenarios

The recently released Swiss Climate Change Scenarios “CH2011” (CH2011 2011) provide a new assessment of how climate may change in Switzerland over the 21st century. These scenarios provide information for three different climate regions (south, west and northeast region of Switzerland). The northeastern region also includes the principality of Liechtenstein. Findings and conclusion within “CH2011” are therefore also valid for Liechtenstein’s future climate development.

According to Switzerland’s 6th National Communication (FOEN 2014) are the new scenario based on a new generation of global and European-scale regional climate models provided by several international projects. New statistical methods were used to generate multi-model estimates of changes and associated uncertainties in seasonal mean temperature and precipitation for three representative Swiss regions and three scenario periods. CH2011 uses two non-intervention emission scenarios (A2 and A1B) that anticipate increases in emissions, and one climate stabilization scenario (RCP3PD) that supposes emissions are cut by about 50 % by 2050.

6.1.2 Observed and expected temperature changes

Observed changes

Liechtenstein's climate is directly connected to the topography of the Upper Rhine Valley and characterized by warm down slope winds. The mean annual temperature at the SwissMetNet[1] station of Vaduz is 10.0 °C for the current standard reference period 1981-2010 (MeteoSwiss 2013a).

The temperature has experienced significant changes in the past years. The mean annual temperature has increased by 0.8 °C between the reference period 1961-1990 (9.2°C; MeteoSwiss 2013b) and the current reference period 1981-2010 (10.0°C; MeteoSwiss 2013a). This development is consistent with general observations experienced during the past 100 years on the northern side of the alps.

Expected changes

Figure 6-1 illustrates observed seasonal temperature changes for northeastern Switzerland including Liechtenstein, as well as projected seasonal temperature changes for three different emission scenarios and selected time periods.

Compared to the period 1980-2009 the best estimates for the non-intervention scenarios project increases of seasonal mean temperature of 3.2-4.8°C by the end of the century for the A2 scenario and 2.7-4.1°C for the A1B scenario (CH2011 2011). For the climate stabilization scenario (keeping global temperature change below 2°C relative to pre-industrial levels), the climate would still change over the next decades, but is projected to stabilize at an annual mean warming of 1.2-1.8°C by the end of the century. Uncertainties due to climate model imperfections and natural variability typically amount to about 1°C (CH2011 2011).

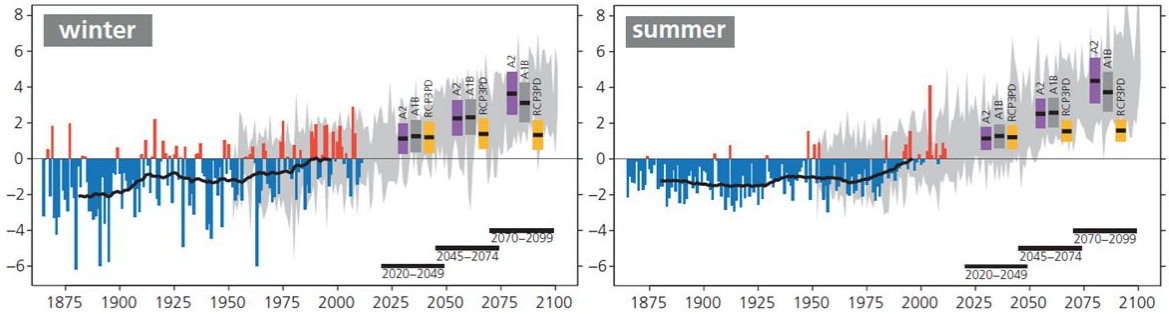

Figure 6-1 Past and future changes in seasonal temperature (°C) over northeastern Switzerland (including the Principally of Liechtenstein). The changes are relative to the reference period 1980–2009. The thin colored bars display the year-to-year differences with respect to the average of observations over the reference period, the heavy black lines are the corresponding smoothed 30-year averages. The grey shading indicates the range of year-to-year differences as projected by climate models for the A1B scenario (specifically, the 5–95 percentile range for each year across the available model set). The thick colored bars show best estimates of the future projections, and the associated uncertainty ranges, for selected 30-year time-periods and for three greenhouse gas emission scenarios (from CH2011 2011).

[1] SwissMetNet is the official meteorological monitoring network of the Swiss Federal Office of Meteorology and Climatology MeteoSwiss. The station at Vaduz is part of the Swiss network.

6.1.3 Observed and expected precipitation changes

Observed changes

In Switzerland, systematic recording of precipitation began in the middle of the 19th century. Compared to long-term changes of mean temperatures, trends in mean precipitation are less distinct. For a number of stations a significant increase in precipitation is found in winter and spring (+2.7 to +3.1% per decade, see OcCC 2008). In Liechtenstein the mean precipitation amount shows 900mm (valley areas) and 1900mm (alpine areas) respectively. From the beginning of systematic recording the annual precipitation amounts have increased by 4%. Intensive rainfall periods lasting 1 – 5 days during autumn and winter periods where also higher than 25 years ago.

Expected changes

Precipitation is projected to change towards the end of the 21st century (see Figure 6-2). Summer mean precipitation will likely decrease by the end of the century all over Switzerland and Liechtenstein, while winter precipitation will likely increase in Southern Switzerland for the investigated emission scenarios A2, A1B and RCP3PD. In other regions and seasons, models indicate that mean precipitation could either increase or decrease. The projections of future precipitation are consistent with past observations (from FOEN 2014).

According to CH2011 (2011) the summer mean precipitation is projected to decrease by 21-28% for the A2 scenario and 18-24% for the A1B scenario. For the climate stabilization scenario (keeping global temperature change below 2°C relative to pre-industrial levels), Switzerland's and Liechtenstein's climate would still change over the next decades, but is projected to stabilize at a summer drying of 8-10% by the end of the century. Uncertainties due to climate model imperfections and natural variability typically amount to about 15% in terms of precipitation.

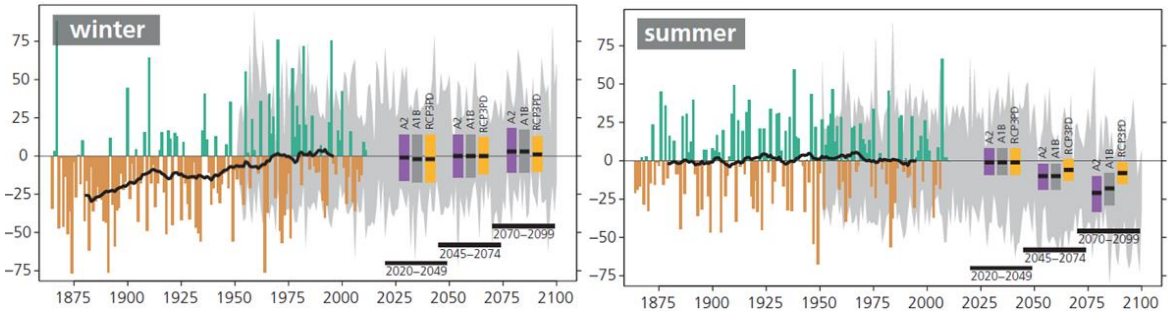

Figure 6-2 Past and future changes in seasonal precipitation (%) over northeastern Switzerland (including the principally of Liechtenstein). The changes are relative to the reference period 1980–2009. The thin colored bars display the year-to-year differences with respect to the average of observations over the reference period, the heavy black lines are the corresponding smoothed 30-year averages. The grey shading indicates the range of year-to-year differences as projected by climate models for the A1B scenario (specifically, the 5–95 percentile range for each year across the available model set). The thick colored bars show best estimates of the future projections, and the associated uncertainty ranges, for selected 30-year time-periods and for three greenhouse gas emission scenarios (from CH2011 2011).

6.1.4 Impacts on the cryosphere

Freezing level

In wintertime, the seasonal freezing level (altitude, where surface air temperature is 0°C) has risen by about 200 m per degree of warming from approximately 600 m in the 1960s to approximately 900 m in the 1990s (Scherrer and Appenzeller 2006). If warming in winter continues as expected, the freezing level will further rise by about 280 m until 2060 in case of a mitigation scenario (~ +1.4 °C, best estimate), by about 460 m in case of a non-intervention scenario (~ +2.3 °C, best estimate) (CH2011 2011).

Snow

According to Switzerland's 6th National Communication (see FOEN 2014) the precipitation falling as snow has been decreasing (Serquet et al. 2011) due to the already observed warming. Together with effects of snow melting, a reduction of snow depth and snow duration has been observed in the past decades. For example, on the plateau the number of days with a snow depth of at least 5 cm has been 50 % lower in the last 20 years than in the decades before (Marty, 2008). On the other hand, despite the warming trend winter temperatures above about 2000 m a.s.l. are still predominantly below freezing and changes in snow cover have thus not yet been observed.

From a recent analysis (Bavay et al. 2012) it can be concluded that the snow season will get shortened in Switzerland as well as in Liechtenstein under future climate scenarios by 2-4 weeks per year. As the lower limit of the snow cover corresponds roughly to the freezing level, an upward shift of the snow line until the mid of this century is expected. The reduced snow pack will result in reduced runoff in spring and summer.

Permafrost

Within the Principally of Liechtenstein only small areas are covered by permafrost (see Permafrost Web-GIS). The related changes due to rising temperatures are adopted from Switzerland 6th National Communication (see below, FOEN 2014).

The warming of permafrost in high mountains regions such as the Swiss Alps is a slow process with long-term implications. While first measurements of permafrost in rock glaciers have started in Switzerland in the late 1980s, systematic monitoring is performed since 2000 by the Swiss Permafrost Monitoring Network (PERMOS) and now also includes other landforms like debris or steep rock slopes. The evaluation of significant trends is difficult because time series mainly cover the past 10 very warm years and temperature anomalies associated with extreme warm years (such as 2003, 2009, 2011) are superimposed over the longer-term trend. Further, several factors (surface and subsurface properties, snow cover) may alter the magnitude and delay of the changes in ground temperatures compared to atmospheric changes resulting in high regional and local variability. However, in relation to the available 12 years of operational observation (see Figure 6-4), current conditions are above average warm with active layers at record depths for most of the sites in the past 3–4 years (PERMOS 2013). In addition, temperature trends at greater depth show clearer warming trends for a number of sites (PERMOS 2013). Remarkable are the increasing rock glacier creep velocities as well as decreasing ice contents that were measured at many sites. Furthermore, studies indicate that the frequency of large rock falls with starting zones in high elevations has increased in the past 20 years, as compared to the 20th century (Huggel et al. 2012).

A further temperature increase according to the CH2011 scenarios (CH2011 2011), will cause warming or complete thawing of cleft ice in rock faces as well as further warming and increasing active layer depths of ice rich debris slopes and rock glaciers (Haeberli et al. 2010). The warming of the outer 50 meters of frozen rock faces is already an effect of the temperature rise in the 20th century. It will penetrate into greater depths and increase the thermal imbalance. For summits and ridges such effects will be particularly pronounced as the warming may penetrate from different sides (see Figure 6-3). Processes related to warming of permafrost (Hasler 2011) may increase the frequency and magnitude of rock fall. Combined with the increasing availability of sediment due to rock fall, deepening of active layers, glacier retreat and

the possibility of mass movements into high mountain lakes, new and complex hazard situations may emerge in regions where they have not been reported from before.

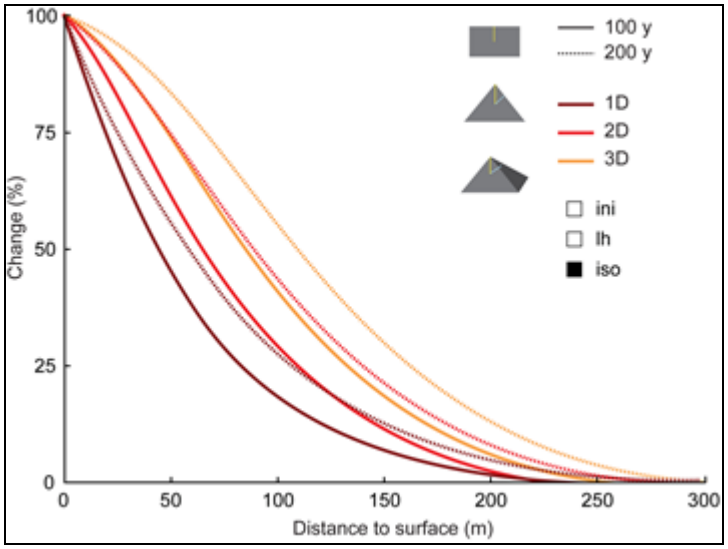

Figure 6-3 Percentage of a temperature signal at the surface that has penetrated to depth: This effect is shown for a one- (flat terrain), two- (ridge), and three-dimensional (pyramid) situation after 100 (solid lines) and 200 years (dotted lines). In the two- and three-dimensional situations values are plotted versus the shortest distance to the surface (from Noetzli and Gruber 2009).

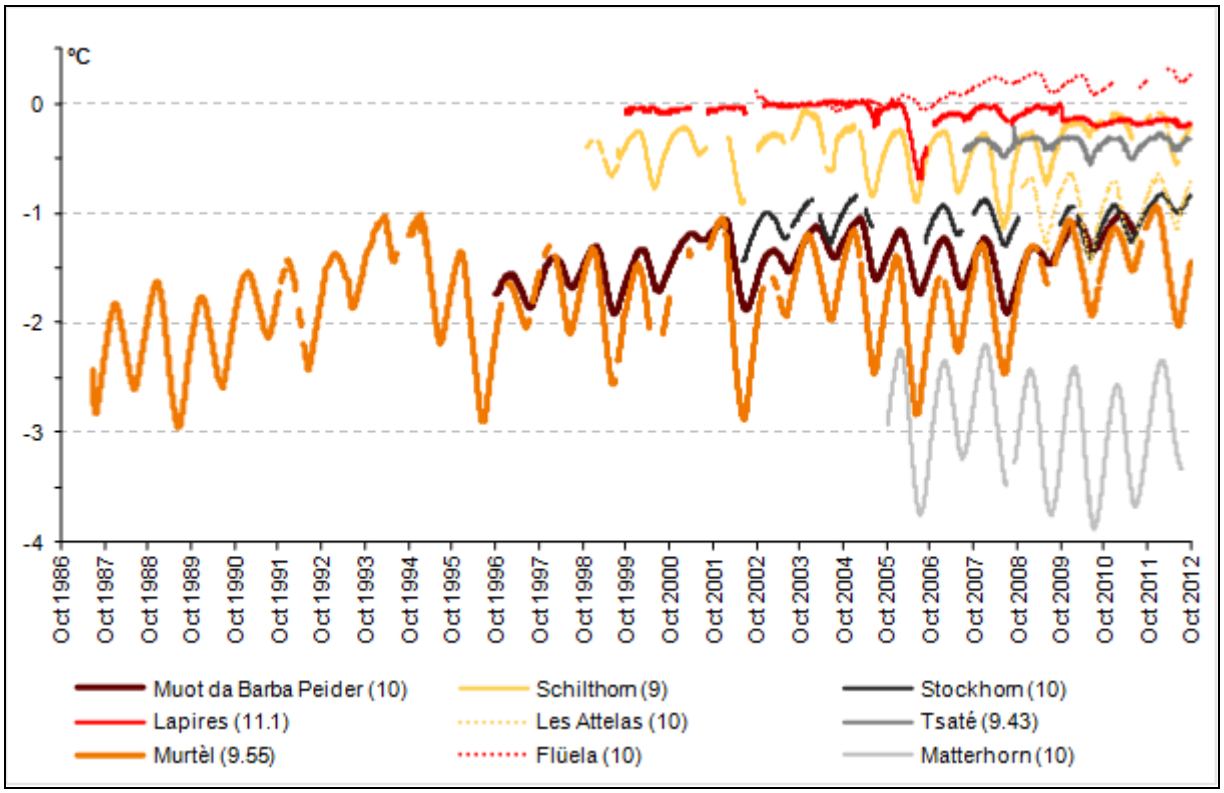

Figure 6-4 Synthesis results of more than 20 years of borehole temperature monitoring at the reference sites of the PERMOS network. Here, the temperatures at ca. 10 m depth are shown (the exact depth is given in parenthesis). The results show no clear general warming trend for the upper ca. 10 m, essentially because effects due to latent heat or surface cover (snow, coarse blocks) strongly influence the penetration of changes in climate conditions into the ground (from Swiss Permafrost Monitoring Network PERMOS).

6.1.5 Impacts on the hydrological cycle and water resources

Stream flow scenarios

In the near future (until 2035), annual runoff in Switzerland and Liechtenstein will change very little. In the long term (by 2085) the annual runoff will fall slightly. However, the seasonal distribution of runoff (runoff regime) will shift in Switzerland and Liechtenstein. By the end of the century, catchments with a snowmelt driven runoff regime will only be found in isolated areas and the seasonal distribution of runoff will follow the rainfall distribution. In the not glaciated regions, runoff is expected to be higher in winter but lower in summer. On the Rhine for example, a second seasonal runoff maximum will develop over time in winter in addition to the existing one in early summer (Figure 6-5). In the catchments of the northern slope of the Alps and the Alps, low flow events will shift from winter to late summer and will be less pronounced.

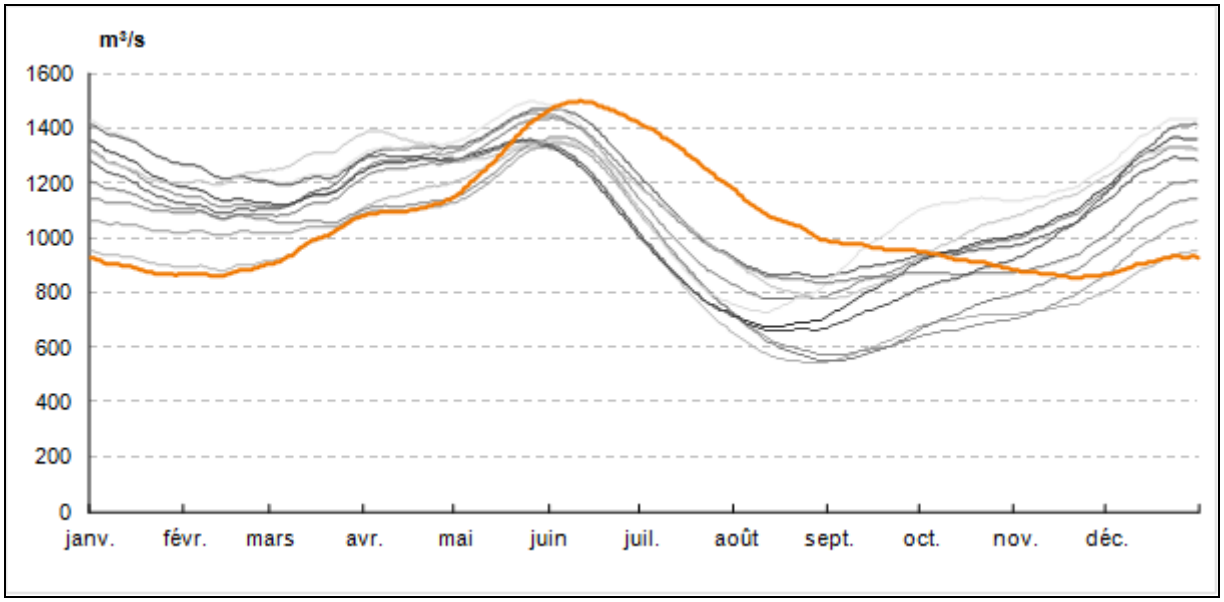

Figure 6-5 Discharge projections in River Rhine at Basel. The orange line indicates the control period, grey lines the ten climate scenarios over the period 2070-2099.

Effects of climate change on water reservoirs

Based on the CH2011 climate scenarios, it must be assumed that precipitation intensity and strength will tend to increase on the long term and high groundwater levels and spring discharge rates may thus occur more frequently. However, summer droughts should happen more often and last longer in the future. Therefore low groundwater levels and spring discharge rates may occur more frequently. Currently, no trend has been clearly identified for both the groundwater levels and the discharge rates (from FOEN 2014).

Impacts on water temperature and water quality

According to Switzerland's 6th National Communication (see FOEN 2014) water temperatures of various rivers and streams have been continuously recorded since 1963 within the framework of the Swiss national temperature measurement network (Figure 6-6). This allows highlighting the effects of various natural and anthropogenic influences on the annual development of water temperatures. The analyses of those measurements show clear tendencies towards increased annual mean temperatures of up to 1.2 °C, and 1.5 – 3 °C in summer, particularly in lower altitudes, as well as in areas affected by lakes (Jakob et al. 2010). In alpine regions the increase in the annual mean is apparent to a lesser extent, due to the compensating influences of melt-water from glaciers. A rapid increase in temperature is noticeable in spring, irrespective

of the altitude. The causes of this temperature change cannot always be clearly identified. Anthropogenic and natural climate change induced effects have a combined influence on the water temperature regime. The temperature changes impact decisively on the development and on the composition of aquatic life. A further rise of the water temperature in the future, especially at times of low flows, could probably also lead to a deterioration of the chemical water quality. The quality of drinking water resources could also change if groundwater temperatures increase. Indeed, the water temperature is one of the most important regulators of life processes in aquatic groundwater ecosystems. Temperature regulates the metabolic and redox processes and defines the evolution, the growth rate and the composition of biocenosis.

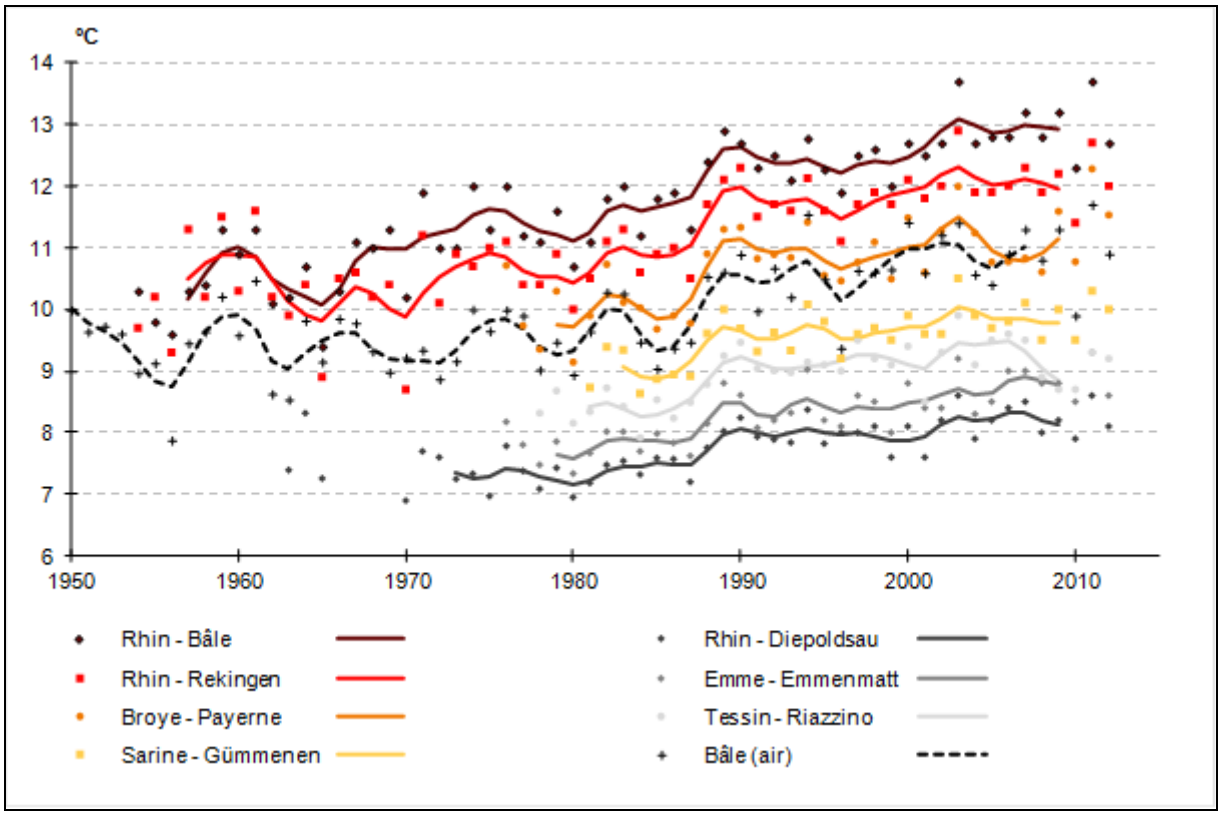

Figure 6-6 Change of yearly water temperature at different measuring stations 1954-2012. For comparison reasons the air temperature at Basel is included in the graph. The yearly moving average over 7 years are represented as lines.

6.1.6 Impacts on extreme events and natural hazards

Scenarios of the trends of frequency and intensity of extreme events are still very uncertain. Due to their limited number, statistical trends of extreme events are difficult to establish (Frei and Schär 2001). So far, they have been detected for a few categories of extreme events only. Here, we will synthesize information on climate extremes from CH2011 (2011) that is predominantly based on a review of the literature for Switzerland and central Europe (from FOEN 2014).

Temperature extremes

By the end of the 21st century, and for the range of scenarios considered, it is very likely that the frequency, duration and intensity of summer warm spells[2] and heat waves in Switzerland and Liechtenstein will increase significantly. As an illustrative example, changes in the warm spell duration index (WSDI) per summer were calculated in each of the considered climate models from CH2011 (2011). Figure 6-1 shows that the multi-model mean projects an increase in WSDI of 10-80 days per summer by the end of the century in northeastern Switzerland (including Liechtenstein). Southern Europe is expected to experience stronger increases in warm spells and heat waves than Switzerland, and northern Europe somewhat weaker increases.

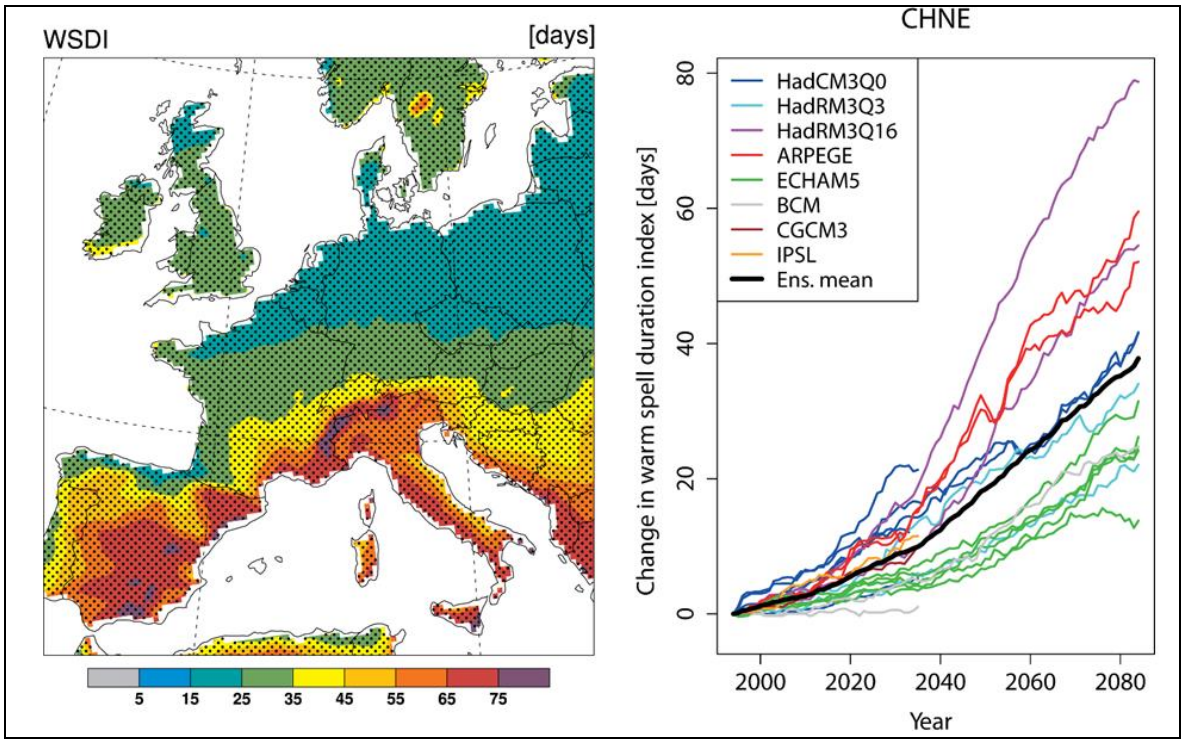

Figure 6-7 Spatial changes in the warm spell duration index (WSDI; May–September) in 2070-2099 (with respect to 1980-2009) for the multi-model mean (left) forced with the A1B emission scenario. Stippled areas indicate significant changes (95 % confidence level) in more than 66 % of the climate models. 30-year running means of WSDI are shown on the right for the individual models and the multi-model mean (black line) for northeastern Switzerland (including Liechtenstein).

[2] A warm spell is defined as a period of at least six consecutive days with maximum temperatures exceeding the local 90th percentile for days in the reference period.

Precipitation extremes and droughts

Projections of the frequency and intensity of precipitation events are more uncertain than in case of temperature, but substantial changes cannot be ruled out. Competing physical mechanisms drive these changes which may yield net effects of different sign depending on season and region. The climate models analysed in CH2011 do for instance not show a consistent climate change signal in heavy winter precipitation events. However, depending on region and season, a shift from solid (snow) to liquid (rain) precipitation is expected with increasing temperatures, with potential implications for the frequency of floods (see section 6.1.5). Despite a decrease in total summer precipitation amounts, several studies suggest a potential increase in extreme daily summer precipitation over central Europe (Frei et al. 2006, Rajczak et al. 2013). Yet, substantial uncertainties remain on the magnitude of the changes and the spatial scale (from FOEN 2014).

According to CH2011 (2011) the length of summer dry spells is likely to increase. Switzerland is part of a larger area experiencing an increasing risk of drought and dry spells along with a decrease in the number of precipitation days (Frei et al. 2006), particularly over the Mediterranean region.

Wind storms

Confidence in projections of windiness in Central Europe remains relatively low and hence no robust projection for extreme wind storms in Switzerland (and thus for Liechtenstein) can be made. Yet, it does not rule out the possibility of severe changes, too. North of Switzerland, a tendency toward more intense cyclones is simulated by one model despite a decrease in the total number of cyclones (Pinto et al. 2007).

6.1.7 Natural hazards

Floods

Floods in Switzerland and Liechtenstein are dominantly caused by extreme precipitation, sometimes in connection with snowmelt and/or high lake water levels. During the last 500 years, periods with many and few floods alternated in Switzerland. Since the 1970s, Switzerland is in a period of high flood frequency. However, no direct relationship was found between flood frequency and mean air temperature (Schmocker-Fackel and Naef 2010). The comparison of flooding patterns in different European countries suggests that changes in large scale atmospheric circulation are responsible for the flood frequency fluctuations. Unfortunately it is not yet possible to make any clear statements about future changes in atmospheric circulation and therefore of changes in extreme and very rare precipitation events in the Alpine area (CH2011 2011).

Rockfalls slope, debris flow and landslides

Changes in temperature and precipitation are likely to have a range of secondary effects on the occurrence of natural hazards, in particular in mountain environments. However, while theoretical understanding exists for increased mass-movement activity as a consequence of projected climate change, impacts can only hardly be detected in observational records for the time being (Stoffel and Huggel, 2012).

Slopes currently underlain by degrading permafrost will probably become less stable at progressively higher altitudes with ongoing climate change. The probability of rock instability and the incidence of large (>106 m^3) rockfalls will likely increase in a warming climate (Huggel, 2009). Quite a large number of recent slope failures have been documented in permafrost areas and have been related to increasing temperatures.

Changes in sediment supply and land-use are further key determinants for mass-movement frequency and magnitude. Recent observations in the Swiss Alps indicate that sediment supply can in fact change significantly as a result of permafrost degradation of rock and scree slopes or mass movements related to other processes (Huggel et al. 2012). As such, warming has been reported to exert indirect control on debris-flow magnitude and frequency through the delivery of larger quantities of sediment into the debris-flow channels under current conditions than in the past (Lugon and Stoffel 2010). The volume of debris flows in

many parts of the Swiss Alps has risen by one order of magnitude since the early 20th century (Stoffel 2010) and is likely to further increase with ongoing permafrost degradation. The actual triggering conditions of debris flows have been shown to occur less frequently today as compared to the most of the 20th century (Schneuwly-Bollschweiler and Stoffel 2012), and are not expected to increase in the future (Stoffel et al., in press). Despite uncertainties, recent developments at high-elevation sites have shown clearly that the sensitivity of mountain and hillslope systems to climate change is likely to be acute, and that events beyond historical experience will continue to occur as climate change continues.

At lower elevations, the temporal frequency of landslides might be affected by climate change, and the events could occur more frequently in winter and spring as a result of warmer temperatures and larger precipitation sums (Lopez Saez et al. 2013). The occurrence of debris flows and shallow landslides at lower elevations (Prealps, Plateau, and Jura) depends on the incidence of intense thunderstorms or long-lasting, persistent rainfalls. Such conditions are likely to become scarcer in future summers and more frequent in winters and springs. As a consequence, a shift might be expected in the seasonality of debris flows and shallow slides, and the occurrence of such events might increase in the decades to come (from FOEN 2014).

6.1.8 Biodiversity

The observed impacts of climate change on biodiversity and some perspectives for the future at the national level were recently reviewed (Vittoz et al. 2013). For all taxonomic groups considered, the following impacts are already evident: elevation shifts of distribution towards mountain summits, spread of thermophilous species, colonisation by new species from warmer areas and phenological shifts. Additionally, in the driest areas, increasing droughts are affecting tree survival and fish species are suffering from warm temperatures in lowland regions.

Plants

Climate warming is already affecting the phenology of plants. In the region of Basel, the wild cherry (Prunus avium L.) now blooms, on average, 16 days earlier than in 1950 (North et al. 2007), and the growing season has lengthened an average of 2.7 days every decade since 1951 (Defila & Clot 2005; OcCC 2008). Longer growing seasons enable plants to grow at higher elevations. Many botanists have been resurveying plant species on mountain summits above 2'800 m (e.g. Frei et al. 2010, Stöckli et al. 2011, Vittoz et al. 2009) and observed increases in plant species richness on most of the summits, with only a few summits showing a stable or decreasing species richness. As the direct anthropogenic influence on ecosystems increases towards lower elevations, it is increasingly difficult to disentangle the impacts due to direct human activities from those induced by climate change. However, Moradi et al. (2012) observed recently in Swiss montane fens an increase of thermophilous, rich-soil-indicator and shade-indicator species. These changes were interpreted as a higher productivity in warmer conditions, on drier soils and/or under airborne nitrogen deposition. Similarly, the 12% increase of xerophilous species in the last 10 years observed by a national monitoring program in lowlands is possibly the consequence of drier conditions because of the warmer temperatures (Bühler, 2012).

Birds

The Swiss Bird Index SBI® Climate Change is an indicator developed by the Swiss Ornithological Institute to document the population trends since 1990 of 20 breeding birds for which an extension of range is expected by the end of the 21st century (e.g. thermophilous species) and of 20 species for which a shrinking distribution range is expected (e.g. alpine species). The combined index for species with an expected range extension showed a strong increase (Keller et al. 2012). For example, the European bee-eater (Merops apiaster) has become a regular breeder in Switzerland and its population is increasing. A recent study identified a significant upward shift between 1999–2002 and 2004–2007 in the distribution for 33 out of 95 species, with an average shift of 94 m for the leading edge (Maggini et al. 2011). Conversely, the species for which a decrease of the range is expected under future climatic conditions did so far not show a declining

trend on average (Keller et al. 2012). For some species of this group, however, significant population trends since 1990 have already become apparent (Revermann et al. 2012).

Insects

As poikilothermic animals, insects depend strongly on warmth for their development and reproduction. Hence, warmer temperatures accelerate their growth. In the Swiss lowlands, Altermatt (2012) observed that 24 out of 28 butterfly species advanced their seasonal appearance over a 13-years monitoring period. This earlier onset allowed a longer reproduction period and 72% of the multivoltine butterfly species increased the frequency of supplementary generations (Altermatt 2010). Changes in the elevational distribution were also observed in the comparison of old (1920–1941) and recent inventories in the Swiss National Park (Pasche et al. 2007). These distribution shifts are in agreement with projections of species distribution models. In Switzerland, an increase in mean temperature of 2°C by 2050 might lead to a decrease of 3–15 species per km2 in lowlands because of the upward shift and to a slight increase above 1200 m (Bureau de coordination du Monitoring de la biodiversité en Suisse 2009). But, on subalpine–alpine ridges, this increase will correspond to an almost complete species turnover (Pearman et al. 2011). Many thermophilous aquatic species took advantage of the warmer temperatures to expand their distribution. Some species that were only sporadically observed at the beginning of the 20th century are now colonising Switzerland (e.g. the dragonflies Aeshna affinis and Sympetrum meridionale). According to models, this could lead to increased species richness in ponds but also to the rarefaction or even extinction of species limited to cold, alpine lakes (Rosset & Oertli 2011).

Projections for biodiversity

On the basis of existing observations and model results, it is possible to make some projections concerning the future climate change impacts on biodiversity in Switzerland and Liechtenstein. Species will certainly move towards higher elevations, and new species will colonize Switzerland. Some species will probably disappear at the regional scale, partly in high mountains because of the decreasing area of the alpine and nival belts, partly in the lowlands because of the increasing summer droughts and existing obstacles to dispersal (landscape fragmentation). Moreover, disruptions in species interactions caused by individual migration rates or phenological shifts are likely to have consequences for biodiversity (Walther 2010). Conversely, the inertia of the ecosystems (species longevity, restricted dispersal) and the local persistence of populations will probably result in lower extinction rates than expected with some models. The adaptation capacity of many species with respect to climate change will depend on their ability to colonise new favorable sites. However, dispersal will be limited by the strong fragmentation of the Swiss landscape (Meier et al. 2012) and this fragmentation forces many species to persist only in small, isolated populations, with low genetic diversity, which will limit their ability to adapt to new climatic conditions (Lavergne et al. 2010). It is thus important to reconnect populations by developing networks of suitable ecosystems with supplementary protected areas scattered across the whole country, along topographic gradients and connected to the larger European networks (Hannah 2008).

6.1.9 Forest and Forestry

In forest ecosystems different natural and anthropogenic environmental factors are acting together, partly enhancing or diminishing their effects, and modified by natural site factors. The identification of one individual factor for an observed effect or its quantification is often not possible. However, due to increased research efforts the contribution of climate change on the forest dynamic becomes clearer (from FOEN 2014).

Tree growth and vegetation shifts

Climate change acts in different ways on the tree species and the composition of forests. It weakens the vigour of drought sensitive tree species and favours the competitiveness of more drought resistant species. Because the tree line is mainly determined by summer temperatures (Körner & Paulsen 2004), warmer conditions induce an upward shift of its limit. As tree line in the Alps is lowered by cattle grazing, the upward shift observable since 1900 is simultaneously driven by climate change and pasture abandonment (Gehrig-Fasel et al. 2007; Vittoz et al. 2008). Due to changes in minimum air temperature in spring (less extreme cold events), European ash (Fraxinus excelsior), Silver Fir (Abies alba Mill.), Wild cherry (Prunus avium L.), Sycamore (Acer pseudoplatanus L.), Sessile oak (Quercus petraea) and European beech (Fagus sylvatica L.) are successfully regenerating at and beyond the upper elevational limits of adult individuals (Vitasse et al. 2012).

One important factor enhancing the severity of drought periods is the eutrophication by the nitrogen deposition. In a long-term field experiment, the water use efficiency, i.e. the relation of assimilated carbon to water, was reduced with increasing nitrogen doses, leading to drought symptoms (Braun et al. 2012).

The reported findings are consistent with current knowledge on the ecophysiology of trees and – as far as known yet - the reactions of forest stands under warmer conditions. However, the future forest composition is difficult to predict, since the influence of climate change on the forests is modified by a lot of other factors, like the site conditions, the regional peculiarities of the development, the influence of pests, diseases, insects, and especially at higher elevations, the change in agricultural practices. All these factors were affected by climate change, but the influences of each of them and their interactions at a given site is not easy to predict. If the development proceeds as predicted by climate models, in many regions a substantial shift in the tree species composition will occur, favouring more drought tolerant trees like oak species, whereas trees adapted to more colder and wetter climate like the Norway spruces will be restricted to more feasible sites at higher elevations (from FOEN 2014).

6.1.10 Agriculture

In accordance with remarks in FOEN (2014) climate change in Switzerland is expected to entail a shift of suitable areas for agricultural production, and to involve both positive (e.g. a longer vegetation period) and negative aspects (e.g. increasing incidence of [insect] pests owing to the milder winters). Changes in the nature of extreme weather events, in particular more frequent, intense and longer-lasting summer heat waves, could also challenge agriculture e.g. by reducing the reliability of harvests. The extent by which climate change will affect agriculture will depend, however, on the regional settings, the overall political framework and the specific economic background of the farms. Economic considerations are expected to play a crucial role for the adoption of adaptation measures.

Water demand and supply for agriculture in a changing climate

Drought is a major threat to agricultural production. Even in Switzerland, where drought is not a recurrent phenomenon under current climatic conditions, water scarcity can induce considerable damages. This was the case in 2003, when losses of about CHF 500 million were suffered by the agricultural sector from an unprecedented heat-wave (from FOEN 2014).

Climate scenarios for Switzerland propose decreasing precipitation amounts during the summer season (CH2011 2011). Accordingly, results of hydrological simulations carried out for selected river catchments using two climate change scenarios representing the range of projections given in CH2011 (2011) indicate that already by 2060 average water requirement in parts of Switzerland could represent as much as 50% of the river water supply (Fuhrer 2012). In extreme years water demand could even easily exceed the supply, suggesting that conflicts concerning the utilization of water resources are likely to arise more frequently in the future if preventive measures are not taken.

Implications of increasing summer temperatures for animal performance

Heat stress caused by elevated daytime temperatures and high humidity levels has the potential to consider-ably affect animal performance and health (Johnson 1994). For Swiss agriculture the risk of reduced animal performance is of concern especially in relation to milk production. A retrospective analysis of the so-called temperature-humidity index (THI, Thom 1958) has revealed that under current climatic conditions an important risk of heat stress for dairy cows (THI > 72°C) exists in the long-term only for Southern Switzerland (See also Fuhrer and Calanca 2012).

This situation could change in the future, though, because according to the newest climate change scenarios for Switzerland (CH2011 2011) summer temperatures could increase in average by up to 4°C until 2060 and up to 6°C until 2085, depending on emission scenario. The consequences are a marked increase in the average number of days with THI > 72°C. The increase is more distinct for the second half of the century under the A1B and A2 emission scenarios. As a result, critical conditions under the A1B and A2 emission scenarios are expected to persist on average for two (Northern Switzerland) to three months (Southern Switzerland) by the end of the century. This calls for the adoption of protective measures, both in relation to indoor and outdoor environments.

6.1.11 Energy

Impacts on heating degree day and cooling degree day

Heating degree day (HDD) provides a measure that reflects the energy needed to heat a building. It is based on a reference temperature below which a building requires heating. For a day, if the average outside temperature is below this reference temperature, the HDD represents the difference between the reference temperature and the average outside temperature, otherwise HDD is equal to zero. The sum of HDDs over a year provides an indication of the total heating requirements for that year. Cooling degree day (CDD) are directly analogous to HDD but estimates the energy demand for air conditioning. It can be expected that climate change will modify these two measures (from FOEN 2014). Figure 6-8 shows the evolution of the HDDs and CDDs computed from the Swiss climate change scenarios CH2011 (CH2011 2011) for the years 2035, 2060 and 2085 and using the three emissions scenarios (RCP3PD, A1B and A2).

In 2085, the heating energy demand is expected to decrease between 20.6% and 8.2% depending on the global emissions scenario. The impact on CDDs is much more important than the impact on HDDs, one must take into account that the use of air conditioning in building is very limited at present in Liechtenstein compared to warmer regions. Thus, the final impact on electricity consumption is highly dependent on the penetration of air conditioning in Liechtenstein for the futures decades.

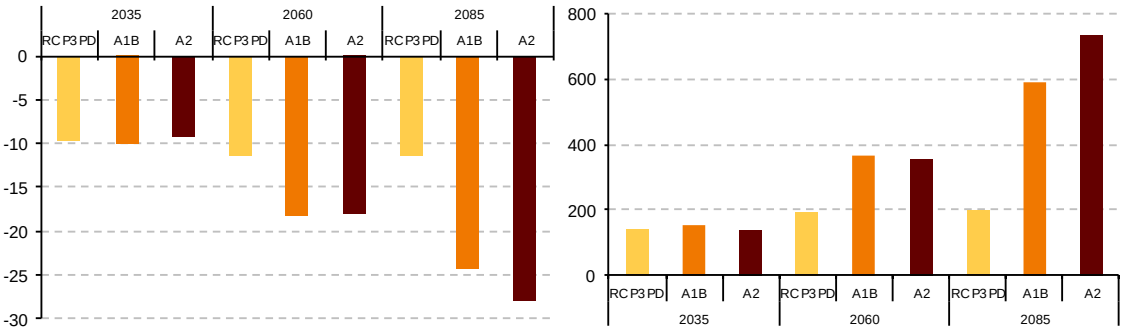

Figure 6-8 Changes in % of HDDs (left) and CDDs (right) in respect to the reference period 1980–2009 (from FOEN 2014 according to Faust et al. (2012).

6.1.12 Health

The projected increase in the frequency and intensity of heat waves (section 6.1.6) in combination with high tropospheric ozone concentrations represents the greatest direct risk that climate change poses to people's health in Switzerland and Liechtenstein. The potential extent became clear during the heat wave of 2003 when almost 1'000 deaths were attributed to the extraordinary heat in Switzerland. The heat wave in 2003 hit the elderly and the very young and was more pronounced in cities intensifying the urban heat island effect.

Since then, the Swiss federal and cantonal authorities have developed measures to inform the population about expected heat waves and about protective measures to be taken. Humans can mitigate the effect of heat waves on health as they are not defenceless exposed to extreme heat. Experiences from other countries indicate that the effect of a heat wave on mortality on a population level can be significantly reduced when heat action plans are put in place.

Additional direct effects of climate change on health are expected from the increase of other extreme events such as floods, mudslides and, possibly, storms. Given the well-developed immediate disaster control measures in Switzerland, health effects are likely to be manageable. However, extreme events may entail severe psychological consequences for the directly affected population which may last longer and are often underestimated.

An increase in annual mean temperature between 1969 and 1996 in Switzerland and Liechtenstein has been paralleled by an increase in total counts of hazel, birch and grass pollen. The starting season of pollen flowering has shifted to earlier periods of the year, especially for hazel trees which started to flower in January / February as compared to March as observed previously. Timing of life cycle events in vegetation (budburst, flowering) is generally sensitive to temperature if not water-limited. Increasing temperature might therefore be a possible driver of pollen production. In addition, factors such as higher atmospheric CO_2 concentration have been shown to increase pollen production. Yet, the relation between a biological system such as vegetation and external drivers is complex and often non-linear. The role of climate change for the observed increase in pollen production is thus not yet elucidated. People sensitized to a variety of different pollens may start suffering earlier from hay fever or asthma symptoms and for a prolonged period of the year when pollen production starts earlier in the year and the amount of pollen increases. However, there is no clear evidence that the increase in the occurrence of allergic diseases which was observed in many westernized countries including Switzerland since the 1960 is causally linked to pollen concentrations in the air. Research shows that environmental factors such as pollen which trigger symptoms in already diseased people are not necessarily the same as those causing the development of the disease.

Another important potential health risk of climate change is the occurrence of vector-borne diseases. The diseases result from a transmission of an infectious agent through an animal vector (mosquito, ticks) usually through biting or touching. Increasing temperatures favor growth of vectors and replication rates of infectious agents, e.g viruses. In Switzerland and Liechtenstein, the most common vector-born diseases are tick-borne encephalitis (FSME) and lime borreliosis. In recent years, outbreaks of some vector-borne diseases, such as Dengue and Chikungunya fever have been observed in neighboring countries such as Italy and France, and the respective vector (aedes mosquito) is present in Switzerland, too. Yet, it is still highly uncertain what future developments are to be expected as many other factors such as human behavior, population density, international trade and global tourism affect disease transmission. Surveillance of disease outbreaks and vector spread are the first steps to develop adapted plans for intervention and prevention (from FOEN 2014).

6.2 Vulnerability Assessment

It is difficult to transfer the consequences of global climate warming calculated on the basis of models to Liechtenstein. The available climate models are not yet able to predict detailed regional consequences. Overall, however, the following general effects can be expected as a consequence of a further increase of the CO_2 concentration and the associated rise in temperature and reduction of permafrost:

Health: Heat waves with increased mortality. In Switzerland, an increase by 7% was observed in 2003 (Grize 2005). Effects on health are also precipitated by changes of the environmental condition for pathogens.

Tropical diseases (FOEN, 2012) will increasingly also surface in Central Europe (malaria, dengue fever), and existing diseases will spread to higher elevations and therefore also to new regions of the country (borreliosis, meningitis). Indirect consequences for health are to be expected from storm, floods, and landslides.

Ecosystems: Warming changes the composition of forest vegetation. Deciduous trees may become more important than today. Additional weather instabilities (e.g., storms, avalanches) may have a further negative effect on forest vegetation (AWNL 2011) and agriculture (hailstorms, droughts).

Water cycles and soil: The increasing weather instabilities may lead to floods in winter and droughts in summer. A great danger in this regard exists in the narrow Alpine valleys (mountain streams), where various protective measures (e.g., rock fall barriers and water course corrections) are necessary. A further danger is posed by the river Rhine; although regulated, the Rhine may endanger the heavily used Rhine Valley floor in the event of a flood.

Tourism: Within the next decades Liechtenstein's tourism sector will have to deal with great challenges caused by climate change related developments in Liechtenstein's ecosystems. Especially the winter tourism sector will be hit by higher temperature as the rise of the freezing level will lead to higher snow lines. As a consequence the skiing periods will be shorter, especially for skiing areas situated between 1500 m and 2000 m above sea level, like Malbun. Consequences will be fewer accommodations in the hotel sector as well as fewer guests in the sectors of winter sports and gastronomy. Additionally, higher costs arise with artificial snow production (snow guns).

Other economic sectors: Global climate warming will affect further economic sectors in Liechtenstein. Due to the processes described above, agriculture and forestry will be affected directly. A rise in temperature will have a negative effect on the productivity of grain cultivation in the long term (Fuhrer 2003). Higher costs for irrigation as well as more energy consumption will occur in a dry, hot summer. The expected increase in elevation of the snow and permafrost boundaries and increasing weather instability also have an effect on the important recreation area of Malbun and Steg. The international engagement of the insurance sector will likely suffer the most severe consequences from an increase in the probability of losses.

As Liechtenstein is the only country within the Alps and two third of its area is mountain regions, it is dependent on the stability of the ecosystem. This is an important reason why Liechtenstein has initiated an active climate policy and why it takes part in international networks (such as the Alpine Convention, Clisp, C3Alps).

6.3 Adaptation measures

The projected consequences of an ongoing climate change require the immediate implementation of the so called Two-Pillar-Strategy – Mitigation (Pillar1) and Adaptation (Pillar2)

Mitigation (Pillar1): The necessary reduction of greenhouse gases can only be achieved if concrete measures are implemented in due time. Liechtenstein has launched a set of measures to address the problem of growing greenhouse gas emissions:

- CO_2-Act (revised in 2013)
- Emissions Trading Act (revised in 2012)
- Energy Strategy 2020 (2012)
- Energy Efficiency Act (2008)
- Action Plan Air (2007)

In addition to the abovementioned measures the Government will revise its National Climate Strategy from 2007 in the course of 2014.

Liechtenstein's climate policy goal is – in the midterm - to exceed the obligations originating from the Kyoto Protocol. The mitigation measures however will be further developed, especially with respect to sectors that have not yet been totally included into strict climate change regulation (eg. traffic and transportation).

Adaptation (Pillar2): It is already obvious that certain climate change related consequences will become irreversible. Pillar 2 deals with the question of how these negative developments could be addressed and how potential future damages can be limited or even avoided. Liechtenstein is an official partner of the C3-Alps: Capitalising Climate Change Knowledge for Adaptation in the Alpine Space European project.

Project Framework

C3-Alps is a European project funded by the Alpine Space Programme under the European Territorial Cooperation 2007-2013. C3-Alps started in January 2012 and will run until December 2014. The Lead Partner is the Umweltbundesamt GmbH / Federal Environment Agency Austria. The partnership is composed of 17 Project Partners from Austria (4), Italy (4), Germany (3), Switzerland (2), France (1), Slovenia (1), the Principality of Liechtenstein (1) plus UNEP's regional office for Europe, and includes international organisations, national and regional government authorities, national agencies, provinces/regions, research institutions and institutes of applied sciences.

Project Description

C3-Alps will synthesize, transfer and implement in policy and practice results of previous Alpine Space projects on climate change adaptation. The capitalization approach aims at

- generating new and directly usable forms of state-of-the-art synthesis adaptation knowledge in the Alps, harmonised across sectors and useful to adaptation decision-makers,
- its effective and tailor-made communication and transfer to target groups,
- enhancing effectiveness of adaptation policy and governance frameworks, and
- initiating, supporting and pioneering tailored and cross-cutting adaptation processes, strategies, action plans and decision support in pilot regions and municipalities.

From a national perspective the project's further aim is to strengthen the topic of climate change adaptation in Liechtenstein by preparing a climate change adaptation strategy document. The elaboration of this document will be done in close co-operation between the Office of Environment, sub-contractor CIPRA International and the relevant departments of the national administration.

The Government envisages finalizing the climate change adaptation strategy in the course of 2014. The strategy will focus, inter alia, on the following sectors:

Natural Hazards: The avoidance of an increasing number of natural hazards as flooding, avalanches, landslides will not be possible. It is, however, necessary to calculate the potential risks by observing and marking the regions that are highly vulnerable to natural hazards – with a special focus on residential areas. Liechtenstein has established so called "Geological Risk Maps". These maps provide regional information on the specific risks regarding avalanches, rock- and landslides and flooding. These maps are continuously updated by the Division of Forests and Landscape.

Agriculture and Forestry: Up to now the agricultural sector has benefited from longer vegetation periods. The projected increase of precipitation intensity as well as longer drought periods will, however, lead to long-term negative effects as crop failure, soil erosion or intensified insect attacks. Identified adaptation measures are an increased use of appropriate corn provenances that have already anticipated future conditions of the changing environment. However, the use of genetically modified crops is not foreseen. The irrigation of agricultural fields will increasingly be used thereby causing conflicts with other public interests, especially during longer draught periods. Considering the given topography Liechtenstein's alpine forests play an important role with respect to natural preservation and protection of residential areas. The increase of draught periods with consequential damages caused by insects, pathogens (viruses, bacteria, fungus) fire or storms will lead to a decrease of the forests protection abilities in Liechtenstein. Adaptation

measures that address the problems of these projected situations and that are already executed are the conversion of spruce and fir stocks into mixed deciduous and coniferous forests.

Tourism: Summer tourism will benefit from climate change related developments. Increased heat waves will not become a major problem for the alpine tourism but the city tourism of Vaduz. With respect to adaptation measures Liechtenstein will have to focus on the projected situation for winter tourism. With this respect further examinations have to be concluded within the next years. The production of artificial snow, as currently practiced, is not considered to be a sustainable solution. Nevertheless, various municipalities and institutions have introduced new offerings for winter and summer tourism, in order to counter potential revenue losses. The focus is on strategies to promote "gentle tourism".

References

Altermatt, F. 2012: Temperature-related shifts in butterfly phenology depend on the habitat. Global Change Biology, 18, 2429–2438

Altermatt, F. 2010: Climatic warming increases voltinism in European butterflies and moths. Proceedings of the Royal Society B: Biological Sciences, 277, 1281–1287.

Alpine Space Programme, http://www.c3alps.eu/index.php/de/ (August 2013)

AWNL, 2011: Der Umgang mit unserem Berggebiet.

Bavay, M., Grünewald, T., Lehning, M. 2012: Response of snow cover and runoff to climate change in high Alpine catchments of Eastern Switzerland, Advances in Water Resources (2012), doi: 10.1016/j.advwatres.2012.12.009.

Braun, S., Rihm, B. and Flückiger, W. 2012: Stickstoffeinträge in den Schweizer Wald: Ausmass und Auswirkungen. Schweiz Z Forstwes 163: 355–362.

Bühler, C. 2012: Traces du changement climatique? MBD Facts 4. Berne: OFEV. http://www.biodiversitymonitoring.ch/ [15.07.2013]

Bureau de coordination du Monitoring de la biodiversité en Suisse 2009: Etat de la biodiversité en Suisse. Synthèse des résultats du Monitoring de la biodiversité en Suisse (MBD). Etat: mai 2009. Etat de l'environnement 0911. Berne: OFEV. http://www.biodiversitymonitoring.ch [15.07.2013]

CH2011 (2011), Swiss Climate Change Scenarios CH2011, published by C2SM, MeteoSwiss, ETH, NCCR Climate, and OcCC, Zurich, Switzerland, 88 pp.

Defila, C., & Clot, B. 2005: Phytophenological trends in the Swiss Alps, 1951–2002. Meteorologische Zeitschrift, 14, 191–196.

Faust, A-K., Gonseth, C. and Vielle, M. 2012: Modélisation de l'adaptation aux changements climatiques dans un modèle intégré. REME, EPFL, Lausanne.

FOEN (Federal Office for the Environment), 2014: Switzerland's Sixth National Communication under the UNFCCC, Berne.

FOEN Federal Office for the Environment), 2012: Anpassung an den Klimawandel in der Schweiz, Berne.

Frei, E., Bodin, J. and Walther, G.-R. 2010: Plant species` range shifts in mountainous areas - all uphill from here? Botanica Helvetica 120 (2), 117-128.

Frei, C., Schöll, R., Fukutome, S., Schmidli, J. and Vidale, P.L. 2006: Future change of precipitation extremes in Europe: Intercomparison of scenarios from regional climate models, J. Geophys. Res., 111, D06105, doi:10.1029/2005JD005965.

Frei C. and Schär, C. 2001: Detection probability of trends in rare events: Theory and application to heavy precipitation in the Alpine region. J. Climate, 14, 1568-1584.

Fuhrer, J. 2012: Bewässerungsbedarf und Wasserdargebot unter heutigen und künftigen Klimabedingungen. Zürich, Forschungsanstalt Agroscope Reckenholz-Tänikon ART, 48 pp.

Fuhrer, J., and Calanca, P. 2012: Klimawandel beeinflusst das Tierwohl bei Milchkühen (Climate effects on the wellbeing of dairy cows). Agrarforschung Schweiz 3(3), 132–139.

Geological Risk Maps, 2013: http://geodaten.llv.li/geoshop/naturgefahren/naturgefahren.html

Gehrig-Fasel, J., Guisan, A., and Zimmermann, N. E. 2007: Tree line shifts in the Swiss Alps: Climate change or land abandonment? Journal of Vegetation Science, 18, 571–582.

Hannah, L. 2008: Protected areas and climate change. Annals of the New York Academy of Sciences, 1134, 201–212.

Hasler, A. 2011: Thermal conditions and kinematics of steep bedrock permafrost (PhD thesis, University of Zurich). Zurich, Switzerland.

Haeberli, W., Noetzli, J., Arenson, L., Delaloye, R., Gaertner-Roer, I., Gruber, S., Isaksen, K., Kneisel, C., Krautblatter, M., and Phillips, M. 2010: Mountain Permafrost: development and challenges of a young research field. Journal of Glaciology, 200, 1043-1058(16).

Huggel, C., Allen, S., Deline, P., Fischer, L., Noetzli, J. and Ravanel, L., 2012: Ice thawing, mountains falling—are alpine rock slope failures increasing? Geol. Today 28, 98–104.

Huggel, C. 2009: Recent extreme slope failures in glacial environments: effects of thermal perturbation. Quaternary Science Reviews 28: 1119-1130.

Jakob, A., Binderheim, E., Schädler, M., Pfammatter, F. 2010: Temperaturen in Schweizer Fliessgewässern [Temperatures in Swiss Rivers and Streams]. Gas-Wasser-Abwasser 3/2010: 221-231.

Johnson, H. D. 1994: Animal Physiology. In Griffiths, J. F. (ed.) Handbook of agricultural meteorology, pp. 256–263. New York: Oxford University Press.

Keller, V., Kéry, M., Schmid, H., and Zbinden, N. 2012: Swiss Bird Index SBI®: update 2011. Fiche info. Sempach: Station ornithologique suisse. http:// www.vogelwarte.ch

Körner, C. and Paulsen, J. 2004: A world-wide study of high altitude treeline temperatures. Journal of Biogeography, 31, 713–732.

Lavergne, S., Mouquet, N., Thuiller, W. and Ronce, O. 2010: Biodiversity and climate change: Integrating evolutionary and ecological responses of species and communities. Annual Review of Ecology, Evolution, and Systematics, 41, 321–350.

Lopez Saez, J., Corona, C., Stoffel, M. and Berger, F. 2013: Climate change increases frequency of shallow spring landslides in the French Alps. Geology 41: 619–622.

Lugon, R. and Stoffel, M. 2010: Rockglacier dynamics and magnitude–frequency relations of debris flows in a high-elevation watershed: Ritigraben, Swiss Alps. Global and Planetary Change 73: 202–210.

Maggini, R., Lehmann, A., Kéry, M., Schmid, H., Beniston, M., Jenni, L. et al. 2011: Are Swiss birds tracking climate change? Detecting elevational shifts using response curve shapes. Ecological Modelling, 222, 21–32.

Marty, C. 2008: Regime shift of snow days in Switzerland. Geophysical Research Letters, 35(12), doi:10.1029/2008GL033998.

Meier, E. S., Lischke, H., Schmatz, D. R. and Zimmermann, N. E. 2012: Climate, competition and connectivity affect future migration and ranges of European trees. Global Ecology and Biogeography, 21, 164–178.

MeteoSwiss 2013a: Air temperature standard normals 1981-2010 at 2m above the ground. Federal Office of Meteorology and Climatology MeteoSwiss. (http://www.meteoschweiz.admin.ch/files/kd/normwerte/norm8110/nvrep_tre200m0_en.pdf)

MeteoSwiss 2013b: Air temperature standard nomrals 1961-1990 at 2m above the ground. Federal Office of Meteorology and Climatology MeteoSwiss. (http://www.meteoschweiz.admin.ch/files/kd/normwerte/norm6190/nvrep_tre200m0_en.pdf)

Noetzli, J. and Gruber, S. 2009: Transient thermal effects in Alpine permafrost. The Cryosphere, 3, 85-99.

North, N., Kljun, N., Kasser, F., Heldstab, J., Maibach, M., Reutimann, J., Guyer, M. et al. 2007: Changements climatiques en Suisse - Indicateurs des causes, des effets et des mesures. Etat de l'environnement 0728. Berne: OFEV. http://www.bafu.admin.ch

Office of Forests, Nature and Land Management, 2011: Der Umgang mit unserem Berggebiet – 40 Jahre Integrale Berggebietssanierung

Pasche, A., Gonseth, Y., and Cherix, D. 2007: Recherches sur les Lépidoptères diurnes au Parc National Suisse: résultats principaux. Nationalpark-Forschung in der Schweiz, 94, 89–110.

Pearman, P. B., Guisan, A., and Zimmermann, N. E. 2011: Impacts of climate change on Swiss biodi-versity: An indicator taxa approach. Biological Conservation, 144, 866–875.

Permafrost Web-GIS (Federal Office for the Environment): Permafrost distribution in Switzerland (http://map.bafu.admin.ch/?Y=659850&X=190100&zoom=1&bgLayer=ch.swisstopo.pixelkarte-grau&layers=ch.bafu.permafrost&layers_opacity=0.7&layers_visibility=true&lang=de).

PERMOS 2013: Permafrost in Switzerland 2008/2009 and 2009/2010. Noetzli, J. (ed.), Glaciological Report (Permafrost) No. 10/11 of the Cryospheric Commission of the Swiss Academy of Sciences (in review).

Pinto, JG., Ulbrich, U., Leckebusch, GC., Spangehl, T., Reyers, M. and Zacharias, S. 2007:Changes in storm track and cyclone activity in three SRES ensemble experiments with the ECHAM5/MPIOM1. GCM. Clim Dyn 29:195–210

Rajczak, J., Pall, P. and Schär, C. 2013: Projections of extreme precipitation events in regional climate simulations for Europe and the Alpine Region, J. Geophys. Res. Atmos., 118 (9), 3610-3626, doi:10.1002/jgrd.50297

Revermann, R., Schmid, H., Zbinden, N., Spaar, R., and Schröder, B. 2012: Habitat at the mountain tops: How long can Rock Ptarmigan (Lagopus muta helvetica) survive rapid climate change in the Swiss Alps? A multi-scale approach. Journal of Ornithology, 153, 891–905.

Rosset, V., and Oertli, B. 2011: Freshwater biodiversity under climate warming pressure: Identifying the winners and losers in temperate standing waterbodies. Biological Conservation, 144, 2311–2319.

Scherrer, S.C. and Appenzeller, C. 2006: Swiss Alpine snow pack variability: major patterns and links to local climate and large-scale flow. Climate Research, 32, 187-199.

Schmocker-Fackel, P. and Naef, F. 2010: Changes in flood frequencies in Switzerland since 1500. Hydrol. Earth Syst. Sci. 14, 1-14.

Schneuwly-Bollschweiler, M. and Stoffel, M. 2012: Hydrometeorological triggers of periglacial debris flows – a reconstruction dating back to 1864. Journal of Geophysical Research – Earth Surface 117: F02033.

Serquet, G., Marty, C., Rebetez, M., Dulex, J.P., 2011: Seasonal trends and temperature dependence of the snowfall/precipitation day ratio in Switzerland. Geophysical Research Letters, 38, L07703, doi:10.1029/2011GL046976.

Stöckli, V, Wipf, S, Nilsson, C and Rixen, C. 2011: Using historical plant surveys to track biodiverstiy on mountain summits. Plant Ecology & Diversity 4, 415-425.

Stoffel, M., Mendlik, T., Schneuwly-Bollschweiler, M., and Gobiet, A. (in press): Possible impacts of climate change on debris-flow activity in the Swiss Alps. Climatic Change.

Stoffel, M. and Huggel, C. 2012: Effects of climate change on mass movements in mountain environ-ments. Progress in Physical Geography 36: 421–439.

Stoffel, M. 2010: Magnitude-frequency relationships of debris flows – A case study based on field surveys and tree-ring records. Geomorphology 116: 67–76.

Thom E. C. 1958: The discomfort index. Weatherwise 12, 57–60.

Vitasse, Y., Hoch, G., Randin, C.F., Lenz, A., Kollas, C., Körner, C. 2012: Tree recruitment of European tree species at their current upper elevational limits in the Swiss Alps. Journal of Biogeography 39: 1439–1449.

Vittoz, P., Cherix, D., Gonseth, Y., Lubini, V., Maggini, R., Zbinden, N., & Zumbach, S. 2013: Climate change impacts on biodiversity in Switzerland: A review. Journal for Nature Conservation 21(3), 154–162.

Vittoz, P., Dussex, N., Wassef, J., & Guisan, A. 2009: Diaspore traits discriminate good from weak colonisers on high-elevation summits. Basic and Applied Ecology, 10, 508–515.

Vittoz, P., Rulence, B., Largey, T., and Frelechoux, F. 2008: Effects of climate and land-use change on the establishment and growth of cembran pine (Pinus cembra L.) over the altitudinal treeline ecotone in the Central Swiss Alps. Arctic Antarctic and Alpine Research, 40, 225–232.

Walther, G.-R. 2010: Community and ecosystem responses to recent climate change. Philosophical Trans-actions of the Royal Society B: 365: 2019-2024.

7. Financial resources and transfer of technology

The following chapter also serves to provide information as required by Art. 10 lit f) of the Kyoto Protocol.

7.1 Assistance to developing country Parties that are particularly vulnerable to climate change

Liechtenstein takes its international humanitarian responsibility seriously. Solidarity with poor countries and with countries affected by disasters and armed conflicts is a traditional focus of Liechtenstein's foreign policy. The operational tasks of International Humanitarian Cooperation and Development (IHCD) are carried out by the Office for Foreign Affairs, the Immigration and Passport Office and the Liechtenstein Development Service (LED). The overall coordination of the IHCD activities lies with the Office for Foreign Affairs.

IHCD encompasses all forms of the humanitarian and development policy of the State of Liechtenstein and of the LED (a foundation under private law). These activities are set out in the Law on International Humanitarian Cooperation and Development (IHCD Act) of 2007. Liechtenstein's engagement focuses on emergency and reconstruction assistance, international refugee and migration assistance as well as bilateral and multilateral development cooperation.

Liechtenstein works closely together with the affected population and local organizations, with aid and development organisations in Liechtenstein, Switzerland, Austria and Germany as well as with European and international organisations. Liechtenstein, through its IHCD, maintains working relationships with a large number of partners. The bulk of Liechtenstein's support is provided in the form of financial resources. Nevertheless, the LED maintains three coordination offices on the ground, namely in Moldova, Bolivia and Zimbabwe from where it can directly supervise its projects.

Emergency and reconstruction assistance encompasses measures aimed at immediately saving human lives during and after political crises, armed conflicts and natural disasters and at alleviating the suffering of the people affected. In addition, the establishment of infrastructures creates the preconditions for further social and economic development in these regions. Urgent measures include the provision of food, tents, blankets, and ovens. The repair of houses, schools, hospitals, water supply lines, and similar elementary infrastructure already serves the purpose of reconstruction. Emergency and reconstruction assistance aid also seeks to prevent acute emergency situations by way of targeted preventive measures and pays special attention to so-called forgotten conflicts and emergency situations. The IHCD Act promotes solidarity of the Liechtenstein population, allowing donations by Liechtenstein aid organizations and of private persons to be supplemented by public IHCD funds.

The central concern of **international refugee and migration assistance** is to support affected persons in improving their living conditions and promoting the self-responsible conduct of their life and the optimal utilization of their potentials. It includes measures for integration of returnees including education, health, municipal and community development, protection of minorities and reconciliation. Worldwide, international refugee and migration assistance advocates on behalf of an improvement of refugee and migration regimes. It supports countries of origin and destination in their search for permanent solutions and the development of appropriate structures to improve the long-term situation of refugees and migrants. Immigration and migration assistance also promotes compliance with international legal, human

rights, and humanitarian standards in connection with migration and combats inhuman practices such as people smuggling and trafficking.

Development cooperation aims at a sustainable and comprehensive development of disadvantaged and marginalized regions of the world. **Bilateral development cooperation** is the oldest and most significant pillar of Liechtenstein IHCD and concentrates on the development of rural regions in 12 priority countries and attaches particular importance in all its activities to the empowerment of women, social justice and the environment. Bilateral development is carried out by the Liechtenstein Development Service (LED), a foundation under private law, on the basis of a service agreement with the Liechtenstein Government. **Multilateral development cooperation** tackles problems, which – due to their complexity, political sensitivity, or global or cross-border relevance – necessitate a common engagement of countries, peoples and organizations.

An intact environment and the sustainable development and use of natural resources are necessary preconditions for the social and economic development of a region. Not only the shortage of certain natural resources, but also the lack of access to these resources constitutes a growing problem for many poor regions. IHCD seeks to protect the environment and natural resources as a basis of life also for coming generations. Of particular note from the perspective of environmental policy is Liechtenstein's engagement through financial and human resources, such as the provision of experts and the promotion of sustainable mountain region development in the Carpathians, the Caucasus, and Central Asia.

7.2 Provision of financial resources, including financial resources under Article 11 of the Kyoto Protocol

In 2012, Liechtenstein IHCD had resources in the amount of about 25.8 million Swiss francs, i.e. about 700 Swiss francs per capita. The total Official Development Assistance (ODA) amount was 26.8 million Swiss francs. The most recent ODA-percentage for the year 2010 is 0.62%.

An overview of Liechtenstein's financial contributions as part of its International Humanitarian Cooperation and Development in 2012 can be found in the 2012 Annual Report of the Government to Parliament (pp. 75-80)[3]. The following table provides an overview of contributions related to the environment in 2012.

Type of contribution	**Partner**	**Amount (CHF)**
Basel Convention: annual contribution	UNEP	470
Capacity Building in Armenia, Azerbaidzhan and Georgia	REC Caucasus	41'952
Climate Convention: annual contribution	UNFCCC	1'641
Contribution to an energy efficient kindergarten in Georgia	UNDP	55'292
Contribution to an energy efficient kindergarten in Arsha/Georgia	Community & Environment (C&E)	16'892
Contribution to an energy efficiency project in Kirgizstan, Kazakhstan and Tadzhikistan	Central Asia Mountain Partnership (CAMP)	97'600

[3] See http://www.llv.li/pdf-llv-rk_rb2012_rechenschaftsbericht_gesamt.pdf (in German).

Contribution to an energy efficient school in Ganja/Azerbaidzhan	C&E	46’682
Contribution to erosion control and reforestations projects in Georgia	Various	100’006
Contribution to the improvement of water supply and erosion control in Tadzhikistan	Various	30’000
Contribution to International Renewable Energy Agency	IRENA	1’865
Contribution to the EMEP Trust Fund	UNECE	432
Contribution to the reconstruction and lining of the Kaparchina river (Georgia)	Various	74’906
Contribution to various energy efficient schools in Armenia and Azerbaidzhan	Various	114’199
Convention on Biological Diversity: annual contribution	UNEP	1’275
Convention on Long-range Transboundary Air Pollution: annual contribution	UNECE	395
Convention on the Conservation of Migratory Species of Wild Animals (CMS): annual contribution	UNEP	359
Energy and reforestation in Burkina Faso	SolidarSuisse	150’000
Erosion control and reforestation in Georgia	C&E	97’600
International Council for Game and Wildlife Conservation (CIC): annual contribution	CIC	2’189
Kyoto Protocol: annual contribution	UNFCCC	992
Multilateral fund of the Montreal Protocol (Ozone Fund): annual contribution	UNEP	14’084
Permanent Secretariat of the Alpine Convention: annual contribution	Secretariat of the Alpine Convention	21’344
Ramsar Convention: annual contribution	IUCN	1'000
Rotterdam Convention: annual contribution	UNEP	196
Stockholm Convention: annual contribution	UNEP	826
UNCCD: annual contribution	UNCCD	780
UNEP: annual contribution / Environment Fund	UNEP	8’370
Water and Energy saving project in Tansania	Liechtenstein Development Service (LED)	18’000
World Conservation Union (IUCN): annual contribution	IUCN	15’096
TOTAL		**914’443**

Table 7-1: Overview of the most important contributions as part of Liechtenstein's international engagement in environmental protection, 2012

Multilateral contributions

	Multilateral contributions (CHF) (SDC only)			
	2009	2010	2011	2012
Multilateral institutions:				
1. European Bank for Reconstruction and Development (EBRD)	**0**	**8'667**	**0**	**0**
2. United Nations Development Programme (UNDP)	**240'000**	**250'000**	**150'000**	**235'292**
3. UNEP	**33'859**	**34'855**	**31'545**	**25'580**
4. UNFCCC (Kyoto Adaptation Fund)	**11'857**	**3'354**	**2'145**	**2'633**
5. UNCCD	**6'221**	**6'147**	**5'955**	**5'780**
6. International Union for the Conservation of Nature (IUCN)	**15'652**	**15'828**	**15'991**	**16'096**
Total	**307'586**	**318'851**	**205'636**	**285'381**

Summary of information on financial resources and technology transfer

Official development assistance (ODA in 2012)	**26'781'303 CHF**
Climate-related aid in bilateral ODA	
Climate-related support programmes	
Contributions to GEF (USD million)	
Pledge for third GEF replenishment	
Activities implemented jointly	
JI and CDM under the Kyoto Protocol (2008 – 2012)	**7'920'000 CHF**
JI and CDM under the Kyoto Protocol (2013 – 2020)	**tbd**
Other (bilateral/multilateral)	

Abbreviations: CDM = clean development mechanism, GEF = Global Environment Facility, JI = joint implementation.

Table 7-2: Multilateral contributions

7.3 Activities related to transfer of technology

In connection with the protection and preservation of the environment, Liechtenstein as an Alpine country is particularly engaged on behalf of the development of mountain regions. Under the umbrella of the Alpine Convention, Alpine countries cultivate a partnership with mountain regions in the Balkans, the Carpathians, the Caucasus, and Central Asia.

Project / programme title: Water and Energy Saving Project, Tansania

Goal: Improvement of food security through adapted water and energy saving irrigation technologies

Recipient country	Sector	Total funding	Years in operation
Tansania	Irrigation Technology	CHF 260'000	2

Description:

- Food security through small irrigation system (pepal pump)
- Provide access to so called swiss-PEP irrigation technology for local peasants

Expected added value of the programme:

- Pedal pumps are produced locally
- Operation of pedal pumps is largely CO_2 neutral
- Improvement of food security and reduction of CO_2 emissions

Technology transferred:

- Transfer of swiss-PEP irrigation technology

Impact on greenhouse gas emissions/sinks: Reduction of 5'850 t of CO_2 per year

Liechtenstein Development Service, LED (2012)

8. Research and systematic observation

8.1 General policy on research and systematic observation

8.1.1 Basic research

The Alpine Rhine Valley is an ideal object for interdisciplinary, scientifically challenging, practice-oriented and regionally anchored research projects. In line with its official mission, the University of Liechtenstein conducts application-oriented research in selected research areas. Around 1200 students from over 40 countries provide an international atmosphere to the small university in the Alpine Rhine Valley. Primary responsibility for research lies with the institutes and associated institutes.

Two of the University's institutes (Institute for Architecture and Planning and Institute for Financial Services) are directly involved in the examination of sustainable and ecological developments within their specific fields of activities.

One of the main focus points of the Institute for Architecture is the establishment of concepts for a sustainable regional development with respect to settlement, transport and landscape.

The Institute for Financial Services examines the impacts, challenges and opportunities of these markets, as they have an impact on social or environmental developments, as for example micro finance or carbon markets. In the context of natural scientific research on the country, national authorities and private organizations are also collaborating with foreign university research facilities and institutes. The goal is to gain ecological insights on a scientific basis that constitute a basis for formulating a sustainable development policy in conjunction with insights gained from economic and socio-cultural surveys and research.

Liechtenstein supports research activities abroad by annual contributions in the total amount of 250,000 CHF (2013) each to Switzerland (Swiss National Science Foundation, SNSF) and Austria (Austrian Science Fund, FWF). As a member of the EEA, Liechtenstein also participates in the European research programs (7th Framework Program on Research, 11.7 million CHF from 2007 to 2013).

8.1.2 Technological research

Public institutions in Liechtenstein are also indirectly engaged in technology research. The University of Liechtenstein contributes a budget of 10.8 million CHF (2012) to the training of experts and 3 million CHF (2012) to research as a base amount. Approximately 2/3 of these sums are dedicated to economic institutes and 1/3 to the institute of architecture and spatial planning. As one of the co-owners Liechtenstein also supports the Interstate University of Applied Sciences of Technology Buchs (NTB) with an annual contribution of 1.1 million CHF (2012).

Liechtenstein envisages contributing another 200'000 CHF annually (from 2014) to the establishment of Rhysearch Innovation Center – a center of research and development, based in neighboring Buchs, Switzerland. The activities of Rhysearch are dedicated to small and midsized enterprises within the Rhine valley and focus amongst others on the development of new energy systems.

8.1.3 Direct international engagement

Liechtenstein is engaged in several collaborations with its neighboring States and with international bodies and advocates cross-border coordination of land use planning. Liechtenstein is involved in the Interreg III B program "Alpine Space". Through the various Interreg projects, Liechtenstein supports the focus areas of

water protection (including agricultural measures), transportation and joint monitoring of air pollutant emissions in the Lake Constance region. Due to its small size, the country's focus is on regional linkages. Liechtenstein is in contact with Switzerland, Austria and Germany through various international agreements.

The University of Liechtenstein in Vaduz, the Federal Institute for Forest, Snow and Landscape Research (WSL) in Birmensdorf and the University of Innsbruck have entered into a cooperation agreement to conduct research projects in the field of Architecture and Sustainable Planning within the Alpine Rhine Valley.

8.2 Research

In 2013 the Institute for Architecture and Planning took the lead in an international research project that focuses on the development of a transparent solar collector combined with an innovative indoor air conditioning system (FLUIDGLASS). The project runs from 2013 to 2017 and is supported by the European Commission. Organizations that also contribute to the development of FLUIDGLASS include the Buchs NTB Interstate University of Applied Sciences (Switzerland), the Technical University of Munich and the University of Stuttgart (Germany) as well as the National Institute of Solar Energy in Chambéry (France).

The Institute for Architecture and Planning also holds the “Chair for Sustainable Spatial Development”, which is involved in the "Alpstore” research project (2012 – 2014). The project seeks strategies to use a variety of mobile and stationary storage systems to allow for extended accessibility and integration of renewable energies in the alpine region. Besides this project the institute is engaged in several other research initiatives such as the Interreg supported "BAER– Bodensee/Lake Constance–Alpine Rhine Valley Energy and Climate Region", a consortium effort by five regional universities, the completed „Renewable Liechtenstein" model development, and a series of projects which deal with urban and landscape integrated solutions for the autonomous supply of renewable energy. Based on the outcome of these research projects, recommendations will be formulated for planners and policy makers.

The Institute for Financial Services is also involved in several research projects that cover the environmental and social aspects of financial markets. The institute holds the “Chair of Company, Foundation and Trust Law”, which currently explores the need for an appropriate legal framework of philanthropic activities in the non-profit-sector (since 2010). From 2011 to 2013 the Institute for Financial Services (“Chair in Business Administration, Banking and Financial Management”) concluded a research project exploring options for the improvement of social impacts within microfinance by the combination with carbon markets. Based on the conclusion a concrete project is currently under implementation.

The Institute of Financial Services is also representing the University of Liechtenstein within the board of LIFE Climate Foundation, a non-for-profit organization that aims at the promotion of a sustainable and credible advancement of climate and environmental protection through an effective inclusion of financial intermediaries and the general public.

8.3 Systematic observation

Liechtenstein collects a wide range of data relating to climate, both through its own measuring stations and through interregional cooperation, especially with Switzerland. The data is fed into the Global Climate Observing System (GCOS). Since 1974, the largest measuring station in the country has been in operation in Vaduz, measuring the usual meteorological data (air pressure, air temperature, relative humidity, wind direction, wind strength, precipitation, sunshine duration, etc.).

A private company has also measured similar data at several locations since 1997. Since 1970, the Office of Civil Protection has measured snow depth at around 10 locations (2013). Since the 1960's, the Office of Environment has taken water samples at various locations to monitor quality and determine the groundwater table.

Since 2001 the Eastern Swiss cantons and Liechtenstein execute a monitoring procedure on joint emissions of air pollutants in order to measure the quality of air, OSTLUFT. The cooperation under OSTLUFT is founded on a contractual basis. The organization's main purpose is the management of several data measuring and evaluation centers in the OSTLUFT region.

Another system for systematic observation is currently developed by the Office of Environment. Its purpose is to manage the increasing amount of environmental procedures. The planned system aims at centralizing environmental data collections (eg. GHG emissions, air pollution etc.) in order to provide the competent authorities with necessary information required for the various legal procedures.

However, due to its size and the limited resources within the national administration Liechtenstein's engagement with regard to research and systematic observation that address international activities is very limited.

References

Gantner-Stokar, R., 1997: Erhebung von Klima– und Wetterdaten in Liechtenstein.

Huber, M and Schäpper, S. Georaphic Data Warehouse to Consilidate Despersed Environmental Information (2008)

Liechtenstein University of Liechtenstein: http://www.uni.li

LIFE Climate Foundation Liechtenstein (2013), www.climatefoundation.li

OSTLUFT – die Luftqualitätsüberwachung der Ostschweizer Kantone und des Fürstentum Liechtensteins, http://www.ostluft.li

9. Education, training and public awareness

9.1 Education at schools

The Ministry of Education is responsible for the coordination of education. Relevant legislative provisions are the Education Act, the Vocational Education and Training Act and the Higher Education Act along with the corresponding ordinances.

Since 2005 environmental education officially forms part of Liechtenstein's all-encompassing educational program. Its origin is to be found on the national curriculum for Kindergarten, Primary and Secondary School of the Principality of Liechtenstein (2005, 2nd Edition). As one out of several reasons for the faculty of "Human and Environment" (topics are, among others: Climate, Weather, Economy, Industrialization) the respective curriculum states: "Students deal with humans as part of society and environment. They recognize dependencies as well as the possibility to act for or to influence relevant procedures. Thanks to this approach environmental education influences the content of various school subjects – it is not only a part of subjects like "Biology" or "Nature" (ecology) but also of "Economy and Policy" (ecological and economic relations).

In addition to the abovementioned, the Government has set eco-friendly office and school supply goals: A specific catalogue recommends eco-friendly office and school supplies to teachers (paper, notebooks, writing implements, etc.). Moreover various school projects on environmental education were conducted at Liechtenstein schools. These included:

Environmental volunteering (or focal points) at various schools: Teachers are exempted from one teaching period in exchange for assuming responsibility for instruction on environmental issues. The environmental focal points initiate and support concrete environmental projects at their schools. This has resulted in forest days, school gardens, environmentally friendly recess areas, field trips, and much more.

Various other support activities: With the publication of various teaching materials (e.g., "School on the Farm"), the organization of specific continuing education courses for teachers, etc. The Office of Education promotes environmental consciousness that fulfills the goals of the new curriculum, several national and international events covering environmental topics are organized on a regular basis within Liechtenstein schools, for example participation within the "Youth Parliament of the Alpine Convention" (YPAC, 2012), Organization of Environment Days in June, etc. .

The Institute for Architecture and Planning (University of Applied Science) offers a concrete climate, energy and environmentally relevant education with the Urban Sustainability, Climate and Planning Education (short UrbanSCAPE) program. It provides an in-depth, English language Master's level program, anchored with the goal of climate protection and energy autonomy in space planning.

The Institute for Financial Services has introduced a Focus on environmental commodities within its Department of Banking and Financial Management. The Institute's intention is to strengthen academic education in the field of social and responsible investments in the future.

Education at schools will also become a topic with regard to climate related capacity building support in developing countries. The Government will examine these aspects (capacity building, public awareness) in the framework of Liechtenstein's engagement within its climate finance activities. The concrete goals within Liechtenstein's climate finance will be formulated in the course of 2014 and be incorporated into the Government's revised National Climate Strategy.

9.2 Public outreach

Public outreach is the responsibility of the administrative office assigned to the area in question. In addition, some tasks are delegated to external institutions and individual outreach campaigns by NGOs are supported.

The Government also supports initiatives and projects in the field of environmental protection:

- In 2010 an architectural competition for projects that serve as showcases within the field of sustainable housing and renovations of old buildings throughout the alpine region was launched. In 2013 the Government continued the competition together with the Swiss Federal Office of Spatial Development, the University of Liechtenstein and the International Alpine Convention, CIPRA. The new cooperation created the international reward for architecture „Constructive Alps“ with a price worth 50‘000,- Euro.
- Further financial support was provided to the Implementation of a personal carbon footprint program within the framework of a social networking platform (KLIMACODE).

The population is also provided with information on individual environmental concerns through reports in the newspapers. Research and survey results concerning the condition of the mountain region and information on environmental developments and changes are regularly brought to the attention of the public by authorities and public authorities via publication series, thematic brochures, posters, and reports in newspapers. Specialized excursions with school classes, population groups, and professional organizations conducted by various authorities constitute an important component of public outreach. An audit is currently under development with the goal of improving the compatibility of winter sports facilities with the landscape and the environment.

The Office of Environment annually distributes an environmental protection calendar to the public. Each year, the environmental protection calendar focuses on a different environmental topic. School children participate in the production process of the calendar, by asking them to contribute a drawing to the calendar's theme. In this way, children are already sensitized to the environment.

Through the establishment of an emissions register and the network of measuring stations mentioned in chapter 8, the population can be provided with precise information on the pollutant emissions of individual facilities and vehicles. The compiled data will be published each year in a report.

9.3 Cooperation with private institutions and NGOs

Since 2012 the Government provides financial support to LIFE Climate Foundation Liechtenstein (established in 2009) on a regular basis. The Non-for-Profit foundation therefore concluded a cooperation agreement with the Swiss Climate Foundation. Since 2012 Liechtenstein based SMEs are eligible to apply for financial (upfront) support if they implement efficiency measures or if they seek financial help for the development of innovative projects that demonstrate a GHG mitigation impact. Additionally, LIFE Climate Foundation aims to further strengthen public awareness by organizing respective events and workshops wich cover the topics climate change and other ecological topics.

The foundation acts within the framework of a real Public-Private Partnership. The participation of representatives from the country’s economy as well as from science and policy sectors provide important access to the relevant players and driving forces within environmental and carbon markets. The close cooperation with the University of Liechtenstein’s Institute for Financial Services offers the possibility to examine environmental questions related to financial issues on an academic basis. Further information is available on www.climatefoundation.li .

Various institutions are also engaged in public information and education. In particular, these include the Liechtenstein Environmental Protection Society (www.lgu.li), the Solar Society (www.solargenossenschaft.li) and the Liechtenstein Transport Association (www.vcl.li).

Another important institution in this field is CIPRA (International Commission for the Protection of the Alps), which is headquartered in Liechtenstein and publishes the "Summary Academy on the Alps" each year since 1998. The Summer Academy is a valuable continuing education program for young people with a university or technical college degree who are interested in an interdisciplinary, transnational approach to Alpine issues. The Summer Academy consists of a three-week basic course on the Alps and an optional four-week practice-oriented project component. Experts from all the Alpine countries are hired as instructors. The State of Liechtenstein supports this project financially.

Reference

Youth Parliament of the Alpine Convention, http://www.lg-vaduz.li/Angebote/YPACJugendparlament/tabid/168/Default.aspx

Lehrplan für das Fürstentum Liechtenstein: Kindergarten, Primarschule, Sekundarstufe I; 2013; 2. Auflage

LIFE Climatefoundation, www.climatefoundation.li (2013)

Swiss Climate Foundation, www.climatefoundation.ch (2013)

Annex

Annex 1: Summary and trend tables for Liechtenstein's Greenhouse Gas Inventory

Summary 1.A: Summary Report for National Greenhouse Gas Inventories (2011)

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A) (Sheet 1 of 3)

Inventory 2011
Submission 2013 v1.1
LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/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	**177.76**	**0.73**	**0.04**	**127.71**	**8.73**	**0.74**	**0.07**	**0.00**	**0.00**	**NA,NE,NO**	**0.01**	**0.21**	**NA,NE,NO**
1. Energy	**184.04**	**0.09**	**0.00**							**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**
A. Fuel Combustion — Reference Approach[2]	184.10												
A. Fuel Combustion — Sectoral Approach[2]	184.04	0.05	0.00							NE,NO	NE,NO	NE,NO	NE,NO
1. Energy Industries	2.89	0.00	0.00							NE	NE	NE	NE
2. Manufacturing Industries and Construction	19.31	0.00	0.00							NE,NO	NE,NO	NE,NO	NE,NO
3. Transport	78.76	0.01	0.00							NE,NO	NE,NO	NE,NO	NE,NO
4. Other Sectors	79.16	0.03	0.00							NE	NE	NE	NE
5. Other	3.92	0.00	0.00							NE,NO	NE,NO	NE,NO	NE,NO
B. Fugitive Emissions from Fuels	NA,NO	0.05	NA,NO							NA,NO	NA,NO	NA,NO	NA,NO
1. Solid Fuels	NA,NO	NA,NO	NA,NO							NA,NO	NA,NO	NA,NO	NA,NO
2. Oil and Natural Gas	NA,NO	0.05	NA,NO							NA,NO	NA,NO	NA,NO	NA,NO
2. Industrial Processes	**NO**	**NO**	**NO**	**127.71**	**8.73**	**0.74**	**0.07**	**0.00**	**0.00**	**NA,NO**	**0.01**	**0.02**	**NA,NO**
A. Mineral Products	NO	NO	NO							NO	0.01	0.02	NO
B. Chemical Industry	NO	NO	NO	NA	NA	NA	NA	NA	NA	NA,NO	NA,NO	NA,NO	NA,NO
C. Metal Production	NO	NO	NO				NO		NO	NO	NO	NO	NO
D. Other Production[3]	NO									NO	NO	NO	NO
E. Production of Halocarbons and SF_6					NA,NO		NA,NO		NO				
F. Consumption of Halocarbons and SF_6				127.71	8.73	0.74	0.07	0.00	0.00				
G. Other	NO	NO	NO	NO	NA,NO	NO	NA,NO	NO	NO	NO	NO	NO	NO

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

Note: All footnotes for this table are given at the end of the table on sheet 3.

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A)
(Sheet 2 of 3)

Inventory 2011
Submission 2013 v1.1
LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/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)			
3. Solvent and Other Product Use	**0.73**		**0.00**							**NO**	**NO**	**0.19**	**NO**
4. Agriculture		**0.61**	**0.03**							**NA,NO**	**NA,NO**	**NA,NE,NO**	**NO**
A. Enteric Fermentation		0.51											
B. Manure Management		0.10	0.00									NE,NO	
C. Rice Cultivation		NA,NO										NA,NO	
D. Agricultural Soils[4]		NA,NO	0.03									NA,NE,NO	
E. Prescribed Burning of Savannas		NA	NA							NO	NO	NO	
F. Field Burning of Agricultural Residues		NA,NO	NA,NO							NA,NO	NA,NO	NA,NO	
G. Other		NA	NA							NA	NA	NA	NO
5. Land Use, Land-Use Change and Forestry	[5] **-7.04**	**NO**	**0.00**							**NE,NO**	**NE,NO**	**NE,NO**	**NO**
A. Forest Land	[5] -19.96	NO	NO							NE,NO	NE,NO	NE	
B. Cropland	[5] 4.59	NO	0.00							NO	NO	NE	
C. Grassland	[5] 3.18	NO	NO							NO	NO	NE	
D. Wetlands	[5] 0.22	NO	NO							NO	NO	NE	
E. Settlements	[5] 3.77	NO	NO							NO	NO	NE	
F. Other Land	[5] 1.15	NO	NO							NO	NO	NE	
G. Other	[5] NO	NO	NO							NO	NO	NO	NO
6. Waste	**0.03**	**0.03**	**0.00**							**NA,NO**	**NA,NO**	**NA,NO**	**NA**
A. Solid Waste Disposal on Land	[6] NO	0.00								NO	NO	NO	
B. Waste-water Handling		0.00	0.00							NA,NO	NA,NO	NA,NO	
C. Waste Incineration	[6] 0.03	0.00	0.00							NA	NA	NA	NA
D. Other	NO	0.03	0.00							NA	NA	NA	NA
7. Other *(please specify)* [7]	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Other non-specified	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Note: All footnotes for this table are given at the end of the table on sheet 3.

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A) (Sheet 3 of 3)

Inventory 2011
Submission 2013 v1.1
LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs		PFCs		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)				(Gg)					
Memo Items: [8]													
International Bunkers	**0.83**	**0.00**	**0.00**							**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**
Aviation	0.83	0.00	0.00							NE	NE	NE	NE
Marine	NA,NO	NA,NO	NA,NO							NO	NO	NO	NO
Multilateral Operations	**NO**	**NO**	**NO**							**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass	**21.22**												

[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 the documentation box to Table 1.A.(c). For estimating national total emissions, the results from the Sectoral approach should be used, where possible.

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

[4] Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

[5] For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

[6] CO_2 from source categories Solid Waste Disposal on Land and Waste Incineration should only be included if it stems from non-biogenic or inorganic waste streams. Only emissions from Waste Incineration Without Energy Recovery are to be reported in the Waste sector, whereas emissions from Incineration With Energy Recovery are to be reported in the Energy sector.

[7] If reporting any country-specific source category under sector "7. Other", detailed explanations should be provided in Chapter 9: Other (CRF sector 7) of the NIR.

[8] Countries are asked to report emissions from international aviation and marine bunkers and multilateral operations, as well as CO_2 emissions from biomass, under Memo Items. These emissions should not be included in the national total emissions from the energy sector. Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO_2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO_2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector.

Summary 1.B: Short Summary Report for National Greenhouse Gas Inventories (2011)

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

Inventory 2011
Submission 2013 v1.1
LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		Net CO_2 emisions/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		**177.76**	**0.73**	**0.04**	**127.71**	**8.73**	**0.74**	**0.07**	**0.00**	**0.00**	**NA,NE,NO**	**0.01**	**0.21**	**NA,NE,NO**
1. Energy		**184.04**	**0.09**	**0.00**							**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**
A. Fuel Combustion	Reference Approach[2]	184.10												
	Sectoral Approach[2]	184.04	0.05	0.00							NE,NO	NE,NO	NE,NO	NE,NO
B. Fugitive Emissions from Fuels		NA,NO	0.05	NA,NO							NA,NO	NA,NO	NA,NO	NA,NO
2. Industrial Processes		**NO**	**NO**	**NO**	**127.71**	**8.73**	**0.74**	**0.07**	**0.00**	**0.00**	**NA,NO**	**0.01**	**0.02**	**NA,NO**
3. Solvent and Other Product Use		**0.73**		**0.00**							**NO**	**NO**	**0.19**	**NO**
4. Agriculture [3]			**0.61**	**0.03**							**NA,NO**	**NA,NO**	**NA,NE,NO**	**NO**
5. Land Use, Land-Use Change and Forestry		[4] **-7.04**	**NO**	**0.00**							**NE,NO**	**NE,NO**	**NE,NO**	**NO**
6. Waste		**0.03**	**0.03**	**0.00**							**NA,NO**	**NA,NO**	**NA,NO**	**NA**
7. Other		**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo Items: [5]														
International Bunkers		**0.83**	**0.00**	**0.00**							**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**
Aviation		0.83	0.00	0.00							NE	NE	NE	NE
Marine		NA,NO	NA,NO	NA,NO							NO	NO	NO	NO
Multilateral Operations		**NO**	**NO**	**NO**							**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass		**21.22**												

Note: A = Actual emissions based on Tier 2 approach of the IPCC Guidelines.
P = Potential emissions based on Tier 1 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 the documentation box to Table 1.A.(c). For estimating national total emissions, the result from the Sectoral approach should be used, where possible.

[3] Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

[4] For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

[5] Countries are asked to report emissions from international aviation and marine bunkers and multilateral operations, as well as CO_2 emissions from biomass, under Memo Items. These emissions should not be included in the national total emissions from the energy sector. Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO_2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO_2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector.

Summary 2: Summary Report for CO_2 Equivalent Emissions (1990)

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 1990
Submission 2013 v1.1
LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**193.63**	**14.35**	**12.88**	**0.00**	**NA,NO**	**NA,NO**	**220.87**
1. Energy	**201.53**	**1.10**	**1.15**				**203.78**
A. Fuel Combustion (Sectoral Approach)	201.53	0.78	1.15				203.46
1. Energy Industries	0.12	0.00	0.05				0.18
2. Manufacturing Industries and Construction	35.23	0.04	0.06				35.33
3. Transport	75.37	0.55	0.77				76.69
4. Other Sectors	88.44	0.19	0.24				88.87
5. Other	2.36	0.00	0.03				2.39
B. Fugitive Emissions from Fuels	NA,NO	0.32	NA,NO				0.32
1. Solid Fuels	NA,NO	NA,NO	NA,NO				NA,NO
2. Oil and Natural Gas	NA,NO	0.32	NA,NO				0.32
2. Industrial Processes	**NO**	**NO**	**NO**	**0.00**	**NA,NO**	**NA,NO**	**0.00**
A. Mineral Products	NO	NO	NO				NO
B. Chemical Industry	NO	NO	NO	NA	NA	NA	NA,NO
C. Metal Production	NO	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 [2]				0.00	NO	NO	0.00
G. Other	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**1.55**		**0.47**				**2.02**
4. Agriculture		**12.57**	**10.38**				**22.96**
A. Enteric Fermentation		10.42					10.42
B. Manure Management		2.16	1.21				3.37
C. Rice Cultivation		NA,NO					NA,NO
D. Agricultural Soils [3]		NA,NO	9.17				9.17
E. Prescribed Burning of Savannas		NA	NA				NA
F. Field Burning of Agricultural Residues		NA,NO	NA,NO				NA,NO
G. Other		NA	NA				NA
5. Land Use, Land-Use Change and Forestry [1]	**-9.47**	**NO**	**0.01**				**-9.46**
A. Forest Land	-19.99	NO	NO				-19.99
B. Cropland	4.44	NO	0.01				4.45
C. Grassland	1.91	NO	NO				1.91
D. Wetlands	0.16	NO	NO				0.16
E. Settlements	3.58	NO	NO				3.58
F. Other Land	0.44	NO	NO				0.44
G. Other	NO	NO	NO				NO
6. Waste	**0.03**	**0.67**	**0.87**				**1.58**
A. Solid Waste Disposal on Land	NO	0.22					0.22
B. Waste-water Handling		0.05	0.79				0.83
C. Waste Incineration	0.03	0.01	0.00				0.04
D. Other	NO	0.40	0.08				0.49
7. Other *(as specified in Summary 1.A)*	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

Memo Items: [4]							
International Bunkers	0.43	0.00	0.00				0.43
Aviation	0.43	0.00	0.00				0.43
Marine	NA,NO	NA,NO	NA,NO				NA,NO
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**5.67**						**5.67**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	230.33
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	220.87

[1] For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

[2] Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

[3] Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

[4] See footnote 8 to table Summary 1.A.

Summary 2: Summary Report for CO_2 Equivalent Emissions (2011)

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 2011
Submission 2013 v1.1
LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**177.76**	**15.39**	**13.05**	**8.73**	**0.07**	**0.01**	**215.02**
1. Energy	**184.04**	**1.99**	**1.05**				**187.08**
A. Fuel Combustion (Sectoral Approach)	184.04	0.96	1.05				186.05
1. Energy Industries	2.89	0.03	0.08				3.00
2. Manufacturing Industries and Construction	19.31	0.03	0.03				19.36
3. Transport	78.76	0.16	0.60				79.53
4. Other Sectors	79.16	0.73	0.29				80.19
5. Other	3.92	0.00	0.05				3.97
B. Fugitive Emissions from Fuels	NA,NO	1.03	NA,NO				1.03
1. Solid Fuels	NA,NO	NA,NO	NA,NO				NA,NO
2. Oil and Natural Gas	NA,NO	1.03	NA,NO				1.03
2. Industrial Processes	**NO**	**NO**	**NO**	**8.73**	**0.07**	**0.01**	**8.81**
A. Mineral Products	NO	NO	NO				NO
B. Chemical Industry	NO	NO	NO	NA	NA	NA	NA,NO
C. Metal Production	NO	NO	NO	NO	NO	NO	NO
D. Other Production	NO						NO
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				8.73	0.07	0.01	8.81
G. Other	NO	NO	NO	NA,NO	NA,NO	NO	NA,NO
3. Solvent and Other Product Use	**0.73**		**0.27**				**0.99**
4. Agriculture		**12.74**	**10.63**				**23.37**
A. Enteric Fermentation		10.72					10.72
B. Manure Management		2.02	1.38				3.40
C. Rice Cultivation		NA,NO					NA,NO
D. Agricultural Soils [3]		NA,NO	9.25				9.25
E. Prescribed Burning of Savannas		NA	NA				NA
F. Field Burning of Agricultural Residues		NA,NO	NA,NO				NA,NO
G. Other		NA	NA				NA
5. Land Use, Land-Use Change and Forestry [1]	**-7.04**	**NO**	**0.01**				**-7.03**
A. Forest Land	-19.96	NO	NO				-19.96
B. Cropland	4.59	NO	0.01				4.61
C. Grassland	3.18	NO	NO				3.18
D. Wetlands	0.22	NO	NO				0.22
E. Settlements	3.77	NO	NO				3.77
F. Other Land	1.15	NO	NO				1.15
G. Other	NO	NO	NO				NO
6. Waste	**0.03**	**0.66**	**1.09**				**1.78**
A. Solid Waste Disposal on Land	NO	0.01					0.01
B. Waste-water Handling		0.07	0.97				1.03
C. Waste Incineration	0.03	0.01	0.00				0.04
D. Other	NO	0.58	0.12				0.70
7. Other *(as specified in Summary 1.A)*	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

Memo Items: [4]							
International Bunkers	0.83	0.00	0.01				0.84
Aviation	0.83	0.00	0.01				0.84
Marine	NA,NO	NA,NO	NA,NO				NA,NO
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**21.22**						**21.22**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	222.04
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	215.02

[1] For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

[2] Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

[3] Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

[4] See footnote 8 to table Summary 1.A.

Annex 2: Summary of reporting of the Supplementary information under Article 7, paragraph 2, of the Kyoto Protocol

Table 7. Summary of reporting of the Supplementary information under Article 7, paragraph 2, of the Kyoto Protocol in the NC5 (example of summary table)

Information reported under Article 7, paragraph 2	NC5 section
National systems in accordance with Article 5, paragraph 1	III.C
National registries	III.D
Supplementarity relating to the mechanisms pursuant to Articles 6, 12 and 17	V.C
Policies and measures in accordance with Article 2	IV.C
Domestic and regional programmes and/or legislative arrangements and enforcement and administrative procedures	IV.B
Information under Article 10	
Art 10a	III.C
Art 10b	IV.B and VI.C;
Art 10c	VII.D
Art 10d	VIII
Art 10e	IX
Financial resources (Annex II only)	VII.A-C

Abbreviations

AZV	Abwasserzweckverband
CH_4	Methane
CHF	Swiss francs
CIPRA	International Commission for the Protection of the Alps
CLRTAP	UNECE Convention on Long-range Transboundary Air Pollution
CO	Carbon monoxide
CO_2	Carbon dioxide
COP	Conference of the Parties
ETH/ETHZ	Swiss Federal Institute of Technology, Zurich
FL	Fürstentum Liechtenstein (Principality of Liechtenstein)
FOEN	Swiss Federal Office for the Environment
GCOS	Global Climate Observing System
GDP	Gross domestic product
Gg	Gigagrams (1,000 tons)
GHG	Greenhouse gases
GWP	Global Warming Potential, factor for converting CH_4, N_2O, HFC, PFC, and SF_6 emissions into CO_2 equivalents
HFC	Hydrofluorcarbons
ILCC	International Lake Constance Conference
IPCC	Intergovernmental Panel on Climate Change
ha	hectare
HVF	Heavy Vehicle Fee
KCA	Key Category Analysis
kha	kilohectare, 1000 hectares
KP	Kyoto Protocol
LGV	Liechtensteinische Gasversorgung (Liechtenstein's gas utility)
LKW	Liechtensteinische Kraftwerke (Liechtenstein's electric power company)
LULUCF	Land Use, Land-Use Change and Forestry
NA	Not applicable (notation key)
NE	Not estimated in Liechtenstein (notation key)
NFR	Nomenclature for reporting (category codes)
NGO	Non-governmental organization
NIC	National Inventory Compiler
NIR	National Inventory Report
NIS	National Inventory System
NMVOC	Non-methane volatile organic compounds
NO	Not occurring (in Liechtenstein)
NO_X	Nitrogen oxides

N_2O	Nitrous oxide
OA	Office of Agriculture
OEA	Office of Economic Affairs
OE	Office of Environment
OFNLM	Office of Forests, Nature and Land Management
OS	Office of Statistics
PFC	Perfluorcarbons
QA/QC	Quality assurance, quality control
SDC	Swiss Agency for Development and Cooperation
SF_6	Sulfur hexafluoride
SFOE	Swiss Federal Office of Energy
SLP	Office of Land Use Planning
T1, T2, T3	Tier 1, Tier 2, Tier 3 (methodological levels)
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

ANNEX
Liechtenstein's Biennial Report 1

December 2013

Table of contents

1. Introduction 3

2. Information on GHG emissions and trends 4

3. Quantified Economy-wide Emission Reduction Target (QEWER) 18

4. Progress in achievement of QEWER target..... 22

5. Projections..... 28

6. Provision of financial, technological and capability-building support to developing country Parties..... 30

7. Other reporting elements 30

1. Introduction

The Government of Liechtenstein is pleased to present its first Biennial Report (BR1). This reporting obligation has been introduced in 2010 at the 16. Conference of the Parties to the United Nations Framework Convention on Climate Change (COP) 2010 in Cancun, Mexico.

The Biennial Report complements the existing national reports "GHG Inventory" and "National Communication", especially by putting a focus on achieved progress with regard to pledged reduction targets of Annex I parties within a 2 year time frequency.

Liechtenstein's first Biennial Report report follows the UNFCCC biennial reporting guidelines for developed country Parties as agreed at COP 17 in 2011 in Durban, South Africa (FCCC/CP/2011/9/Add.1, Annex I).

The report provides information on Liechtenstein's

- greenhouse gas emission and trends,
- quantified economy-wide emission reduction target,
- progress in achievement of quantified economy-wide emission reduction targets and relevant information,
- projections,
- provisions of financial, technological and capacity-building support to developing country Parties.

Liechtenstein's First Biennial Report has been prepared as Annex to Liechtenstein's Sixth National Communication. Due to the fact that both reports have to be submitted by 1st of January 2014 and considering the overlap of some information to be reported according to the respective guideline, Liechtenstein decided to refer to the respective section of its Sixth National Communication in those cases, where such overlap would occur within the Biennial Report.

Liechtenstein qualifies that approach as justified since it corresponds to the ratio of the UNFCCC Guidelines for the technical review of biennial reports from Parties included in Annex I to the Convention (Part IV) especially under paragraph 63 (d) as it states:

"The individual review will (…) serve as part of the review of the NC, where there is an overlap between the content of the BR and that of the NC."[1]

That approach will be adjusted within the preparation of Liechtenstein's second Biennial Report, which will take place in the course of 2015.

Liechtenstein's first Biennial Report has been prepared by:

Office of Environment Liechtenstein

Environmental Protection Division and the Legal and International Affairs Division

P.O. Box 684, 9490 Vaduz, Liechtenstein.

[1] see http://unfccc.int/files/meetings/warsaw_nov_2013/decisions/application/pdf/cop19_review_crf.pdf

2. Information on GHG emissions and trends

Summary from Liechtenstein's latest greenhouse gas inventory

In 2011, Liechtenstein emitted 222 Gg CO_2 equivalent (excluding LULUCF) to the atmosphere corresponding to 6.1 tonnes CO_2 equivalent per capita. About 84.3% of all greenhouse gas emissions were caused by energy-related processes. Emissions within this sector are distributed as follows: 42.5% by Transport, 10.4% by Manufacturing Industries and Construction, and 42.9% "Other sectors" (Residential, Institutional, and Commercial combustion). Compared to 1990, the emissions have decreased by 8.2% in this sector and overall by 3.6% (excluding LULUCF).

Carbon dioxide emissions (CO_2) account for 184.8 Gg and for 83.2% of total emissions in 2011. 42.8% of these CO_2 emissions occur in in "Other sectors", 42.6% in the Transport sector and 10.4% in Manufacturing Industries and Construction.

Methane emissions (CH_4) in 2011 amount to 0.7 Gg – corresponding 15.4 Gg CO_2 eq - and mainly occur in the Agriculture sector (82%). Compared to 1990, methane emissions have increased by 7.2 %. The share of methane on the overall Greenhouse gas emissions (in CO_2 equivalent) is 6.9%.

Nitrous oxide emissions (N_2O) in 2011 amount to 0.041 Gg – corresponding 13 Gg CO_2 eq - and arise primarily from Agriculture (81%) with additional minor contribution from Transport (5%) and Waste (8%). The share of N_2O on the overall GHG emissions (in CO_2 equivalent) is 5.8%.

National Inventory Arrangements

The Government of Liechtenstein bears the overall responsibility for the National Inventory System (NIS). By Liechtenstein's Emission Trading Act, the Office of Environment (OE) is in charge of emission inventories and therefore also responsible for all aspects concerning the compilation of the NIS under the UN Framework Convention on Climate Change (UNFCCC) and under the Kyoto Protocol. The responsibility by OE for compiling the NIS is also described in the report of the Government to the parliament when the Kyoto Protocol was ratified. The Government mandated the realisation of the NIS to its Office for the Environment (OE). Please note that the Office for the Environment is reorganized since 2013. The Office of Agriculture (OA), the Office of Forest, Nature and Land Management (OFNLM) and the Office of Environmental Protection (OEP) have been merged to the Office for the Environment (OE).

The Office of Economic Affairs (OEA) and the Office of Land Use Planning (SLP) participate directly in the compilation of the inventory. Several other administrative and private institutions are involved in inventory preparation.

The Office for the Environment (OE) plays a major role in the National Inventory System and is acting as the National Registry Administrator. Its representative, the head of the OE, is the registered National Focal Point. He also coordinates in cooperation with the responsible head of the unit the data flow from the governmental data suppliers to the Inventory Group

For further information please refer to chapter 3 of Liechtenstein's Sixth National Communication.

Table 1: Summary of emission trends from 1990-2011 and by gases

Table 1
Emission trends: summary [1]
(Sheet 1 of 3)

BR v0.1, Liechtenstein
Source: Submission 2014 v1.1, LIECHTENSTEIN

GREENHOUSE GAS EMISSIONS	Base year[a] *Base year* [a]	1991	1992	1993	1994	1995	1996	1997	1998
	(kt CO_2eq)[3]kt	*kt CO_2 eq*	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq
CO_2 emissions including net CO_2 from LULUCF	193.63	201.31	202.16	210.44	196.47	199.78	201.94	214.50	226.07
CO_2 emissions excluding net CO_2 from LULUCF	203.10	210.82	211.70	220.01	206.08	209.43	211.62	223.91	235.21
CH_4 emissions including CH_4 from LULUCF	14.35	14.24	13.97	13.34	13.47	13.36	13.78	13.54	13.49
CH_4 emissions excluding CH_4 from LULUCF	14.35	14.24	13.97	13.34	13.47	13.36	13.78	13.54	13.49
N_2O emissions including N_2O from LULUCF	12.88	13.21	13.08	12.68	12.60	12.53	12.50	12.37	12.30
N_2O emissions excluding N_2O from LULUCF	12.87	13.20	13.07	12.67	12.59	12.52	12.49	12.36	12.29
HFCs	0.00	0.00	0.01	0.05	0.14	0.38	0.66	1.04	1.38
PFCs	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00
SF_6	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00	0.00	0.00
Total (including LULUCF)	220.87	228.76	229.22	236.51	222.68	226.06	228.89	241.46	253.23
Total (excluding LULUCF)	230.33	238.26	238.75	246.08	232.28	235.70	238.56	250.86	262.36

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a] *Base year* [a]	1991	1992	1993	1994	1995	1996	1997	1998
	(kt CO_2eq)[3]kt CO_2 eq	*kt CO_2 eq*	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq
1. Energy	203.78	211.71	212.77	221.15	207.17	210.56	212.87	225.35	236.72
2. Industrial Processes	0.00	0.00	0.01	0.05	0.14	0.38	0.66	1.04	1.38
3. Solvent and Other Product Use	2.02	1.92	1.84	1.75	1.68	1.61	1.52	1.43	1.36
4. Agriculture	22.96	23.14	22.61	21.64	21.69	21.62	21.88	21.46	21.33
5. Land Use, Land-Use Change and Forestry[b]	-9.46	-9.50	-9.53	-9.57	-9.60	-9.64	-9.67	-9.40	-9.13
6. Waste	1.58	1.50	1.51	1.49	1.60	1.52	1.63	1.58	1.57
7. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total (including LULUCF)	220.87	228.76	229.22	236.51	222.68	226.06	228.89	241.46	253.23

Note: All footnotes for this table are given on sheet 3.

The common tabular format will be revised, in accordance with relevant decisions of the Conference of the Parties and, where
applicable, with decisions of the Conference of the Parties serving as the meeting of the Parties to the Kyoto

Table 1
Emission trends: summary [1]
(Sheet 2 of 3)

BR v0.1, Liechtenstein
Source: Submission 2014 v1.1, LIECHTENSTEIN

GREENHOUSE GAS EMISSIONS	Base year[a] *1999*	2000	2001	2002	2003	2004	2005	2006	2007	2008
	(kt CO_2eq)[3]kt	*kt CO_2 eq*	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq
CO_2 emissions including net CO_2 from LULUCF	225.46	218.95	217.29	222.50	232.07	232.34	232.22	233.98	203.44	222.50
CO_2 emissions excluding net CO_2 from LULUCF	234.34	227.56	225.62	230.56	240.02	240.18	239.95	241.59	210.94	229.89
CH_4 emissions including CH_4 from LULUCF	13.05	12.99	13.59	13.85	14.01	14.09	14.62	15.18	15.53	15.80
CH_4 emissions excluding CH_4 from LULUCF	13.05	12.99	13.59	13.85	14.01	14.09	14.62	15.18	15.53	15.80
N_2O emissions including N_2O from LULUCF	12.14	11.96	12.30	12.33	12.41	12.45	12.60	12.78	12.91	12.98
N_2O emissions excluding N_2O from LULUCF	12.13	11.95	12.29	12.31	12.40	12.43	12.59	12.76	12.90	12.97
HFCs	1.81	2.32	2.99	3.28	3.77	4.33	4.38	4.39	4.66	5.08
PFCs	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.06
SF_6	0.00	0.09	0.17	0.26	0.26	0.28	0.27	0.06	0.12	0.36
Total (including LULUCF)	252.47	246.31	246.35	252.22	262.53	263.50	264.13	266.42	236.72	256.78
Total (excluding LULUCF)	261.33	254.90	254.67	260.27	270.46	271.33	271.84	274.02	244.21	264.16

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a] *1999*	2000	2001	2002	2003	2004	2005	2006	2007	2008
	(kt CO_2eq)[3]kt CO_2 eq	*kt CO_2 eq*	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq
1. Energy	235.98	229.46	227.43	232.38	241.99	242.22	242.11	243.78	213.19	232.26
2. Industrial Processes	1.81	2.41	3.17	3.54	4.04	4.63	4.68	4.49	4.83	5.50
3. Solvent and Other Product Use	1.30	1.24	1.19	1.13	1.09	1.02	1.02	1.01	1.02	1.00
4. Agriculture	20.63	20.07	21.30	21.47	21.58	21.71	22.12	22.96	23.32	23.40
5. Land Use, Land-Use Change and Forestry[b]	-8.86	-8.59	-8.32	-8.05	-7.93	-7.82	-7.71	-7.60	-7.49	-7.38
6. Waste	1.61	1.72	1.58	1.74	1.76	1.75	1.91	1.78	1.85	2.00
7. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total (including LULUCF)	252.47	246.31	246.35	252.22	262.53	263.50	264.13	266.42	236.72	256.78

Note: All footnotes for this table are given on sheet 3.

Table 1
Emission trends: summary (1)
(Sheet 3 of 3)

BR v0.1, Liechtenstein
ırce: Submission 2014 v1.1, LIECHTENSTEIN

GREENHOUSE GAS EMISSIONS	*2009*	2010	2011	Change from base to latest reported year
	(kt CO_2eq)(3)kt	*kt CO_2 eq*	kt CO_2 eq	(%)
CO_2 emissions including net CO_2 from LULUCF	206.93	192.41	177.76	-8.20
CO_2 emissions excluding net CO_2 from LULUCF	214.19	199.56	184.80	-9.01
CH_4 emissions including CH_4 from LULUCF	15.52	15.10	15.39	7.23
CH_4 emissions excluding CH_4 from LULUCF	15.52	15.10	15.39	7.23
N_2O emissions including N_2O from LULUCF	12.79	12.72	13.05	1.28
N_2O emissions excluding N_2O from LULUCF	12.78	12.71	13.03	1.24
HFCs	5.33	6.65	8.73	9,196,614.98
PFCs	0.05	0.07	0.07	100.00
SF_6	0.14	0.02	0.01	100.00
Total (including LULUCF)	240.77	226.98	215.02	-2.65
Total (excluding LULUCF)	248.01	234.12	222.04	-3.60

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	*2009*	2010	2011	Change from base to latest reported year
	(kt CO_2eq)(3)kt CO_2 eq	*kt CO_2 eq*	kt CO_2 eq	(%)
1. Energy	216.51	201.89	187.08	-8.19
2. Industrial Processes	5.53	6.75	8.81	9,286,805.57
3. Solvent and Other Product Use	1.00	0.99	0.99	-50.69
4. Agriculture	23.19	22.73	23.37	1.79
5. Land Use, Land-Use Change and Forestry[b]	-7.24	-7.14	-7.03	-25.74
6. Waste	1.78	1.77	1.78	13.16
7. Other	NO	NO	NO	0.00
Total (including LULUCF)	240.77	226.98	215.02	-2.65

Notes:

(1) Further detailed information could be found in the common reporting format tables of the Party's greenhouse gas inventory, namely "Emission trends (CO_2)", "Emission trends (CH_4)", "Emission trends (N_2O)" and "Emission trends (HFCs, PFCs and SF_6)", which is included in an annex to this biennial report.

(2) 2011 is the latest reported inventory year.

(3) 1 kt CO_2 eq equals 1 Gg CO_2 eq.

Abbreviation: LULUCF = land use, land-use change and forestry.

[a] The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

[b] Includes net CO_2, CH_4 and N_2O from LULUCF.

Table 1 (a)
Emission trends (CO_2)
(Sheet 1 of 3)

BR v0.1, Liechtenstein
Source: Submission 2014 v1.1, LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	*Base year*[a]	1991	1992	1993	1994	1995	1996	1997	1998
	(kt)kt	kt	kt	kt	kt	kt	kt	kt	kt
1. Energy	201.53	209.32	210.27	218.66	204.77	208.17	210.43	222.79	234.13
A. Fuel Combustion (Sectoral Approach)	201.53	209.32	210.27	218.66	204.77	208.17	210.43	222.79	234.13
1. Energy Industries	0.12	0.77	1.78	1.84	1.72	1.96	2.46	2.40	2.77
2. Manufacturing Industries and Construction	35.23	34.15	34.06	35.88	34.12	34.26	34.23	35.77	38.10
3. Transport	75.37	88.54	87.76	85.66	78.37	80.32	81.59	85.18	84.92
4. Other Sectors	88.44	83.01	83.74	92.87	88.29	89.45	89.92	96.92	105.41
5. Other	2.36	2.85	2.91	2.41	2.26	2.19	2.24	2.53	2.93
B. Fugitive Emissions from Fuels	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
1. Solid Fuels	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
2. Oil and Natural Gas	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
2. Industrial Processes	NO	NO	NO	NO	NO	NO	NO	NO	NO
A. Mineral Products	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Other Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Production of Halocarbons and SF6									
F. Consumption of Halocarbons and SF6									
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	1.55	1.46	1.40	1.33	1.29	1.23	1.17	1.10	1.05
4. Agriculture									
A. Enteric Fermentation									
B. Manure Management									
C. Rice Cultivation									
D. Agricultural Soils									
E. Prescribed Burning of Savannas									
F. Field Burning of Agricultural Residues									
G. Other									
5. Land Use, Land-Use Change and Forestry	-9.47	-9.51	-9.54	-9.58	-9.61	-9.65	-9.68	-9.41	-9.14
A. Forest Land	-19.99	-20.01	-20.03	-20.04	-20.06	-20.08	-20.10	-20.11	-20.13
B. Cropland	4.44	4.43	4.43	4.42	4.42	4.41	4.41	4.44	4.47
C. Grassland	1.91	1.89	1.88	1.87	1.86	1.85	1.84	1.97	2.11
D. Wetlands	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.17	0.18
E. Settlements	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.62	3.65
F. Other Land	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.51	0.59
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Waste	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
A. Solid Waste Disposal on Land	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Waste-water Handling									
C. Waste Incineration	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
D. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO
7. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total CO2 emissions including net CO2 from LULUCF	193.63	201.31	202.16	210.44	196.47	199.78	201.94	214.50	226.07
Total CO2 emissions excluding net CO2 from LULUCF	203.10	210.82	211.70	220.01	206.08	209.43	211.62	223.91	235.21
Memo Items:									
International Bunkers	0.43	0.43	0.43	0.43	0.43	0.43	0.44	0.45	0.46
Aviation	0.43	0.43	0.43	0.43	0.43	0.43	0.44	0.45	0.46
Marine	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO2 Emissions from Biomass	5.67	4.48	5.84	5.46	6.58	5.17	5.04	5.76	6.38

Note: All footnotes for this table are given on sheet 3.

Table 1 (a)
Emission trends (CO_2)
(Sheet 2 of 3)

BR v0.1, Liechtenstein
Source: Submission 2014 v1.1, LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	*1999*	2000	2001	2002	2003	2004	2005	2006	2007	2008
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1. Energy	233.29	226.55	224.65	229.64	239.14	239.36	239.14	240.79	210.14	229.11
A. Fuel Combustion (Sectoral Approach)	233.29	226.55	224.65	229.64	239.14	239.36	239.14	240.79	210.14	229.11
1. Energy Industries	2.77	2.61	2.77	2.38	2.67	2.79	2.97	2.69	2.44	2.75
2. Manufacturing Industries and Construction	37.52	34.24	34.46	35.56	38.19	37.27	36.09	37.34	30.81	32.92
3. Transport	90.62	94.54	90.98	86.55	86.25	85.06	84.60	81.71	85.82	90.22
4. Other Sectors	99.28	92.19	93.90	102.42	108.61	111.22	111.97	115.43	87.74	99.67
5. Other	3.10	2.96	2.53	2.73	3.41	3.02	3.50	3.62	3.33	3.55
B. Fugitive Emissions from Fuels	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
1. Solid Fuels	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
2. Oil and Natural Gas	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
2. Industrial Processes	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
A. Mineral Products	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Other Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Production of Halocarbons and SF6										
F. Consumption of Halocarbons and SF6										
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	1.01	0.97	0.94	0.89	0.84	0.79	0.78	0.77	0.77	0.75
4. Agriculture										
A. Enteric Fermentation										
B. Manure Management										
C. Rice Cultivation										
D. Agricultural Soils										
E. Prescribed Burning of Savannas										
F. Field Burning of Agricultural Residues										
G. Other										
5. Land Use, Land-Use Change and Forestry	-8.87	-8.60	-8.33	-8.06	-7.95	-7.84	-7.72	-7.61	-7.50	-7.39
A. Forest Land	-20.15	-20.17	-20.18	-20.20	-20.17	-20.14	-20.11	-20.08	-20.05	-20.02
B. Cropland	4.50	4.53	4.56	4.59	4.59	4.59	4.59	4.59	4.59	4.59
C. Grassland	2.24	2.38	2.51	2.65	2.71	2.76	2.82	2.88	2.94	3.00
D. Wetlands	0.19	0.20	0.21	0.22	0.22	0.22	0.22	0.22	0.22	0.22
E. Settlements	3.69	3.72	3.76	3.80	3.79	3.79	3.79	3.78	3.78	3.78
F. Other Land	0.66	0.74	0.82	0.89	0.92	0.94	0.97	0.99	1.02	1.05
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Waste	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
A. Solid Waste Disposal on Land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Waste-water Handling										
C. Waste Incineration	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
D. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total CO2 emissions including net CO2 from LULUCF	225.46	218.95	217.29	222.50	232.07	232.34	232.22	233.98	203.44	222.50
Total CO2 emissions excluding net CO2 from LULUCF	234.34	227.56	225.62	230.56	240.02	240.18	239.95	241.59	210.94	229.89
Memo Items:										
International Bunkers	0.48	0.49	0.50	0.45	0.49	0.35	0.48	0.77	0.76	0.74
Aviation	0.48	0.49	0.50	0.45	0.49	0.35	0.48	0.77	0.76	0.74
Marine	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO2 Emissions from Biomass	6.96	10.60	7.25	7.40	9.21	9.97	10.72	12.12	15.65	15.81

Note: All footnotes for this table are given on sheet 3.

Table 1(a)
Emission trends (CO_2)
(Sheet 3 of 3)

BR v0.1, Liechtenstein
: Submission 2014 v1.1, LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	*2009*	2010	2011	Change from base to latest reported year
	kt	kt	kt	%
1. Energy	213.41	198.81	184.04	-8.68
A. Fuel Combustion (Sectoral Approach)	213.41	198.81	184.04	-8.68
1. Energy Industries	2.81	3.09	2.89	2,333.33
2. Manufacturing Industries and Construction	23.71	22.33	19.31	-45.19
3. Transport	84.11	79.67	78.76	4.49
4. Other Sectors	99.18	90.26	79.16	-10.50
5. Other	3.61	3.47	3.92	65.78
B. Fugitive Emissions from Fuels	NA, NO	NA, NO	NA, NO	0.00
1. Solid Fuels	NA, NO	NA, NO	NA, NO	0.00
2. Oil and Natural Gas	NA, NO	NA, NO	NA, NO	0.00
2. Industrial Processes	NO	NO	NO	0.00
A. Mineral Products	NO	NO	NO	0.00
B. Chemical Industry	NO	NO	NO	0.00
C. Metal Production	NO	NO	NO	0.00
D. Other Production	NO	NO	NO	0.00
E. Production of Halocarbons and SF6				
F. Consumption of Halocarbons and SF6				
G. Other	NO	NO	NO	0.00
3. Solvent and Other Product Use	0.75	0.72	0.73	-52.87
4. Agriculture				
A. Enteric Fermentation				
B. Manure Management				
C. Rice Cultivation				
D. Agricultural Soils				
E. Prescribed Burning of Savannas				
F. Field Burning of Agricultural Residues				
G. Other				
5. Land Use, Land-Use Change and Forestry	-7.26	-7.16	-7.04	-25.66
A. Forest Land	-20.00	-19.98	-19.96	-0.17
B. Cropland	4.59	4.59	4.59	3.46
C. Grassland	3.06	3.12	3.18	66.86
D. Wetlands	0.22	0.22	0.22	39.10
E. Settlements	3.79	3.77	3.77	5.35
F. Other Land	1.08	1.12	1.15	163.90
G. Other	NO	NO	NO	0.00
6. Waste	0.03	0.03	0.03	9.11
A. Solid Waste Disposal on Land	NO	NO	NO	0.00
B. Waste-water Handling				
C. Waste Incineration	0.03	0.03	0.03	9.11
D. Other	NO	NO	NO	0.00
7. Other (as specified in the summary table in CRF)	NO	NO	NO	0.00
Total CO2 emissions including net CO2 from LULUCF	206.93	192.41	177.76	-8.20
Total CO2 emissions excluding net CO2 from LULUCF	214.19	199.56	184.80	-9.01
Memo Items:				
International Bunkers	0.88	0.78	0.83	94.34
Aviation	0.88	0.78	0.83	94.34
Marine	NA, NO	NA, NO	NA, NO	0.00
Multilateral Operations	NO	NO	NO	0.00
CO2 Emissions from Biomass	18.59	19.66	21.22	273.91

Abbreviations: CRF = common reporting format, LULUCF = land use, land-use change and forestry.

[a] The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

[b] Fill in net emissions/removals as reported in CRF table Summary 1.A of the latest reported inventory year. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

Table 1(b)
Emission trends (CH_4)
(Sheet 1 of 3)

BR v0.1, Liechtenstein
Source: Submission 2014 v1.1, LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a] *Base year*[a]	1991	1992	1993	1994	1995	1996	1997	1998
	(kt)kt	kt	kt	kt	kt	kt	kt	kt	kt
1. Energy	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06
A. Fuel Combustion (Sectoral Approach)	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03
1. Energy Industries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Manufacturing Industries and Construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3. Transport	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.01
4. Other Sectors	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Fugitive Emissions from Fuels	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03
1. Solid Fuels	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
2. Oil and Natural Gas	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03
2. Industrial Processes	NO	NO	NO	NO	NO	NO	NO	NO	NO
A. Mineral Products	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Other Production									
E. Production of Halocarbons and SF6									
F. Consumption of Halocarbons and SF6									
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use									
4. Agriculture	0.60	0.60	0.58	0.55	0.55	0.55	0.57	0.56	0.55
A. Enteric Fermentation	0.50	0.49	0.48	0.45	0.46	0.46	0.47	0.46	0.46
B. Manure Management	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09
C. Rice Cultivation	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
D. Agricultural Soils	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
E. Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA	NA	NA	NA
F. Field Burning of Agricultural Residues	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	NO	NO	NO	NO	NO	NO	NO	NO	NO
A. Forest Land	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Cropland	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Grassland	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Wetlands	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Settlements	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Other Land	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Waste	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
A. Solid Waste Disposal on Land	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00
B. Waste-water Handling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Other	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02
7. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total CH4 emissions including CH4 from LULUCF	0.68	0.68	0.67	0.64	0.64	0.64	0.66	0.64	0.64
Total CH4 emissions excluding CH4 from LULUCF	0.68	0.68	0.67	0.64	0.64	0.64	0.66	0.64	0.64
Memo Items:									
International Bunkers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Marine	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO2 Emissions from Biomass									

Note: All footnotes for this table are given on sheet 3.

Table 1(b)
Emission trends (CH_4)
(Sheet 2 of 3)

BR v0.1, Liechtenstein
Source: Submission 2014 v1.1, LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	*1999*	2000	2001	2002	2003	2004	2005	2006	2007	2008
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1. Energy	0.06	0.07	0.07	0.07	0.07	0.08	0.08	0.09	0.09	0.09
A. Fuel Combustion (Sectoral Approach)	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04
1. Energy Industries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Manufacturing Industries and Construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3. Transport	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
4. Other Sectors	0.01	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Fugitive Emissions from Fuels	0.03	0.03	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05
1. Solid Fuels	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
2. Oil and Natural Gas	0.03	0.03	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05
2. Industrial Processes	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
A. Mineral Products	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Other Production										
E. Production of Halocarbons and SF6										
F. Consumption of Halocarbons and SF6										
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use										
4. Agriculture	0.53	0.51	0.55	0.56	0.56	0.56	0.57	0.60	0.61	0.62
A. Enteric Fermentation	0.44	0.43	0.46	0.46	0.47	0.47	0.48	0.51	0.51	0.52
B. Manure Management	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10
C. Rice Cultivation	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
D. Agricultural Soils	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
E. Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F. Field Burning of Agricultural Residues	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
A. Forest Land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Cropland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Grassland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Wetlands	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Settlements	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Other Land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Waste	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.03	0.04	0.04
A. Solid Waste Disposal on Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Waste-water Handling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Other	0.02	0.03	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.04
7. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total CH4 emissions including CH4 from LULUCF	0.62	0.62	0.65	0.66	0.67	0.67	0.70	0.72	0.74	0.75
Total CH4 emissions excluding CH4 from LULUCF	0.62	0.62	0.65	0.66	0.67	0.67	0.70	0.72	0.74	0.75
Memo Items:										
International Bunkers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Marine	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO2 Emissions from Biomass										

Note: All footnotes for this table are given on sheet 3.

Table 1(b)
Emission trends (CH_4)
(Sheet 3 of 3)

BR v0.1, Liechtenstein
: Submission 2014 v1.1, LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	*2009*	2010	2011	Change from base to latest reported year
	kt	kt	kt	%
1. Energy	0.09	0.09	0.09	80.14
A. Fuel Combustion (Sectoral Approach)	0.04	0.04	0.05	21.80
1. Energy Industries	0.00	0.00	0.00	882.73
2. Manufacturing Industries and Construction	0.00	0.00	0.00	-39.07
3. Transport	0.01	0.01	0.01	-70.01
4. Other Sectors	0.03	0.03	0.03	286.33
5. Other	0.00	0.00	0.00	63.19
B. Fugitive Emissions from Fuels	0.05	0.05	0.05	223.12
1. Solid Fuels	NA, NO	NA, NO	NA, NO	0.00
2. Oil and Natural Gas	0.05	0.05	0.05	223.12
2. Industrial Processes	NO	NO	NO	0.00
A. Mineral Products	NO	NO	NO	0.00
B. Chemical Industry	NO	NO	NO	0.00
C. Metal Production	NO	NO	NO	0.00
D. Other Production				
E. Production of Halocarbons and SF6				
F. Consumption of Halocarbons and SF6				
G. Other	NO	NO	NO	0.00
3. Solvent and Other Product Use				
4. Agriculture	0.62	0.59	0.61	1.30
A. Enteric Fermentation	0.52	0.50	0.51	2.92
B. Manure Management	0.10	0.09	0.10	-6.50
C. Rice Cultivation	NA, NO	NA, NO	NA, NO	0.00
D. Agricultural Soils	NA, NO	NA, NO	NA, NO	0.00
E. Prescribed Burning of Savannas	NA	NA	NA	0.00
F. Field Burning of Agricultural Residues	NA, NO	NA, NO	NA, NO	0.00
G. Other	NA	NA	NA	0.00
5. Land Use, Land-Use Change and Forestry	NO	NO	NO	0.00
A. Forest Land	NO	NO	NO	0.00
B. Cropland	NO	NO	NO	0.00
C. Grassland	NO	NO	NO	0.00
D. Wetlands	NO	NO	NO	0.00
E. Settlements	NO	NO	NO	0.00
F. Other Land	NO	NO	NO	0.00
G. Other	NO	NO	NO	0.00
6. Waste	0.03	0.03	0.03	-1.55
A. Solid Waste Disposal on Land	0.00	0.00	0.00	-94.60
B. Waste-water Handling	0.00	0.00	0.00	44.43
C. Waste Incineration	0.00	0.00	0.00	9.11
D. Other	0.03	0.03	0.03	43.39
7. Other (as specified in the summary table in CRF)	NO	NO	NO	0.00
Total CH4 emissions including CH4 from LULUCF	0.74	0.72	0.73	7.23
Total CH4 emissions excluding CH4 from LULUCF	0.74	0.72	0.73	7.23
Memo Items:				
International Bunkers	0.00	0.00	0.00	94.34
Aviation	0.00	0.00	0.00	94.34
Marine	NA, NO	NA, NO	NA, NO	0.00
Multilateral Operations	NO	NO	NO	0.00
CO2 Emissions from Biomass				

Abbreviations: CRF = common reporting format, LULUCF = land use, land-use change an

[a] The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

Table 1(c)
Emission trends (N_2O)
(Sheet 1 of 3)

BR v0.1, Liechtenstein
Source: Submission 2014 v1.1, LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a] *Base year*[a]	1991	1992	1993	1994	1995	1996	1997	1998
	(kt)kt	kt	kt	kt	kt	kt	kt	kt	kt
1. Energy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A. Fuel Combustion (Sectoral Approach)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1. Energy Industries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Manufacturing Industries and Construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3. Transport	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4. Other Sectors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Fugitive Emissions from Fuels	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
1. Solid Fuels	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
2. Oil and Natural Gas	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
2. Industrial Processes	NO	NO	NO	NO	NO	NO	NO	NO	NO
A. Mineral Products	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Other Production									
E. Production of Halocarbons and SF6									
F. Consumption of Halocarbons and SF6									
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4. Agriculture	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
A. Enteric Fermentation									
B. Manure Management	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Rice Cultivation									
D. Agricultural Soils	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
E. Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA	NA	NA	NA
F. Field Burning of Agricultural Residues	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A. Forest Land	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Cropland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Grassland	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Wetlands	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Settlements	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Other Land	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A. Solid Waste Disposal on Land									
B. Waste-water Handling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total N2O emissions including N2O from LULUCF	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Total N2O emissions excluding N2O from LULUCF	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Memo Items:									
International Bunkers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Marine	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO2 Emissions from Biomass									

Note: All footnotes for this table are given on sheet 3.

Table 1(c)
Emission trends (N_2O)
(Sheet 2 of 3)

BR v0.1, Liechtenstein
Source: Submission 2014 v1.1, LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	*1999*	2000	2001	2002	2003	2004	2005	2006	2007	2008
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1. Energy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A. Fuel Combustion (Sectoral Approach)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1. Energy Industries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Manufacturing Industries and Construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3. Transport	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4. Other Sectors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Fugitive Emissions from Fuels	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
1. Solid Fuels	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
2. Oil and Natural Gas	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
2. Industrial Processes	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
A. Mineral Products	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Other Production										
E. Production of Halocarbons and SF6										
F. Consumption of Halocarbons and SF6										
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4. Agriculture	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
A. Enteric Fermentation										
B. Manure Management	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Rice Cultivation										
D. Agricultural Soils	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
E. Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F. Field Burning of Agricultural Residues	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A. Forest Land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Cropland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Grassland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Wetlands	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Settlements	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Other Land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A. Solid Waste Disposal on Land										
B. Waste-water Handling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total N2O emissions including N2O from LULUCF	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Total N2O emissions excluding N2O from LULUCF	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Memo Items:										
International Bunkers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Marine	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO2 Emissions from Biomass										

Note: All footnotes for this table are given on sheet 3.

Table 1(c)
Emission trends (N_2O)
(Sheet 3 of 3)

BR v0.1, Liechtenstein
: Submission 2014 v1.1, LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	*2009*	2010	2011	Change from base to latest reported year
	kt	kt	kt	%
1. Energy	0.00	0.00	0.00	-8.47
A. Fuel Combustion (Sectoral Approach)	0.00	0.00	0.00	-8.47
1. Energy Industries	0.00	0.00	0.00	47.32
2. Manufacturing Industries and Construction	0.00	0.00	0.00	-49.74
3. Transport	0.00	0.00	0.00	-21.66
4. Other Sectors	0.00	0.00	0.00	22.11
5. Other	0.00	0.00	0.00	64.06
B. Fugitive Emissions from Fuels	NA, NO	NA, NO	NA, NO	0.00
1. Solid Fuels	NA, NO	NA, NO	NA, NO	0.00
2. Oil and Natural Gas	NA, NO	NA, NO	NA, NO	0.00
2. Industrial Processes	NO	NO	NO	0.00
A. Mineral Products	NO	NO	NO	0.00
B. Chemical Industry	NO	NO	NO	0.00
C. Metal Production	NO	NO	NO	0.00
D. Other Production				
E. Production of Halocarbons and SF6				
F. Consumption of Halocarbons and SF6				
G. Other	NO	NO	NO	0.00
3. Solvent and Other Product Use	0.00	0.00	0.00	-43.52
4. Agriculture	0.03	0.03	0.03	2.38
A. Enteric Fermentation				
B. Manure Management	0.00	0.00	0.00	13.92
C. Rice Cultivation				
D. Agricultural Soils	0.03	0.03	0.03	0.85
E. Prescribed Burning of Savannas	NA	NA	NA	0.00
F. Field Burning of Agricultural Residues	NA, NO	NA, NO	NA, NO	0.00
G. Other	NA	NA	NA	0.00
5. Land Use, Land-Use Change and Forestry	0.00	0.00	0.00	47.29
A. Forest Land	NO	NO	NO	0.00
B. Cropland	0.00	0.00	0.00	47.29
C. Grassland	NO	NO	NO	0.00
D. Wetlands	NO	NO	NO	0.00
E. Settlements	NO	NO	NO	0.00
F. Other Land	NO	NO	NO	0.00
G. Other	NO	NO	NO	0.00
6. Waste	0.00	0.00	0.00	24.66
A. Solid Waste Disposal on Land				
B. Waste-water Handling	0.00	0.00	0.00	22.69
C. Waste Incineration	0.00	0.00	0.00	9.11
D. Other	0.00	0.00	0.00	43.39
7. Other (as specified in the summary table in CRF)	NO	NO	NO	0.00
Total N2O emissions including N2O from LULUCF	0.04	0.04	0.04	1.28
Total N2O emissions excluding N2O from LULUCF	0.04	0.04	0.04	1.24
Memo Items:				
International Bunkers	0.00	0.00	0.00	94.34
Aviation	0.00	0.00	0.00	94.34
Marine	NA, NO	NA, NO	NA, NO	0.00
Multilateral Operations	NO	NO	NO	0.00
CO2 Emissions from Biomass				

Abbreviations : CRF = common reporting format, LULUCF = land use, land-use change and

[a] The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

Table 1(d)
Emission trends (HFCs, PFCs and SF_6)
(Sheet 1 of 3)

BR v0.1, Liechtenstein
Source: Submission 2014 v1.1, LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a] *Base year*[a]	1991	1992	1993	1994	1995	1996	1997	1998
	(kt)kt	kt	kt	kt	kt	kt	kt	kt	kt
Emissions of HFCsc - (kt CO2 eq)	0.00	0.00	0.01	0.05	0.14	0.38	0.66	1.04	1.38
HFC-23	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-32	NO	NO	NO	0.00	0.00	0.00	0.00	0.00	0.00
HFC-41	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-43-10mee	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-125	NO	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-134	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-134a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-152a	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-143	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-143a	NO	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-227ea	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-236fa	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-245ca	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspecified mix of listed HFCsd - (kt CO_2 eq)	NO	NO	NO	NO	NO	NO	NO	NO	NO
Emissions of PFCsc - (kt CO2 eq)	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00
CF_4	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_2F_6	NO	NO	NO	NO	NO	NO	NO	NO	NO
C 3F8	NO	NO	NO	NO	NO	NO	NO	NO	0.00
C_4F_{10}	NO	NO	NO	NO	NO	NO	NO	NO	NO
c-C_4F_8	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_5F_{12}	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_6F_{14}	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspecified mix of listed PFCs(4) - (Gg CO_2 equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	NO
Emissions of SF6(3) - (Gg CO2 equivalent)	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00	0.00	0.00
SF_6	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00	0.00	0.00

Note: All footnotes for this table are given on sheet 3.

Table 1(d)
Emission trends (HFCs, PFCs and SF_6)
(Sheet 2 of 3)

BR v0.1, Liechtenstein
Source: Submission 2014 v1.1, LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	*1999*	2000	2001	2002	2003	2004	2005	2006	2007	2008
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
Emissions of HFCsc - (kt CO2 eq)	1.81	2.32	2.99	3.28	3.77	4.33	4.38	4.39	4.66	5.08
HFC-23	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-41	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-43-10mee	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-125	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-134	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-134a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-152a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-143	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-143a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-227ea	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-236fa	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-245ca	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspecified mix of listed HFCsd - (kt CO_2 eq)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Emissions of PFCsc - (kt CO2 eq)	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.06
CF_4	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_2F_6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C 3F8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C_4F_{10}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
c-C_4F_8	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_5F_{12}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_6F_{14}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspecified mix of listed PFCs(4) - (Gg CO_2 equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Emissions of SF6(3) - (Gg CO2 equivalent)	0.00	0.09	0.17	0.26	0.26	0.28	0.27	0.06	0.12	0.36
SF_6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: All footnotes for this table are given on sheet 3.

Table 1(d)
Emission trends (HFCs, PFCs and SF_6)
(Sheet 3 of 3)

BR v0.1, Liechtenstein
: Submission 2014 v1.1, LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	*2009*	2010	2011	Change from base to latest reported year
	kt	kt	kt	%
Emissions of HFCsc - (kt CO2 eq)	5.33	6.65	8.73	9,196,614.98
HFC-23	NO	NO	NO	0.00
HFC-32	0.00	0.00	0.00	100.00
HFC-41	NO	NO	NO	0.00
HFC-43-10mee	NO	NO	NO	0.00
HFC-125	0.00	0.00	0.00	100.00
HFC-134	NO	NO	NO	0.00
HFC-134a	0.00	0.00	0.00	3,645,950.74
HFC-152a	NO	NO	NO	0.00
HFC-143	NO	NO	NO	0.00
HFC-143a	0.00	0.00	0.00	100.00
HFC-227ea	NO	NO	NO	0.00
HFC-236fa	NO	NO	NO	0.00
HFC-245ca	NO	NO	NO	0.00
Unspecified mix of listed HFCsd - (kt CO_2 eq)	NO	NO	NO	0.00
Emissions of PFCsc - (kt CO2 eq)	0.05	0.07	0.07	100.00
CF_4	NO	NO	NO	0.00
C_2F_6	NO	NO	NO	0.00
C 3F8	0.00	0.00	0.00	100.00
C_4F_{10}	NO	NO	NO	0.00
c-C_4F_8	NO	NO	NO	0.00
C_5F_{12}	NO	NO	NO	0.00
C_6F_{14}	NO	NO	NO	0.00
Unspecified mix of listed PFCs(4) - (Gg CO_2 equivalent)	NO	NO	NO	0.00
Emissions of SF6(3) - (Gg CO2 equivalent)	0.14	0.02	0.01	100.00
SF_6	0.00	0.00	0.00	100.00

Abbreviations : CRF = common reporting format, LULUCF = land use, land-use change and

[a] The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

For further information please refer to chapter 3 of Liechtenstein's Sixth National Communication.

3. Quantified Economy-wide Emission Reduction Target (QEWER)

Liechtenstein's quantified economy-wide emission reduction target

Liechtenstein quantified economy-wide emission reduction target is -20% of its 1990 total GHG emissions by 2020. Optionally, to increase its ambitions to -30%, if other developed countries commit themselves to comparable emissions reduction efforts and if economically more advanced developing countries take appropriate mitigation actions.

Table 2(a) LIE_BR1_v0.1

Description of quantified economy-wide emission reduction target: base year[a]

Party	*Liechtenstein*	
Base year /base period	1990	
Emission reduction target	% of base year/base period	% of 1990 [b]
		20.00
Period for reaching target	BY-2020	

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] Optional.

Table 2(b) LIE_BR1_v0.1

Description of quantified economy-wide emission reduction target: gases and sectors covered[a]

Gases covered		*Base year for each gas (year):*
CO_2		1990
CH_4		1990
N_2O		1990
HFCs		1990
PFCs		1990
SF_6		1990
NF_3		
Other Gases (specify)		
Sectors covered[b]	Energy	Yes
	Transport[f]	Yes
	Industrial processes[g]	Yes
	Agriculture	Yes
	LULUCF	Yes
	Waste	Yes
	Other Sectors (specify)	

Abbreviations: LULUCF = land use, land-use change and forestry.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] More than one selection will be allowed. If Parties use sectors other than those indicated above, the explanation of how these sectors relate to the sectors defined by the IPCC should be provided.

[f] Transport is reported as a subsector of the energy sector.

[g] Industrial processes refer to the industrial processes and solvent and other product use sectors.

Table 2(c) LIE_BR1_v0.1

Description of quantified economy-wide emission reduction target: global warming potential values (GWP)[a]

Gases	*GWP values* [b]
CO_2	2nd AR
CH_4	2nd AR
N_2O	2nd AR
HFCs	2nd AR
PFCs	2nd AR
SF_6	2nd AR
NF_3	2nd AR
Other Gases (specify)	

Abbreviations: GWP = global warming potential

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] Please specify the reference for the GWP: Second Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) or the Fourth Assessment Report of the IPCC.

Table 2(d) LIE_BR1_v0.1

Description of quantified economy-wide emission reduction target: approach to counting emissions and removals from the LULUCF sector[a]

Role of LULUCF	LULUCF in base year level and target	Included
	Contribution of LULUCF is calculated using	Land-based approach

Abbreviation: LULUCF = land use, land-use change and forestry.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

Use of international market based mechanisms

Liechtenstein will continue the use of carbon credits generated from the flexible mechanisms of the Kyoto Protocol and from new market based mechanisms under the Convention in order to ensure the achievement of the abovementioned reduction target. Current projections, as contained in Liechtenstein's 6th National Communication (Chapter 5.3), forecast an annual demand of around 22'000 t CO_2 eq to be reduced abroad. This number is based on annual emissions estimates of 193.99 Gg CO_2.

However, in order to calculate the exact amount of carbon credits until 2020 the Government will have to conclude further estimations and projections, based on the effective implementation of policy measures which have been proposed in the Government's Energy Strategy 2020.

As described above Liechtenstein has not yet calculated the exact amount of required carbon credits from abroad (2013). During COP 18 in 2012 in Doha, Qatar Liechtenstein declared not to acquire AAUs for compliance purposes under the second commitment period of the Kyoto Protocol (FCCC/KP/CMP/2012/L.9). Liechtenstein may, however, use a limited amount of its own AAUs to be carried over in the second commitment period.

Table 2(e)I LIE_BR1_v0.1

Description of quantified economy-wide emission reduction target: market-based mechanisms under the Convention[a]

Market-based mechanisms under the Convention	*Possible scale of contributions (estimated kt CO_2 eq)*
CERs	NE
ERUs	NO
AAUs[i]	NE
Carry-over units[j]	NE
Other mechanism units under the Convention (specify)[d]	

Abbreviations: AAU = assigned amount unit, CER = certified emission reduction, ERU = emission reduction unit.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[d] As indicated in paragraph 5(e) of the guidelines contained in annex I of decision 2/CP.17 .

[i] AAUs issued to or purchased by a Party.

[j] Units carried over from the first to the second commitment periods of the Kyoto Protocol, as described in decision 13/CMP.1 and consistent with decision 1/CMP.8.

Table 2(e)II LIE_BR1_v0.1

Description of quantified economy-wide emission reduction target: other market-based mechanisms[a]

Other market-based mechanisms	*Possible scale of contributions*
(Specify)	*(estimated kt CO_2 eq)*

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

Table 2(f) LIE_BR1_v0.1

Description of quantified economy-wide emission reduction target: any other information[a,b]

The aim of Liechtenstein is to prioritize domestic greenhouse gas reductions. The reduction goal for the year 2020 together with the respective priority of domestic mitigation action has therefore been incorporated into Liechtenstein's Emissions Trading Act from 2012.
In case the envisaged reductions would be higher than 20% by 2020, Liechtenstein would need to increase its use of carbon credits in order to achieve the respective target. The precise amount of additional credits has not been estimated yet.
To that respect Liechtenstein envisages to take the option of continuing its engagement within the Kyoto Protocol's flexible mechanism. This engagement will be guided by the National Climate Strategy, which will be revised in the course of 2014.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] This information could include information on the domestic legal status of the target or the total assigned amount of emission units for the period for reaching a target. Some of this information is presented in the narrative part of the biennial report.

Custom Footnotes

For further information please refer to chapter 5.3 of Liechtenstein's Sixth National Communication.

4. Progress in achievement of QEWER target

Mitigation actions and their effects in Liechtenstein

Liechtenstein has implemented its climate related policies and measures strongly into individual sectorial policies. The responsibility of monitoring the effects of individual measures or policies is therefore beard by the respective administration offices that are in charge of the execution of the individual measure. These authorities provide an annual report of their activities (not only climate change related) which will be forwarded to the Liechtenstein Parliament. The reports are publicly available.

Liechtenstein's legislative and administrative main arrangements to meet its commitments under the Kyoto Protocol are to be found in the Emissions Trading Act and the CO_2 Act.

The Emissions Trading Act (EHG) sets up the general framework for the fulfilment of Liechtenstein's reduction obligations originating from the respective ratification of the Kyoto Protocol. In 2012 the Government introduced a legally binding greenhouse gas reduction target from at least 20% compared to 1990 until 2020. In addition the EHG states that emission reductions are first and foremost to be reduced by

domestic measures. If the reduction obligations cannot be fulfilled through domestic measures the government may participate in project activities abroad or in international emissions trading. Besides this the EHG implements Directive 2003/87/EC (Emissions Trading Directive) into national law and obliges two industrial installations (2013) to participate within the European Emissions Trading Scheme. Due to comprehensive amendments of Directive 2003/87/EC the EHG has been revised in 2012. The regulations of the EHG with respect to the participation of Liechtenstein in the Kyoto Protocols flexible mechanisms as well as with respect to domestic emissions trading are executed by the Office of Environment.

The CO_2 Act corresponds with the CO_2 Act of Switzerland (in force since 2008) and introduces a levy on the consumption of fossil fuel (oil and natural gas). In 2013 the CO2 Act has been revised. Besides the levy on fossil fuel an obligation to compensate CO_2 emissions from the use of motor fuels (gasoline and diesel) as well as emission regulations for passenger cars has been introduced.

The CO_2 Act is part of "The bilateral Agreement between the Principality of Liechtenstein and the Swiss Confederation on Environmental Levies within the Principality of Liechtenstein".

In terms of measurable mitigation actions the most relevant measures are to be found in the energy sector, since over 80 % of Liechtenstein's CO_2 emissions are energy related. To this regard the Energy Efficiency Act and the Energy Strategy 2020 serve as central drivers for the achievement of Liechtenstein's GHG reduction targets until 2020:

The **Energy Efficiency Act** (2008) and the relevant Ordinance (2008) as well as the Energy Ordinance (2007) on the Construction Act constitute the legal framework for the implementation of measures relating to buildings. A gratifying development is also that municipalities now supplement national Energy Conservation Act subsidies with their own funds. The Government intends to promote the measures for implementing the objectives laid down in the energy strategy with financial resources and advice. The increase of energy efficiency and in particular the increased use of renewable energies are of central importance for the reduction of greenhouse gas emissions and accordingly for a long-term climate policy.

In 2012 the Government adopted the "**Energy Strategy 2020**". The strategy provides future-oriented impulses for the national energy policy. The focus areas of the concept are the promotion of efficient energy use, the use of renewable energies, and energy conservation. These goals correspond to the aims of the EU's 20-20-20 climate package from 2008. Increase the share of renewable energy in total energy use from 8% to 20% by 2020. Increase the energy efficiency to 20% to stabilize the energy consumption on the level of 2008 by 2020 and 20% reduction of the CO_2 emission by 2020. The Energy Strategy 2020 also addressed the need to minimize adverse effects of its proposed measures as required by Art. 2 paragraph 3 of the Kyoto Protocol. The proposed set of measures has been checked against its compatibility with economic as well as social requirements.

Table 3

Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects

Name of mitigation action [a]	*Sector(s) affected* [b]	*GHG(s) affected*	*Objective and/or activity affected*	*Type of instrument* [c]	*Status of implementation* [d]	*Brief description* [e]	*Start year of implementation*	*Implementing entity or entities*	*Estimate of mitigation impact (not cumulative, in kt CO_2 eq)*	
Steam Pipeline	Energy	CO_2	Acquistion of steam from a waste incineration plant in Buchs (Switzerland) to replace fossil fuels for manufacturing industries.	Other (Other (Infrastructure measure))	Implemented		2009	Private		2.20
Deep Geothermal Energy	Energy	CO_2	Use of geological heat from deep thermal aquifiers for electic power and heating	Other (Other (Planning measure))	Planned	Planned measure, but no decision yet.	2030	Office of Environment		NO
Energy Efficiency Act	Energy	CO_2	Aims for energy reduction, the intelligent and economic use of energy as well as the promotion of renewable energies. Promotion of heat insulation (renovation of old buildings), residential technical installations (room heating and nonpotable water), solar energy (thermal solar collectors and photovoltaic) and demonstration facilities.	Fiscal	Implemented		2008	Office of Economic Affairs		2.89
Liechtenstein Energy Strategy 2020	Energy	CO_2	Governmental Strategy that ensures a sustainable energy supply.	Other (Planning measure)	Implemented		2012	Government of Liechtenstein/Office of Economic Affaris		6.89

Note: The two final columns specify the year identified by the Party for estimating impacts (based on the status of the measure and whether an ex post or ex ante estimation is available).

Abbreviations: GHG = greenhouse gas; LULUCF = land use, land-use change and forestry.

[a] Parties should use an asterisk (*) to indicate that a mitigation action is included in the 'with measures' projection.

[b] To the extent possible, the following sectors should be used: energy, transport, industry/industrial processes, agriculture, forestry/LULUCF, waste management/waste, other sectors, cross-cutting, as appropriate.

[c] To the extent possible, the following types of instrument should be used: economic, fiscal, voluntary agreement, regulatory, information, education, research, other.

[d] To the extent possible, the following descriptive terms should be used to report on the status of implementation: implemented, adopted, planned.

[e] Additional information may be provided on the cost of the mitigation actions and the relevant timescale.

[f] Optional year or years deemed relevant by the Party.

Information on the effective quantity of units from market based mechanisms under the Convention will be available in the course of 2015, once the last submission of the first Kyoto period's inventory data has been finalized and reviewed (2014/2015).

Table 4 LIE_BR1_v0.1

Reporting on progress[a, b]

	Total emissions excluding LULUCF	*Contribution from LULUCF*[d]	*Quantity of units from market based mechanisms under the Convention*		*Quantity of units from other market based mechanisms*	
Year[c]	*(kt CO_2 eq)*	*(kt CO_2 eq)*	*(number of units)*	*(kt CO_2 eq)*	*(number of units)*	*(kt CO_2 eq)*
(1990)	230.33	9.40				
2010	234.12	7.10			NO	
2011	222.04	4.84	NE, NO			
2012	NE	NE	NO, NE			

Abbreviation: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] For the base year, information reported on the emission reduction target shall include the following: (a) total GHG emissions, excluding emissions and removals from the LULUCF sector; (b) emissions and/or removals from the LULUCF sector based on the accounting approach applied taking into consideration any relevant decisions of the Conference of the Parties and the activities and/or land that will be accounted for; (c) total GHG emissions, including emissions and removals from the LULUCF sector. For each reported year, information reported on progress made towards the emission reduction targets shall include, in addition to the information noted in paragraphs 9(a–c) of the UNFCCC biennial reporting guidelines for developed country Parties, information on the use of units from market-based mechanisms.

[c] Parties may add additional rows for years other than those specified below.

[d] Information in this column should be consistent with the information reported in table 4(a)I or 4(a)II, as appropriate. The Parties for which all relevant information on the LULUCF contribution is reported in table 1 of this common tabular format can refer to table 1.

Table 4(a)I LIE_BR1_v0.1

Progress in achieving the quantified economy-wide emission reduction targets – further information on mitigation actions relevant to the contribution of the land use, land-use change and forestry sector in 2011 [a,b]

	Net GHG emissions/removals from LULUCF categories [c]	*Base year/period or reference level value* [d]	*Contribution from LULUCF for reported year*	*Cumulative contribution from LULUCF* [e]	*Accounting approach* [f]
	(kt CO_2 eq)				
Total LULUCF					Land-based approach
A. Forest land					Land-based approach
1. Forest land remaining forest land					Land-based approach
2. Land converted to forest land					Land-based approach
3. Other [g]					Land-based approach
B. Cropland					Land-based approach
1. Cropland remaining cropland					Land-based approach
2. Land converted to cropland					Land-based approach
3. Other [g]					Land-based approach
C. Grassland					Land-based approach
1. Grassland remaining grassland					Land-based approach
2. Land converted to grassland					Land-based approach
3. Other [g]					Land-based approach
D. Wetlands					Land-based approach
1. Wetland remaining wetland					Land-based approach
2. Land converted to wetland					Land-based approach
3. Other [g]					Land-based approach
E. Settlements					Land-based approach
1. Settlements remaining settlements					Land-based approach
2. Land converted to settlements					Land-based approach
3. Other [g]					Land-based approach
F. Other land					Land-based approach
1. Other land remaining other land					Land-based approach
2. Land converted to other land					Land-based approach
3. Other [g]					Land-based approach
Harvested wood products					Land-based approach

Abbreviations: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] Parties that use the LULUCF approach that is based on table 1 do not need to complete this table, but should indicate the approach in table 2. Parties should fill in a separate table for each year, namely 2011 and 2012, where 2014 is the reporting year.

[c] For each category, enter the net emissions or removals reported in the most recent inventory submission for the corresponding inventory year. If a category differs from that used for the reporting under the Convention or its Kyoto Protocol, explain in the biennial report how the value was derived.

[d] Enter one reference level or base year/period value for each category. Explain in the biennial report how these values have been calculated.

[e] If applicable to the accounting approach chosen. Explain in this biennial report to which years or period the cumulative contribution refers to.

[f] Label each accounting approach and indicate where additional information is provided within this biennial report explaining how it was implemented, including all relevant accounting parameters (i.e. natural disturbances, caps).

[g] Specify what was used for the category "other". Explain in this biennial report how each was defined and how it relates to the categories used for reporting under the Convention or its Kyoto Protocol.

Table 4(a)I LIE_BR1_v0.1

Progress in achieving the quantified economy-wide emission reduction targets – further information on mitigation actions relevant to the contribution of the land use, land-use change and forestry sector in 2012 [a, b]

	Net GHG emissions/removals from LULUCF categories [c]	*Base year/period or reference level value* [d]	*Contribution from LULUCF for reported year*	*Cumulative contribution from LULUCF* [e]	*Accounting approach* [f]
	(kt CO_2 eq)				
Total LULUCF					Land-based approach
A. Forest land					Land-based approach
1. Forest land remaining forest land					Land-based approach
2. Land converted to forest land					Land-based approach
3. Other [g]					Land-based approach
B. Cropland					Land-based approach
1. Cropland remaining cropland					Land-based approach
2. Land converted to cropland					Land-based approach
3. Other [g]					Land-based approach
C. Grassland					Land-based approach
1. Grassland remaining grassland					Land-based approach
2. Land converted to grassland					Land-based approach
3. Other [g]					Land-based approach
D. Wetlands					Land-based approach
1. Wetland remaining wetland					Land-based approach
2. Land converted to wetland					Land-based approach
3. Other [g]					Land-based approach
E. Settlements					Land-based approach
1. Settlements remaining settlements					Land-based approach
2. Land converted to settlements					Land-based approach
3. Other [g]					Land-based approach
F. Other land					Land-based approach
1. Other land remaining other land					Land-based approach
2. Land converted to other land					Land-based approach
3. Other [g]					Land-based approach
Harvested wood products					Land-based approach

Abbreviations: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] Parties that use the LULUCF approach that is based on table 1 do not need to complete this table, but should indicate the approach in table 2. Parties should fill in a separate table for each year, namely 2011 and 2012, where 2014 is the reporting year.

[c] For each category, enter the net emissions or removals reported in the most recent inventory submission for the corresponding inventory year. If a category differs from that used for the reporting under the Convention or its Kyoto Protocol, explain in the biennial report how the value was derived.

[d] Enter one reference level or base year/period value for each category. Explain in the biennial report how these values have been calculated.

[e] If applicable to the accounting approach chosen. Explain in this biennial report to which years or period the cumulative contribution refers to.

[f] Label each accounting approach and indicate where additional information is provided within this biennial report explaining how it was implemented, including all relevant accounting parameters (i.e. natural disturbances, caps).

[g] Specify what was used for the category "other". Explain in this biennial report how each was defined and how it relates to the categories used for reporting under the Convention or its Kyoto Protocol.

Table 4(a)II

BR v0.1, Liechtenstein
Source: Submission 2014 v1.1, LIECHTENSTEIN

Progress in achievement of the quantified economy-wide emission reduction targets – further information on mitigation actions relevant to the counting of emissions and removals from the land use, land-use change and forestry sector in relation to activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol[a,b,c]

GREENHOUSE GAS SOURCE AND SINK ACTIVITIES	*Base year*[d]	*Net emissions/removals*[e]					*Accounting parameters*[h]	*Accounting quantity*[i]
		2008	2009	*2010*	*2011*	Total[f]		
	(kt CO_2 **eq**)							
A. Article 3.3 activities								
A.1. Afforestation and Reforestation								-0.81
A.1.1. Units of land not harvested since the beginning of the commitment periodj		-0.21	-0.22	-0.20	-0.18	-0.81		-0.81
A.1.2. Units of land harvested since the beginning of the commitment periodj								NO
A.2. Deforestation		0.35	0.43	0.14	0.39	1.32		1.31934
B. Article 3.4 activities								
B.1. Forest Management (if elected)		NA	NA	NA	NA	NA		NA
3.3 offset[k]							0.50614	NA
FM cap[l]							183.33333	NA
B.2. Cropland Management (if elected)	0	NA	NA	NA	NA	NA	0	0
B.3. Grazing Land Management (if elected)	0	NA	NA	NA	NA	NA	0	0
B.4. Revegetation (if elected)	0	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0	0

Note: 1 kt CO_2 eq equals 1 Gg CO_2 eq.

Abbreviations: CRF = common reporting format, LULUCF = land use, land-use change and forestry.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] Developed country Parties with a quantified economy-wide emission reduction target as communicated to the secretariat and contained in document FCCC/SB/2011/INF.1/Rev.1 or any update to that document, that are Parties to the Kyoto Protocol, may use table 4(a)II for reporting of accounting quantities if LULUCF is contributing to the attainment of that target.

[c] Parties can include references to the relevant parts of the national inventory report, where accounting methodologies regarding LULUCF are further described in the documentation box or in

[d] Net emissions and removals in the Party's base year, as established by decision 9/CP.2.

[e] All values are reported in the information table on accounting for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, of the CRF for the relevant inventory year as reported in the current submission and are automatically entered in this table.

[f] Additional columns for relevant years should be added, if applicable.

[g] Cumulative net emissions and removals for all years of the commitment period reported in the current submission.

[h] The values in the cells "3.3 offset" and "Forest management cap" are absolute values.

[i] The accounting quantity is the total quantity of units to be added to or subtracted from a Party's assigned amount for a particular activity in accordance with the provisions of Article 7, paragraph 4, of the Kyoto Protocol.

[j] In accordance with paragraph 4 of the annex to decision 16/CMP.1, debits resulting from harvesting during the first commitment period following afforestation and reforestation since 1990 shall not be greater than the credits accounted for on that unit of land.

[k] In accordance with paragraph 10 of the annex to decision 16/CMP.1, for the first commitment period a Party included in Annex I that incurs a net source of emissions under the provisions of Article 3 paragraph 3, may account for anthropogenic greenhouse gas emissions by sources and removals by sinks in areas under forest management under Article 3, paragraph 4, up to a level that is equal to the net source of emissions under the provisions of Article 3, paragraph 3, but not greater than 9.0 megatonnes of carbon times five, if the total anthropogenic greenhouse gas emissions by sources and removals by sinks in the managed forest since 1990 is equal to, or larger than, the net source of emissions incurred under Article 3, paragraph 3.

[l] In accordance with paragraph 11 of the annex to decision 16/CMP.1, for the first commitment period of the Kyoto Protocol only, additions to and subtractions from the assigned amount of a Party resulting from Forest management under Article 3, paragraph 4, after the application of paragraph 10 of the annex to decision 16/CMP.1 and resulting from forest management project activities undertaken under Article 6, shall not exceed the value inscribed in the appendix of the annex to decision 16/CMP.1, times five.

Information on the effective quantity of units from market based mechanisms under the Convention will be available in the course of 2015, once the last submission of the first Kyoto period's inventory data has been finalized and reviewed (2014/2015).

Table 4(b) LIE_BR1_v0.1

Reporting on progress [a, b, c]

Units of market based mechanisms			*Year*	
			2011	*2012*
Kyoto Protocol units [d]	*Kyoto Protocol units*	*(number of units)*	NE, NO	NO, NE
		(kt CO_2 eq)		
	AAUs	*(number of units)*	NE	NE
		(kt CO2 eq)		
	ERUs	*(number of units)*	NO	NO
		(kt CO2 eq)		
	CERs	*(number of units)*	NE	NE
		(kt CO2 eq)		
	tCERs	*(number of units)*	NO	NO
		(kt CO2 eq)		
	lCERs	*(number of units)*	NO	NO
		(kt CO2 eq)		
Other units [d,e]	*Units from market-based mechanisms under the Convention*	*(number of units)*		
		(kt CO_2 eq)		
	Units from other market-based mechanisms	*(number of units)*		
		(kt CO_2 eq)		
Total		*(number of units)*	NE, NO	NO, NE
		(kt CO_2 eq)		

Abbreviations: AAUs = assigned amount units, CERs = certified emission reductions, ERUs = emission reduction units, lCERs = long-term certified emission reductions, tCERs = temporary certified emission reductions.
Note: 2011 is the latest reporting year.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] For each reported year, information reported on progress made towards the emission reduction target shall include, in addition to the information noted in paragraphs 9(a-c) of the reporting guidelines, on the use of units from market-based mechanisms.

[c] Parties may include this information, as appropriate and if relevant to their target.

[d] Units surrendered by that Party for that year that have not been previously surrendered by that or any other Party.

[e] Additional rows for each market-based mechanism should be added, if applicable.

For further information please refer to chapter 4 of Liechtenstein's Sixth National Communication.

5. Projections

The starting point for Liechtenstein's projections is the Energy Strategy 2020. The strategy describes three different energy scenarios until 2020. Two of them have been used in order to define Liechtenstein's emission scenarios "with measures" (WM) and "with additional measures" (WAM) within the energy-related sectors (see chapters 5.1.2 and 5.1.3 of Liechtenstein's Sixth National Communication).

The projections presented for the years 2015, 2020 and 2030 rely on the latest emission and energy use data available for Liechtenstein, projections of reductions through measures implemented from the Bureau of Energy Consumption and Conservation as well as on comparisons and analogies with the projections and assumptions developed for Switzerland.

Based on various national acts a number of measures have already been or are currently planned to be implemented. This includes environmental levies, the package of energy related measures in the Energy Strategy 2020 and direct payments for agriculture.

Liechtenstein's financially most relevant and for projections most reliably quantifiable measures currently in place, focus on the refurbishment of old buildings, on solar collector systems and on substitutions towards heat pumps and wood heater induced under the Energy ordinance (EEG). Their effects are visible in a reduction in the consumption of heating fuels and finally in the reduction of emissions in the sectors Industry (1A2) and "Others" (1A4). The municipalities individually supplement the national subsidies with additional funds. Other measures, such as savings through more efficient new private heaters or recovery of steam in industry, are independent of the EEG but relevant for emission reduction.

Table 5 LIE_BR1_v0.1

Summary of key variables and assumptions used in the projections analysis [a]

Key underlying assumptions		*Historical* [b]						Projected			
Assumption	*Unit*	*1990*	*1995*	2000	2005	2010	2011	2015	2020	2025	2030
Population	*thousands*	29.03	30.92	32.86	34.90	36.14	36.47	38.03	39.59	40.99	42.18
Population growth	*%*			1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55

[a] Parties should include key underlying assumptions as appropriate.

[b] Parties should include historical data used to develop the greenhouse gas projections reported.

Table 6(a) LIE_BR1_v0.1

Information on updated greenhouse gas projections under a 'with measures' scenario [a]

	GHG emissions and removals [b]							GHG emission projections	
	(kt CO_2 eq)							(kt CO_2 eq)	
	Base year (1990)	1990	1995	2000	2005	2010	2011	2020	2030
Sector [d,e]									
Energy	203.78	203.78	210.56	229.46	242.11	201.89	201.89	160.11	144.24
Transport	76.69	76.69	81.55	95.84	85.57	80.47	79.53	82.33	65.63
Industry/industrial processes	0.00	0.00	0.35	2.41	4.68	6.75	8.81	8.49	6.93
Agriculture	22.96	22.96	21.62	20.07	22.12	22.73	23.37	22.10	22.10
Forestry/LULUCF	-9.46	-9.46	-9.64	-8.59	-7.71	-7.14	-7.03	-5.99	-4.85
Waste management/waste	1.58	1.58	1.52	1.72	1.91	1.77	1.78	2.33	2.74
Other (specify)									
Gas									
CO_2 emissions including net CO_2 from LULUCF	193.60	193.60	199.80	219.00	239.90	192.40	177.80	NE	NE
CO_2 emissions excluding net CO_2 from LULUCF	203.10	203.10	209.40	227.60	239.90	199.60	184.80	158.23	142.52
CH_4 emissions including CH_4 from LULUCF	14.40	14.40	13.40	13.00	14.56	15.10	15.40	NE	NE
CH_4 emissions excluding CH_4 from LULUCF	14.40	14.20	13.40	13.00	14.60	15.10	15.40	14.53	14.51
N_2O emissions including N_2O from LULUCF	12.90	12.90	12.50	12.00	12.80	12.70	13.00	NE	NE
N_2O emissions excluding N_2O from LULUCF	12.90	12.90	12.50	12.00	12.60	12.70	13.00	12.73	12.84
HFCs	0.00	0.00	0.38	2.41	4.63	6.75	8.81	8.41	6.86
PFCs	0.00	0.00	0.00	0.02	0.04	0.05	0.07	0.07	0.06
SF_6	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Other (specify)									
Total with LULUCF [f]	220.90	220.90	226.08	246.43	271.94	227.01	215.09	8.49	6.93
Total without LULUCF	230.40	230.20	235.68	255.03	271.78	234.21	222.09	193.98	176.80

Abbreviations : GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

[a] In accordance with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications", at a minimum Parties shall report a 'with measures' scenario, and may report 'without measures' and 'with additional measures' scenarios. If a Party chooses to report 'without measures' and/or 'with additional measures' scenarios they are to use tables 6(b) and/or 6(c), respectively. If a Party does not choose to report 'without measures' or 'with additional measures' scenarios then it should not include tables 6(b) or 6(c) in the biennial report.

[b] Emissions and removals reported in these columns should be as reported in the latest GHG inventory and consistent with the emissions and removals reported in the table on GHG emissions and trends provided in this biennial report. Where the sectoral breakdown differs from that reported in the GHG inventory Parties should explain in their biennial report how the inventory sectors relate to the sectors reported in this table.

[c] 20XX is the reporting due-date year (i.e. 2014 for the first biennial report).

[d] In accordance with paragraph 34 of the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications", projections shall be presented on a sectoral basis, to the extent possible, using the same sectoral categories used in the policies and measures section. This table should follow, to the extent possible, the same sectoral categories as those listed in paragraph 17 of those guidelines, namely, to the extent appropriate, the following sectors should be considered: energy, transport, industry, agriculture, forestry and waste management.

[e] To the extent possible, the following sectors should be used: energy, transport, industry/industrial processes, agriculture, forestry/LULUCF, waste management/waste, other sectors (i.e. cross-cutting), as appropriate.

[f] Parties may choose to report total emissions with or without LULUCF, as appropriate.

For further information please refer to chapter 5 of Liechtenstein's Sixth National Communication.

6. Provision of financial, technological and capacity-building support to developing country Parties

According to the biennial reporting guidelines the reporting obligations concerning financial, technological and capacity-building support to developing country parties only apply to Annex II Parties to the Convention (see FCCC/CP/2011/9/Add.1, Annex I, Chapter VI). Since Liechtenstein is not listed in Annex II to the Convention the Government does not consider itself to be bound by the respective provisions.

However, due to Liechtenstein's activities within the Fast Start Finance Period 2010 to 2012 as well as with regard to the Government decision of 2012 to continue its engagement within the framework of international climate finance Liechtenstein has chosen to report these activities under paragraph 25, Chapter 7 "Other Reporting matters".

With respect to future submissions Liechtenstein aims at using that reporting format and opportunity to also address the request by Parties made in conjunction with the work program on long term finance at COP 19 in Warsaw.[2]

7. Other reporting elements

Liechtenstein's emissions measurements, reporting and verification and emission projections

Liechtenstein accounts yearly for the national greenhouse gas inventory (NIR).

The annual publication of Liechtenstein's energy statistics, provided by the Office of Statistics, serves as a monitoring tool in order to evaluate the effect of the respective policies. Based on the Energy Strategy 2020 the Government has set up an administrative body that is responsible for the implementation and monitoring of measures set up by the Energy Strategy 2020.

[2] see paragraph 10 http://unfccc.int/files/meetings/warsaw_nov_2013/decisions/application/pdf/cop19_ltf.pdf

Liechtenstein's activities within international climate finance

Liechtenstein has repeatedly underscored its commitment to achieving the international ODA target of 0.7% as soon as possible. Under the budget line "International Humanitarian Cooperation and Development", Liechtenstein's most recent ODA percentage for the year 2011 is 0.62. In addition to its ODA, as part of the global effort, Liechtenstein has committed a respective climate finance contribution:

With calculations taking into account the national level of emissions, the financial capacity and the population size, the Liechtenstein Parliament decided in 2010 to introduce a new fast-start financing budget line of CHF 700.000 for the years 2011 and 2012, a budget line based on additional, new increases in the cooperation and development aid budget. Liechtenstein's fast-start financing commitment is therefore not diverting from other important development priorities, but instead will complement and further strengthen these. In 2012, the Parliament decided to extend its engagement in climate finance until 2015 with a total budget of CHF 600.000. Liechtenstein envisages continuing its engagement after 2015 – provided the respective budgetary approval by parliament is granted.

Within its climate finance engagement Liechtenstein's prime concern is the delivery of effective results and benefits which address the sustainable development and climate change needs and priorities of developing countries. Moreover Liechtenstein aims at giving support in planning and realising sustainable development by further defining a responsible development framework, evaluating capacities, making wise use of and therefore securing resources. To this respect Liechtenstein's climate finance not only aims to assist in governance and capacity-building, but also to foster effects like safe living conditions and guaranteeing subsistence, which is respecting dignity and creating additional sources of income and constant progress in the field of education and jobs.

Project actions and components covered by Liechtenstein's support under climate finance therefore need to:

- show a need driven approach, because they are developed by recipients and reflect their priorities;
- allow recipients to gain ownership of the processes and projects;
- activate the self-organisation of local populations;
- support socially, economically and environmentally friendly initiatives;
- contribute to solving gender problems, empowering women, raising awareness among young people and civil society and finally strengthening peace and security.

In general, support is given to development country partners to help them both adapt to and mitigate the effects of climate change. For the sake of performance and efficiency, Liechtenstein prefers a bilateral allocation of climate finance projects. Therefore the realisation of projects is focused on traditional cooperation partners under the umbrella of the Mountain Partnership or partners of the Liechtenstein Development Service (LED).

Liechtenstein's **adaptation** assistance focuses on improving resilience to extreme weather conditions and other hazards, by investing in infrastructure which can better withstand climate change impacts, and through other practical measures to help local communities be more prepared.

To assist in **mitigating** climate change, Liechtenstein is placing emphasis on supporting energy efficiency programmes and renewable energy systems in the Caucasus, Central Asia and African countries. Liechtenstein strives to allocate these official funds in a balanced manner by supporting climate projects, which are reflecting recipient needs as regards sustainable development and which are politically supported by respective authorities.

With regard to the implementation of efficient and effective development policies, both partnerships and networks are indispensable: partnerships, which for their mutual benefit are embracing governments, institutions and civil society. Such Public Private Partnerships (PPP) with their potential for mobilising private funds and knowledge in order to carry out governmental obligations and at the same time making best use of each partners strengths must much more determine successful environment and development policies in future as they do today. Therefore, from the very start of its climate finance activities,

Liechtenstein has always strived for supplementing its national fast-start contributions by private or institutional sources.

As it has been communicated on the occasion of a Side Event on "Fast Start Finance – Lessons Learnt" at COP 19 in Warsaw 2013 Liechtenstein will revise its climate finance strategy post 2015 in the course of 2014 in order to strengthen the involvement of Liechtenstein's private sector and to explore the possibilities to make use of new and innovated sources of public revenues.[3]

For further information please refer to chapter 7 of Liechtenstein's Sixth National Communication.

3 further information available: https://unfccc.int/files/cooperation_support/financial_mechanism/fast_start_finance/application/pdf/131112fsf_liechtenstein.pdf