Austria's

SIXTH NATIONAL COMMUNICATION

in Compliance with the Obligations under the
United Nations Framework Convention on Climate Change,
according to Decisions 9/CP.16 and 4/CP.5
of the Conference of the Parties,
and in Compliance with the Obligations under the Kyoto Protocol,
according to Decisions 7/CMP.8 and 15/CMP.1
of the Conference of the Parties
serving as the meeting of the Parties to the Kyoto Protocol

The Sixth National Communication of Austria under the Framework Convention on Climate Change was drafted, co-ordinated and compiled by the Federal Ministry of Agriculture, Forestry, Environment and Water Management, Unit V/4 (Manfred Kohlbach, Martin Kriech, Christopher Lamport). Further contributions have been provided by other units of the Federal Ministry of Agriculture, Forestry, Environment and Water Management.

Amendments to the draft report have been contributed by the members of the Interministerial Committee for the Co-ordination of Measures on the Protection of the Global Climate (IMC Climate).

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Chapter 1

Executive Summary

1.1 Introduction

The United Nations Framework Convention on Climate Change (UNFCCC) was signed by 158 countries, including Austria, within the scope of the UN Conference on Environment and Development (UNCED) held in Rio in June 1992. Austria, as the 58th country Party, ratified the UNFCCC on 27 February 1994.

Parties are obliged to prepare National Communications, in order to communicate their activities undertaken with a view to meeting commitments under the Convention. They shall report inter alia on the following: greenhouse gas inventory information; measures to mitigate greenhouse gas emissions; measures to counteract adverse effects of climate change; measures to promote research and systematic observation; financial support for developing countries; initiatives to enhance the transfer of technology between Parties; and measures to foster education and public awareness with respect to climate change.

This document is Austria's Sixth National Communication, by which Austria is complying with the obligation of communicating information to the Secretariat of the UNFCCC as specified under Art. 12 of the Convention.

The most noteworthy development after the ratification of the Convention is the Kyoto Protocol to the Convention on Climate Change, which contains concrete reduction targets for greenhouse gas emissions for Annex I Parties. Austria signed the Kyoto Protocol in April 1998 and ratified it on 31 May 2002 as one of the 15 Member States of the European Union, who have agreed to fulfil their commitments under the Kyoto Protocol jointly according to Art. 4 of the Protocol. This report serves to fulfil also the reporting obligations according to Art. 7.2 of the Protocol.

1.2 National Circumstances relevant to Greenhouse Gas Emissions and Removals

Austria is a land-locked country in central Europe with an area of 83,858 km^2. A large part of Austria is covered by the eastern Alps; about 40 % of the total area lies more than 1000 m above sea level. An increase of more than 1°C in average temperature has been observed during the last century. Forests make up more than 40 % of the Austrian total territory; the agricultural area including alpine pastures has a comparable share. The Austrian political system is a Federation with 9 federal provinces (*Länder*), each of which has its own government and parliament. Government responsibilities are shared between federation, federal provinces and local authorities. Austria acceded to the European Union in 1995 and ceded some areas of national jurisdiction to the community.

Austria's total permanent population has reached 8.44 million inhabitants in 2012; after stagnation in the early 1980ies this represents an increase of more than 900,000 since 1985. Less than one third of all Austrians live in 5 cities with more than 100,000 inhabitants each; about half of the population lives in communes with 1,000 to 10,000 inhabitants. Whereas population increased by 9 % from 1990 to 2011, the number of households increased by 24 % and useful floor space by 37 %.

Gross domestic product (GDP) at current prices was € 307 billion in the year 2012 with a growth of 2.6 % in that year; per capita GDP was € 36,430. The largest contribution to Austria's GDP with more than two third comes from the tertiary production, the rest is contributed mainly by secondary production. Gross value added of manufacturing industries (at constant prices) showed an increase of about 60 % from 1990 to 2012. The Austrian energy profile shows a high share of renewable energy with about one quarter of total gross energy consumption, contributed mainly by biomass and hydropower. With a gross domestic consumption per capita of 170 MJ in 2011 Austria belongs to the countries with low energy consumption among industrialised countries. Regarding the development of final energy consumption since 1990 the transport sector exhibits by far the strongest increase; however, the amount of road fuel that is sold in Austria but consumed abroad ("fuel export in the vehicle tank", the so called "fuel tourism") has been a significant reason for that increase. Regarding transport activity in Austria, public transport has a relevant share: 24 % of all passenger kilometres in 2011 were travelled by public transport, rail and navigation had a share of about one third of freight transport.

1.3 Greenhouse Gas Inventory Information

The Sixth National Communication lists Austria's greenhouse gas emissions as reported in the annual inventory submission from April 2013. It contains data on carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) for the years 1990–2011. Summary tables according to the common reporting format, including CO_2 equivalent and emission trend tables, are shown in Annex B of this report.

Austria's total emissions of the greenhouse gases CO_2, N_2O, CH_4, HFCs, PFCs and SF_6 (without emissions/removals from "Land-Use Change and Forestry") amounted to 82.84 Tg (i. e. million tons) CO_2 equivalent in the year 2011. The emissions of CO_2 clearly dominate the GHG emissions in Austria with 70.46 Tg or 85 % compared to 6 % for CH_4 and for 6 % respectively. The ranking of the (sub)sectors according to their relative contribution is as follows:

1A3: Transport (26 %)
1A2: Manufacturing Industries and Construction (18 %)
1A1: Energy Industries (17 %)
2: Industrial Processes (14 %)
1A4: Other Sectors (13 %)
4: Agriculture (9 %).
6: Waste (2 %)

CO_2 emissions per capita amounted to 8.4 t in 2011 and total greenhouse gas emissions per capita to 9.9 t CO_2 equivalent.

Total greenhouse gas emissions in 2011 were 4.6 Tg or 6 % above the 1990 base year emissions. The increase in emissions is caused mainly by the increase of emissions from fuel combustion, which could not be compensated by the steady decline in the sectors "Waste" and "Agriculture" (cf. Fig. 1.1). The most important single contributions to emissions growth from 1990 to 2011 came from road transport and steel production, for the former to an important extent from road fuel export in the vehicle tank.

Table 1.1: Austrian GHG emissions 1990 and 2007, in Tg CO_2 equivalent

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990					2011				
	CO_2	CH_4	N_2O	F-Gases	Total	CO_2	CH_4	N_2O	F-Gases	Total
Total without LULUCF	**62.06**	**8.30**	**6.20**	**1.60**	**78.16**	**70.46**	**5.36**	**5.29**	**1.73**	**82.84**
Total with LULUCF	**52.09**	**8.30**	**6.24**	**1.60**	**68.23**	**66.91**	**5.36**	**5.34**	**1.73**	**79.35**
1. Energy	**54.17**	**0.67**	**0.56**		**55.40**	**60.83**	**0.46**	**0.69**		**61.99**
A. Fuel Combustion (Sectoral Approach)	54.07	0.46	0.56		55.09	60.60	0.22	0.69		61.51
1. Energy Industries	13.79	0.00	0.05		13.84	13.86	0.01	0.12		13.99
2. Manufacturing Industries and Construct.	12.69	0.01	0.08		12.77	14.83	0.01	0.15		15.00
3. Transport	13.77	0.06	0.19		14.03	21.52	0.01	0.21		21.75
4. Other Sectors	13.79	0.39	0.23		14.41	10.34	0.19	0.20		10.73
5. Other	0.04	0.00	0.00		0.04	0.05	0.00	0.00		0.05
B. Fugitive Emissions from Fuels	0.10	0.21	IE,NA		0.31	0.23	0.24	IE,NA		0.47
2. Industrial Processes	**7.58**	**0.01**	**0.91**	**1.60**	**10.10**	**9.45**	**0.02**	**0.05**	**1.73**	**11.25**
3. Solvent and Other Product Use	**0.28**		**0.23**		**0.51**	**0.17**		**0.15**		**0.32**
4. Agriculture		**4.19**	**4.36**		**8.56**		**3.55**	**4.03**		**7.58**
5. Land Use, Land-Use Change and Forestry	**-9.97**	**0.00**	**0.04**		**-9.93**	**-3.54**	**0.00**	**0.05**		**-3.49**
6. Waste	**0.03**	**3.43**	**0.13**		**3.59**	**0.00**	**1.33**	**0.38**		**1.71**

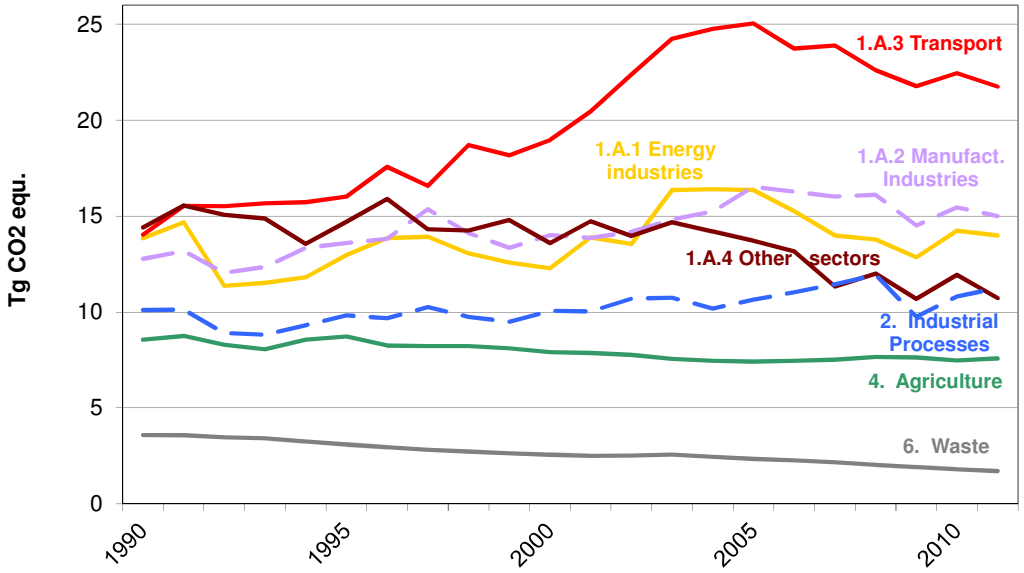

Figure 1.1: GHG emission, split by sector

1.4 Policies and Measures

The Ministry for Agriculture and Forestry, Environment and Water Management has a co-ordinating function with respect to the overall climate change policy in Austria. However, jurisdiction for policies and measures to mitigate greenhouse gas emissions is distributed among several federal ministries and other policy making and implementing entities, namely the federal provinces (*Länder*) and the municipalities. To provide assistance related to climate change research and to support the co-ordination of policies and measures, different committees have been established.

On the basis of this institutional framework, a national mitigation programme – the Climate Strategy – was adopted in 2002 and, after a comprehensive evaluation process, amended in 2007. Most *Länder* have adopted their own regional climate

change programmes, taking into account specific regional circumstances and areas of competence. An Austrian Energy Strategy for the coming decade was developed in the course of a stakeholder process and presented by the Minister for the Environment and the Minister for Economic Affairs in 2010. In order to bring forward measures that can ensure compliance with the 2020 GHG target under the EU Effort Sharing Decision, the first part of a new programme has been adopted by the federal government and the *Länder* in June 2013, covering measures ready to implement in the course of 2013 and 2014. The legislative arrangements for the implementation of the national strategies are quite different for the individual elements of the strategy; some important elements are laws relating to the European Emissions Trading Scheme and to JI/CDM. A new cornerstone is the 2011 Climate Change Act, which fixes sectoral targets and administrative responsibilities to fulfil international and European climate change commitments.

A series of important measures has been implemented over the past years. With respect to residential energy demand, policies and measures aim at increased energy efficiency in space heating and hot water preparation as well as the use of energy sources that are less carbon-intensive. Instruments include improving technical minimum standards, support schemes for energy efficient construction of buildings as well as subsidies for biomass and solar space heating systems and for the thermal rehabilitation of buildings. In the energy supply sector, measures to increase the share of renewable energy sources in electricity production (Green Electricity Act) and to promote district heating from renewable energy sources have been implemented. Emission trading is the stimulus with highest relevance for emission reduction in conventional power plants.

Measures in the transport sector range from CO_2 related tax incentives and increased use of bio fuels to awareness-raising and support programmes for sustainable mobility. Emissions in the waste sector have been significantly reduced by low total organic carbon content of waste fractions disposed to landfills and by the collection of landfill gas. About 220 energy intensive installations from manufacturing and energy industries are covered by the EU emissions trading scheme, which entered into effect in 2005. Subsidies are provided for energy efficiency measures and use of renewable energy sources for industrial installations not covered be the EU ETS. The use of fluorinated gases has been restricted by law. The Austrian Programme for Environmentally sound Farming (ÖPUL) provides support for measures which directly or indirectly contribute to GHG emission reduction.

1.5 Projections and the Total Effect of Policies and Measures

Up to date national greenhouse gas (GHG) emission projections have been developed in 2012/2013. The ‘with measures’ scenario comprises climate change mitigation measures that were implemented and adopted under the Austrian Climate Strategy and its amendment before February 2012. The ‘with additional measures’ scenario also takes into account planned policies and measures with a realistic chance of being adopted and implemented in the near future.

The emission calculations have been performed by the Umweltbundesamt. The underlying sectoral forecasts of activities are based on the use of various models and

methods and have been carried out in close collaboration with several institutions. The calculations show a decrease of GHG emissions in the 'with measures' scenario from 2011 to 2020 and an increase to 2030, in total +1.2 Tg (i. e. million tons) CO_2 equivalent. Additional measures will lead to a sharper decrease from 2011 to 2020 and only a slight rise afterwards, in total -4.7 Tg. Table 1.2 and Figure 1.2 give an overview of the expected development.

Table 1.2: Projected greenhouse gas emissions 2011–2030 in Tg (million tons) CO_2 equ.

	Inventory data			With Measures				With Additional Measures			
	1990	**2000**	**2011**	**2015**	**2020**	**2025**	**2030**	**2015**	**2020**	**2025**	**2030**
CO_2	62.06	65.97	70.46	70.55	69.98	71.31	72.72	68.39	66.22	66.53	67.12
CH_4	8.30	6.62	5.36	5.21	5.02	4.88	4.80	5.19	4.97	4.83	4.75
N_2O	6.20	6.29	5.29	5.18	5.14	5.06	4.98	5.07	4.91	4.83	4.75
F-gases	1.60	1.32	1.73	1.50	1.49	1.51	1.53	1.46	1.40	1.42	1.44
Total	**78.16**	**80.20**	**82.84**	**82.44**	**81.64**	**82.76**	**84.03**	**80.10**	**77.50**	**77.62**	**78.06**

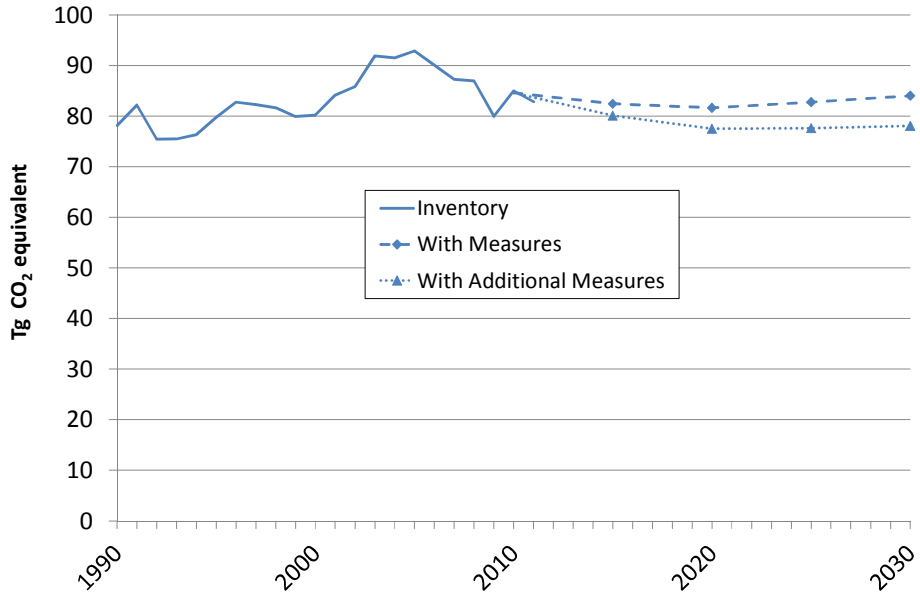

Figure 1.2: Projected greenhouse gas emissions in Austria

The aggregate effect of *implemented and adopted* policies and measures, which are listed in Chapter 4 of this report, is estimated at more than 20 Tg CO_2 equivalent for the year 2010 and more than 40 Tg for 2030. The effect of planned measures is 2.3 Tg in the year 2015 and projected to increase to 6 Tg in 2030. Austria's efforts to make use of the Kyoto Protocol flexible instruments are supplemental to domestic efforts.

1.6 Vulnerability Assessment, Climate Change Impacts and Adaptation Measures

Austria is expected to be very vulnerable to a climatic change in view of the fact that ecosystems in mountainous regions are highly sensitive. 70% of Austria's surface area is situated higher than 500 m above sea level and 40% higher than 1,000 m, showing a distinct small-scale orographic structure. A significant climate change can

already be observed, for example mean annual temperature has increased by 2°C since the mid 19th century and glacier inventories show losses in area and volume.

That is the reason why a detailed assessment has been compiled on the aspects of climate change relevant for Austria. The "Austrian Assessment Report" deals with the physical science basis as well as with consequences for society and nature and with mitigation and adaptation.

The development of a comprehensive national adaptation strategy has been initiated in 2007. Expert knowledge and an extensive stakeholder process has supported the finalisation of the Austrian adaptation strategy, which has been adopted by the Federal Government and by the *Länder* in 2012 and 2013 respectively. In total 132 recommendations in 14 areas have been included in the National Strategy for Adaptation. The Action Plan, as the second part of the Strategy, describes the recommendations in detail. The Action Plans lists a. o. the objective, relations to other instruments, status of implementation, further steps, necessary ressources and responsibilities for every recommendation. Implementation if the strategy at different levels of administration is under way.

1.7 Financial Resources and Transfer of Technology

The Global Environmental Facility (GEF) was set up in 1991 in order to help developing countries and, to some extent, countries with economies in transition, cope with four major environmental problems of basic and world-wide importance, among them the issue of global warming. Austria has provided contributions to the GEF since 1991; the Austrian participation in the GEF has been financed in addition to existing commitments and payments to other international financial institutions. From 2009 to 2012, Austria provided about US$ 18.5 million.

As a priority in the area of climate finance, Austria's focus is on the poorest and most vulnerable developing countries and bilateral financial resources are concentrated mainly on LDCs and Africa. In order to maximise synergies with non-climate development finance, focus is largely on the Austrian Development Cooperation's six key regions and priority countries in Africa, Asia, Central America and South-Eastern and Eastern Europe.

Austria's climate finance has increased continuously from 1992 onwards. Milestones for increasing our climate finance contributions include 1997 (Kyoto Protocol), 2001 ("Marrakech Accords"), 2006 ("Bonn Declaration") and 2009 (Copenhagen Accord), respectively. In the last three years, we have met – and indeed even slightly exceeded – our commitments under Fast-Start Finance in the period of 2010 to 2012. Austria contributes to the Adaptation Fund through the Share of Proceeds levied on the issuance of Certified Emission Reductions (CERs) under the Kyoto Protocol's Clean Development Mechanism.

Austria is a pioneer nation in environment topics of the future. Austrian technologies in the fields of e.g. solar energy, wind and hydropower for the generation of electricity, biomass as well as ecological construction are meanwhile used world-wide. The joint environmental-technologies export initiative of the Federal Ministry of

Agriculture, Forestry, Environment and Water Management and the Federal Economic Chamber is a vital contribution to global environmental protection. The initiative provides support and strengthens the export orientation especially of SME's and hence supports technology transfer. Activities with regard to technology transfer are also supported by the Federal Ministry for Transport, Innovation and Technology, for example with respect to technology for sustainable mobility. The Ministry of Economy has initiated a partnership with China related to energy and environmental technology. Austria is an active member of institutions and initiatives that have the exchange of research results and transfer of technology as a main target, e.g. the International Energy Agency and the Climate Technology Initiative (CTI).

1.8 Research and Systematic Observation

Austria is actively engaged in promoting research and systematic observation related to the climate system by supporting numerous research projects and programmes, at both the national and the international level. Climate system research and research on climate change impacts are heavily influenced by the Alps, which cover almost two thirds of the surface area of Austria.

Research programmes on sustainable development have been set up by different ministries concerned. Projects related to climate change (impacts, adaptation, mitigation) are carried out by a large number of university institutes as well as by extra-university institutions like the Central Institute for Meteorology and Geodynamics, the Federal Environment Agency and research institutes of the Federal Ministry of Agriculture and Forestry, Environment and Water Management. A special focus on climate change is given within the research programme "StartClim", which was brought into being in 2002 and which is financed by private-public-partnership. In 2011 the ClimateChangeCenterAustria (CCCA) has been established as a coordinating facility to promote and support climate research in Austria.

A dense network of observing stations for meteorological and hydrological parameters has been brought about by the rather heterogeneous meteorological patterns in the alpine region. Austria's instrumental time series are amongst the longest in Europe and go back as far as the 18th century. The high altitude meteorological observatory at Hoher Sonnblick (at 3,106 metres above sea level) has been operating continuously since 1886, which is the longest continuous and homogeneous meteorological time series for high altitudes worldwide. Austrian data are exchanged within international networks such as the GCOS surface network, the GCOS upper air network, the Global Atmosphere Watch, CLIMAT and the Global Terrestrial Network – Glaciers. During the recent years Austria has increasingly engaged in space-based observation programmes. The Austrian GCOS coordination unit has been established at the Central Institute for Meteorology and Geodynamics and has compiled a comprehensive GCOS report in 2013.

1.9 Education, Training and Public Awareness

Environmental education in schools is an inter-disciplinary instruction principle and issues related to climate protection, such as energy saving and renewable energy, have received increased attention during the recent decades. A national *Strategy for Education for Sustainable Development* passed the Austrian Council of Ministers in 2008. Awareness of climate issues in schools is strengthened by various initiatives at Federation and *Länder* level, e. g. by competitions and workshops. Austria also plays an active role in the international decentralised network "Environment and School Initiatives" (ENSI, http://www.ensi.org) and participates in network projects at EU level.

Training programmes and seminars have been established by public institutions and regional energy agencies for different target groups. Reliable and independent advisory services on energy issues are offered free of charge to private households by energy agencies and several non-profit environmental consulting organisations and partly by the *Länder* authorities themselves. Related programmes directed especially at small and medium enterprises exist in all *Länder*. The Federal Ministry of Agriculture and Forestry, Environment and Water Management has launched the eight-year initiative “klima:aktiv” with a series of target-group oriented programmes in the areas construction and energy efficiency, transport and mobility, communities and renewable energy sources. Training and advisory services dealing with sustainable farming and forestry are offered by the regional Chambers of Agriculture and further institutions.

There is substantial public awareness on climate change issues in Austria. Campaigns and initiatives are organised and funded by the Federal Government and by the *Länder*; they usually focus on concrete recommendations and incentives for measures to protect the climate system, for example in the areas energy, transport and agriculture. Particular mention must be made of the Climate Alliance, which is a partnership between more than 1,600 European municipalities and the Indigenous Peoples of the rainforest in the Amazon Basin with the goal of protecting the earth’s atmosphere. In Austria more than 950 municipalities and all *Länder* as well as a considerable number of companies and schools have joined the Climate Alliance. Climate Alliance Austria does not only contribute to public awareness of the global dimension of climate change, but has initiated many successful and impressive mitigation projects at community level.

Chapter 2

National Circumstances relevant to Greenhouse Gas Emissions and Removals

2.1 Government structure

Austria is a federal state comprising nine federal provinces. Government responsibilities are shared by three levels of territorial authority, the federation ("Bund"), the nine federal provinces ("Länder") and the local authorities ("Gemeinden", municipalities).

The head of the Austrian state is the federal president („Bundespräsident"), who is directly elected by the people and represents the Republic of Austria internationally. He appoints the federal chancellor („Bundeskanzler"), who is the head of the Federal Government and, at the suggestion of the Bundeskanzler, the federal ministers. The "Nationalrat" and the "Bundesrat" are the two houses of Parliament, the main legislative body. The Nationalrat is elected every five years on the basis of an electoral system of proportional representation; the members of the Bundesrat are nominated by the parliaments of the provinces, the "Landtage".

Every federal province ("Land") has its own regional government ("Landesregierung") headed by the provincial governor ("Landeshauptmann"); the members of the Länder governments corresponding to the federal ministers are the "Landesräte".

A characteristic of Austria's political structure is the so-called "social partnership", the system of co-operation and co-ordination of interest between different interest groups, especially employers and employees. Several national federations are key players in the system, like the Federal Chamber of Labour, the Austrian Economic Chamber, the Austrian Chambers of Agriculture and the Austrian Trade Union Federation. The umbrella federations of the social partners also have influence as regards political opinion forming and decision-making.

Legislative and executive competences are distributed between the federation and the Länder according to the regulations on this matter in the Federal Constitution Act. Whenever a national approach is required but the federal government does not have the authority of policy making the parties involved may conclude a treaty of state ("Staatsvertrag") according to Art. 15a of the Federal Constitution Act in which they agree to undertake certain actions, jointly or separately.

2.2 Population Profile

Austria's total permanent population reached 8.44 million inhabitants in 2012. After declines in the late 1970ies and stagnation in the early 1980ies this represents an increase of more than 900,000 since 1985, which is due to immigration and increasing life expectancy. The population increase was only slightly higher in urban communities compared to rural communities. The population density is about 100 inhabitants per square kilometre total area or 260 per square kilometre settlement area.

In 2012, 14 % of the Austrian population was younger than 15 years of age, about one fifth between the ages of 15 and 29, 30 and 44 and 45 and 59 respectively, 16 % between 60 and 74, and 8 % was 75 years old or older. The Austrian population is aging; in 2030 31 % of all Austrians are expected to be 60 years or older and only

30 % younger than 30 years. Future trends of Austrian population growth and age structure will be primarily determined by immigration policies. Life expectancy at birth is 78 years for male and 83 years for female persons. (Statistik Austria 2013)

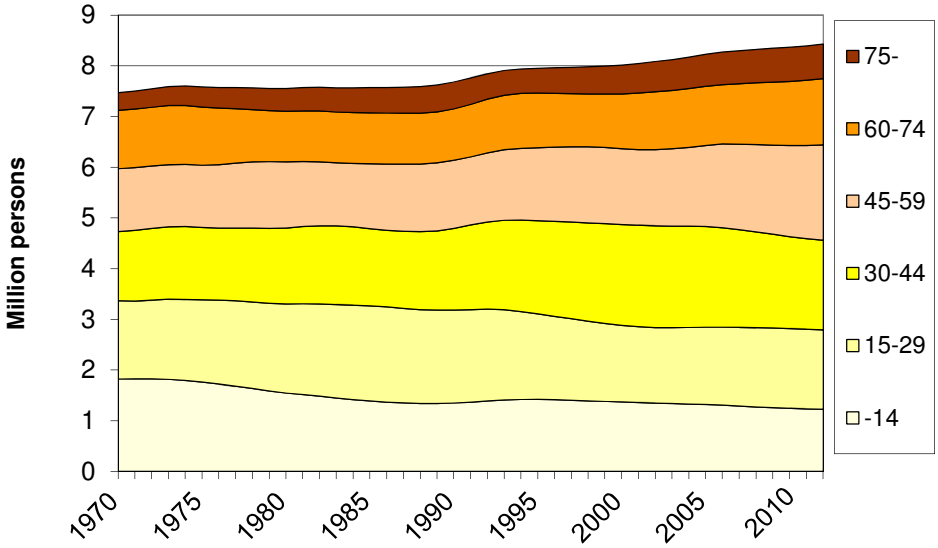

Fig. 2.1: Austrian Population 1970–20012 by age groups (Data: Statistik Austria)

2.3 Geographical Profile

Austria is located in southern central Europe, between 49°01' and 46°22' north and from 9°32' to 17°10' east, covering part of the eastern Alps and the Danube region. It is land-locked and has common borders with eight other countries. Due to its situation in the centre of Europe, Austria is quite exposed to activities of its neighbouring countries, e. g. to transit traffic and cross-border air pollution.

Austria's total surface area covers 83,858 km^2 with a share of 37.5 % settlement area. The landscape falls into five main sections: The dominating Eastern Alps (63 % of total area), the Alpine and Carpathian foothills (11 %), the eastern foreland which is part of the low-lying Pannonic plains (11 %), the Vienna basin (4 %) and the Granite and Gneiss Highland north of the Danube which is part of the Bohemian massif (10 %). Almost half of the area is covered by forests and about one third is used for agriculture.

About 70 % of Austria's surface is situated higher than 500 m above Sea level (maSl), 40 % higher than 1000 m; the landscape shows a very distinct orographic structure. Given the fact that ecosystems in mountainous regions are highly sensitive to changes, it is obvious that large parts of Austria are highly vulnerable to climatic changes.

2.4 Climate Profile

Austria belongs to the central European transitional climatic zone; climate is crucially influenced by the Alps, which are situated in a transitional area of the Mediterranean, the Atlantic Ocean and continental Europe. Austria can be divided into three climatic zones: The eastern part shows a continental Pannonian climate (mean temperature for July usually above 19°C, annual rainfall often less than 800 mm), while the central Alpine region has the characteristic features of the Alpine Climate (high precipitation, short summers, long winters). The remaining part of the country belongs to the transitional central European climatic zone, which is characterised by a wet and temperate climate (mean temperature for July 14–19°C, annual precipitation 700–2000 mm, depending on location, exposure and altitude). As Austria is a country with a highly structured relief, a lot of small-scale climatic processes occur caused by orographic conditions.

Mean daily temperature in Vienna (about 200 maSl) in January is 0.1°C (July: 20.2°C), the number of days per year with minimum temperature below 0°C is 66. In alpine regions temperatures can become considerably lower, e.g. in St. Jakob at 1,400 maSl mean daily temperature in January is -7.5°C (July: 13.2°C), the number of days per year with minimum temperature below 0°C is 197. This may explain why almost one third of final energy consumption in Austria is used for space heating.

Since 1880 an increase of about 1.5°C in average temperatures has been measured in Austria, a trend, which could be observed in all regions, whereas precipitation shows no homogeneous trend. In the western part, a rising tendency was observed during the 20th century; in the east and south precipitation has shown a falling tendency since the 1940ies. Exceptionally warm years could be observed during the last fifteen years, some of them years with the highest average temperature since the beginning of measurements in 1775. Since 1989, almost two third of the winter seasons showed heating degree days below the average (cf. Fig. 2.2). Useful indicators for long-term tendencies in average temperatures stem from measurements of the Alpine glaciers. Historical measurements reveal a steady decline of the volume of glaciers since the 19th century. This tendency has increased since the early 1980ies. (Source: Central Institute for Meteorology and Geodynamics, Institute of Meteorology of the University of Natural Resources and Applied Life Sciences, Vienna)

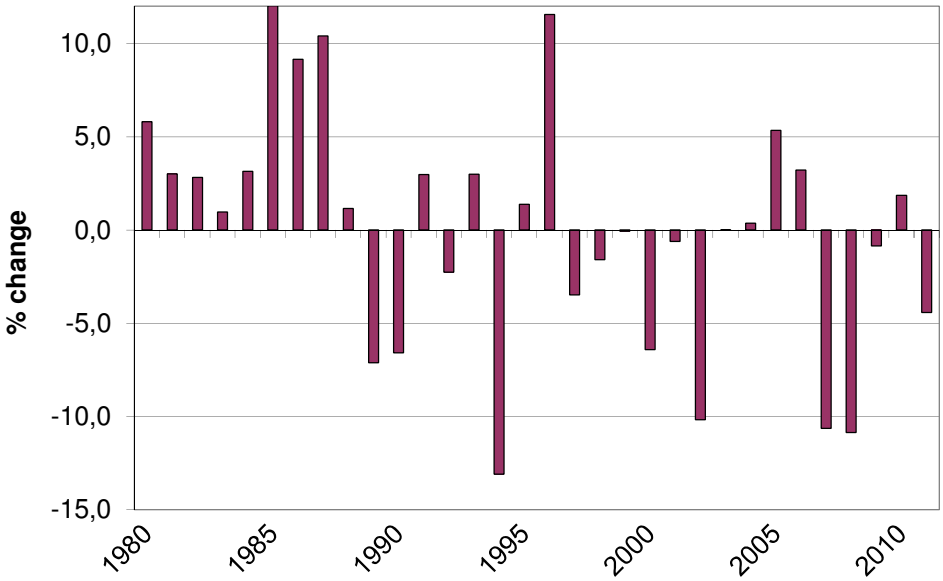

Fig. 2.2: Heating degree days in winter (Jan–Mar and Nov–Dec), deviation from mean value for 1980–2011 (Data: Statistik Austria)

2.5 Economic Profile

In 2012 Austria's GDP at current prices was € 307 billion. With a per capita GDP of € 36,430 Austria lists in the top ranks of the world. Austria has the characteristics of a small open economy; export and imports of goods are at a comparable level, the balance of trade in services shows high surplus.

Accession to the European Union and opening of the economies in eastern Europe have strengthened economic growth. Export and import quotas for goods have considerably increased from the beginning of the 1990ies – the export quota from about 20 % to 40 % of GDP. The largest share of exports – more than two third – is related to final goods. Austria's main trading partner still is its neighbour Germany with almost one third of total exports.

Table 2.1: Development of GDP in the period 1980-2012 (Source: Statistik Austria)

	GDP at Current Prices		GDP Price Index		GDP/capita
	Bio €	% Change	Index	% Change	€
1980	76,36	+ 7,4	56,5	+ 1,7	10.110
1985	103,26	+ 5,5	60,8	+ 2,5	13.650
1990	136,14	+ 7,5	70,6	+ 4,3	17.730
1991	145,95	+ 7,2	73,0	+ 3,4	18.820
1992	154,19	+ 5,6	74,5	+ 2,1	19.670
1993	159,27	+ 3,3	74,9	+ 0,5	20.150
1994	167,22	+ 5,0	76,7	+ 2,4	21.070
1995	174,79	+ 4,5	78,8	+ 2,7	21.990
1996	180,56	+ 3,3	80,7	+ 2,5	22.690
1997	184,32	+ 2,1	82,6	+ 2,3	23.130
1998	191,91	+ 4,1	85,7	+ 3,8	24.060
1999	199,27	+ 3,8	88,8	+ 3,5	24.930
2000	208,47	+ 4,6	92,0	+ 3,7	26.020
2001	214,20	+ 2,7	92,8	+ 0,9	26.630
2002	220,53	+ 3,0	94,4	+ 1,7	27.290
2003	225,00	+ 2,0	95,2	+ 0,9	27.710
2004	234,71	+ 4,3	97,7	+ 2,6	28.730
2005	245,24	+ 4,5	**100,0**	+ 2,4	29.820
2006	259,03	+ 5,6	103,7	+ 3,7	31.330
2007	274,02	+ 5,8	107,5	+ 3,7	33.030
2008	282,74	+ 3,2	109,1	+ 1,4	33.980
2009	276,23	- 2,3	104,9	- 3,8	33.110
2010	285,17	+ 3,2	106,7	+ 1,8	34.110
2011	299,24	+ 4,9	109,8	+ 2,8	35.670
2012	307,00	+ 2,6	110,7	+ 0,9	**36.430**

The largest contribution to Austria's GDP with more than two third comes from the tertiary production (69.8 %), the rest is contributed mainly by secondary production (28.6 %, almost two third thereof from manufacturing industries) and to a small extent by primary production (1.6 %). The share of tertiary production has increased by 6 percentage points since 1990. Greenhouse gas emissions per GDP unit were 277 tonnes per million € in 2011, which is in the bottom range of the EU and considerably below the OECD average. From 1990 to 2011 emissions per GDP have decreased by almost one third. CO_2 emission indicators can be found in Appendix A.

Austria is one of the few countries in the world where tourism contributes significantly to GDP with a share of 5.5 % in 2012. Obviously this sector is highly vulnerable to weather conditions. This is one way in which climate change might impact not only tourist regions, but also the economy as a whole. (Source: Statistik Austria 2013; BMWFJ 2012)

2.6 Energy

Compared to other industrialized countries the Austrian energy sector has a rather high share of renewables that amounted to 8.6 % hydro power[1] and 17.5 % other renewables (mainly biomass) of total gross energy consumption in 2011. Public

[1] Without net imports/exports for electricity

awareness of the importance of renewables is high since they also offer economic opportunities; this may be illustrated by the fact that Austria is among those countries with the highest installed area of solar collectors per capita in Europe.

Nevertheless energy supply in Austria is still heavily dependent on fossil fuels, with shares of 10 % of coal products, 36 % of oil products, and 23 % of natural gas of total gross energy consumption in 2011. After considerable changes in the 1970ies and early 1980ies, the share of fuels has been quite stable until the about 2000, with a slight increase in natural gas and a decrease in coal only. The last decade shows a considerable increase of renewables and a decrease of oil products (see Figure 2.3). Around two thirds of gross energy consumption stem from imports, a share that has been also rather stable. Whereas gross energy consumption per capita has increased by more than one third since the mid 1970ies to 170 GJ/cap in 2011, gross energy consumption per GDP (at 2005 prices) has decreased by almost one third to 5,3 MJ/€. Figure 2.5 shows the decoupling of the growth of GHG gas emissions from energy demand.

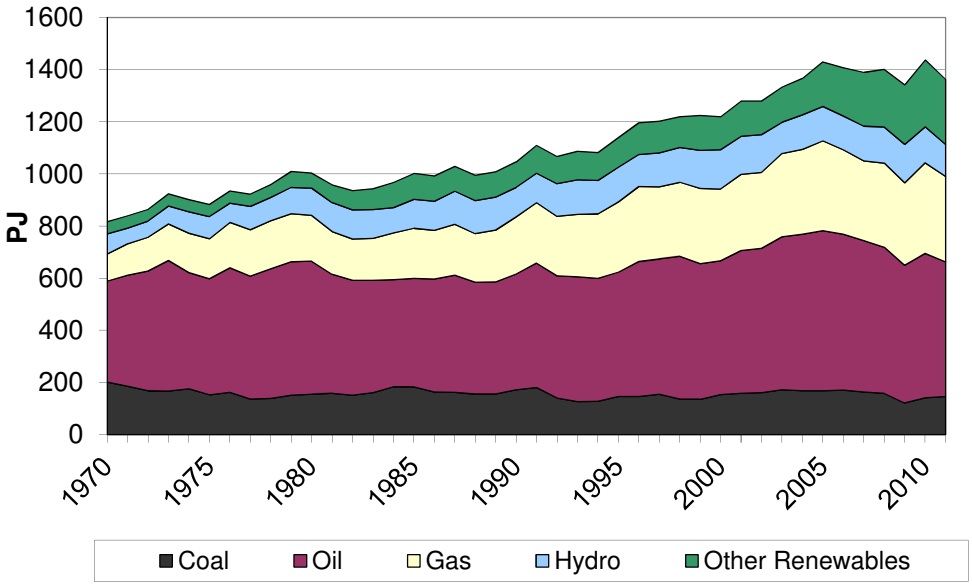

Fig. 2.3: Gross energy consumption 1970–2011 (Data: Statistik Austria)

Final energy consumption is characterized by increasing shares of gas (17 % in 2011) and district heating (7 %), see Figure 2.4. The share of coal has been continuously reduced to 2%; oil has held a constant share since the 1980ies but has decreased after 2005 (38 % in 2011). Renewables have a share of 15 %, the share of electricity is about 20 % since the late 1980ies.

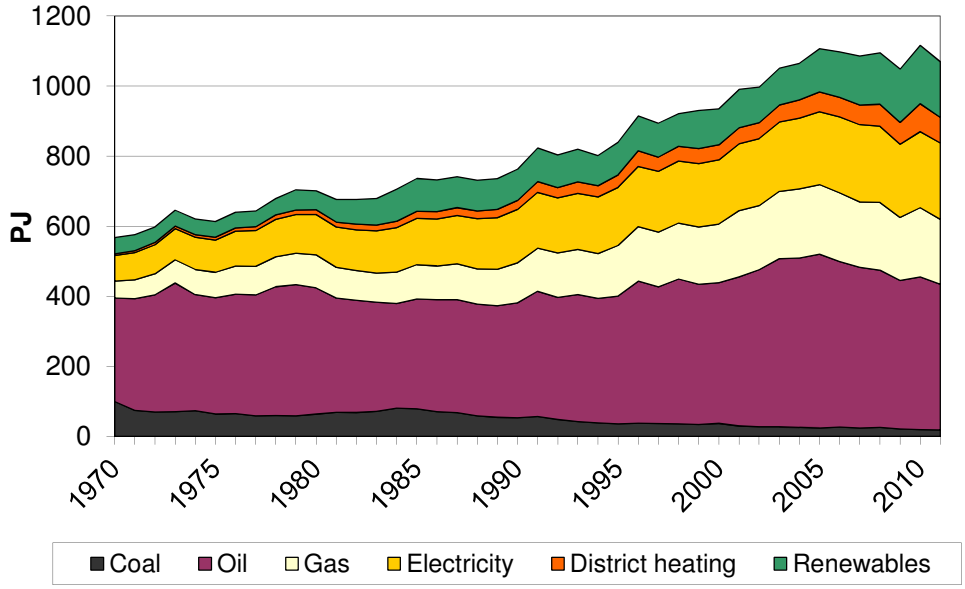

Fig. 2.4: Final energy consumption 1970–2011 (Data: Statistik Austria)

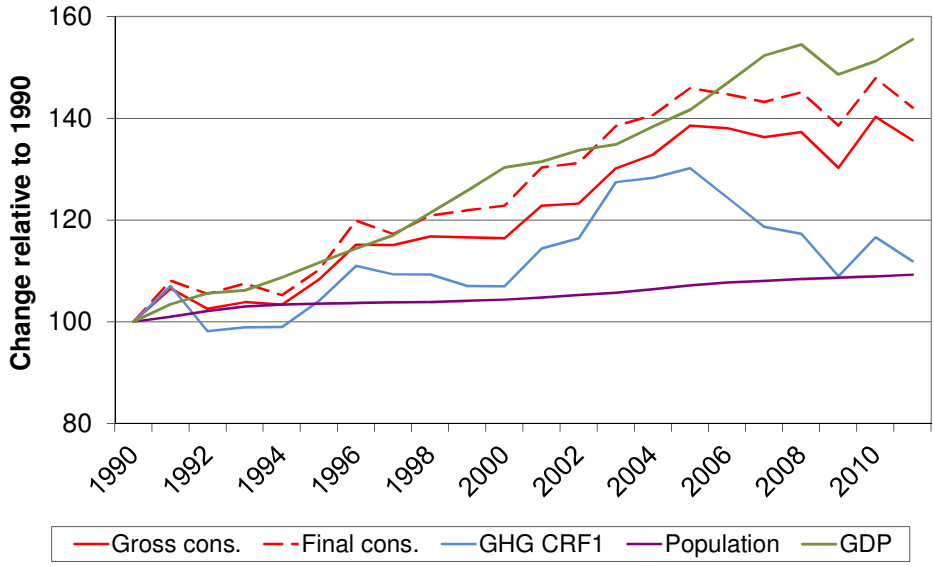

Fig. 2.5: Gross inland and final energy consumption, GHG emissions from fuel combustion, population und GDP at constant prices 2005; development relative to 1990 values (Data: Statistik Austria, Umweltbundesamt)

The share of private households in final energy consumption shows a falling tendency (1990: 32 %, 2011: 24%); the share of manufacturing industries and construction has stayed in the range of 25 to 30 % during the last two decades. The share of transport showed a continuously increasing tendency until 2007 (1970: 20 %, 2007: 35 %), but has decreased afterwards. It should be mentioned that the amount of road fuel, that is sold in Austria but consumed abroad, has become significant in the last years (see next section). More information on the driving forces for emissions from the production of electricity and heat can be found in Section 3.2.2. CO_2 emission indicators can be found in Appendix A.

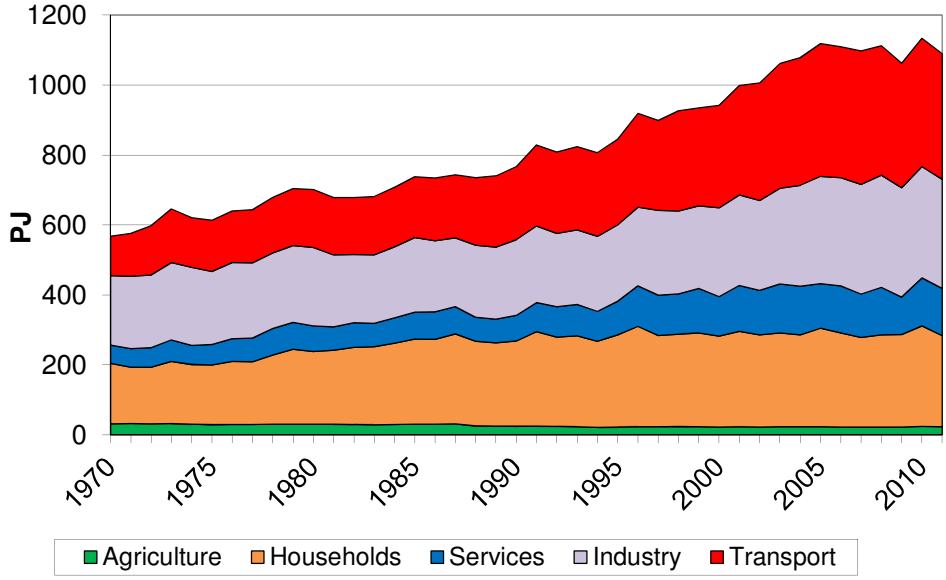

Fig. 2.6: Final energy consumption according to sectors1970–2011 (Energy consumption for transport based on total fuel sold in Austria. Data: Statistik Austria)

(Source: Statistik Austria, 2013)

2.7 Transport

Economic and demographic development in the past decades, especially since the opening of the East European market, entailed an enormously increased transport performance in terms of passenger as well as freight transport. The number of passenger cars rose from 1.2 million in 1970 to 4.5 million in 2011, the total number of motor vehicles from 2.2 million to 5.7 million. The share of diesel fuelled passenger cars has increased enormously from one tenth at the end of the 1980ies to more than half in 2011; the number of electric cars began to rise in the last years but is still three orders of magnitude lower.

In 2011 Austria's inland passenger transport amounted to approx. 104 billion passenger kilometres, 71 % thereof travelled by cars and 24 % by public transport. Since 1990 passenger transport rose by 31%, modal split did not change significantly. Walking and cycling are important mainly for short distance trips and therefore have just a share of 3 % of total transport demand. Aviation, with a share of 0.2 %, contributes insignificantly to inland travel; only when international travel is taken into account, aviation shows a noteworthy share in transport with more than 10 billion passenger kilometres (including pkm abroad, only starts considered) and a considerable increase of more than 100 % since 1990.

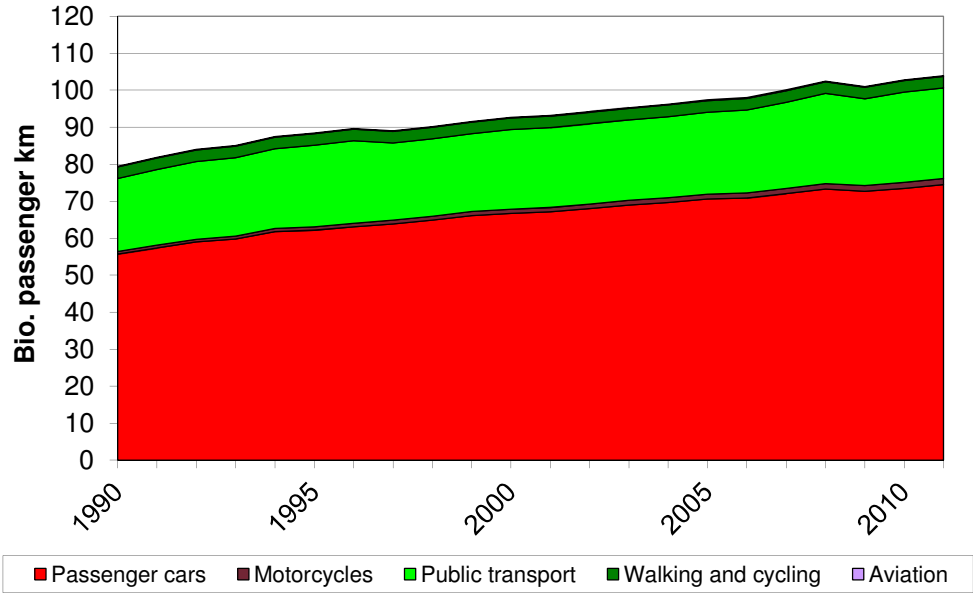

Fig. 2.7: Trend in inland passenger transport 1990–2011 (Source: Umweltbundesamt)

The total performance in freight transport in Austria amounted to 63 billion ton kilometres in 2011; it has almost doubled since 1990 (cf. Fig. 2.8). The share of road transport in modal split increased from 59 % in 1990 to 67 % in 2011, the share of rail transport decreased accordingly. The share of navigation stayed at a relatively constant level of 4–5 %.

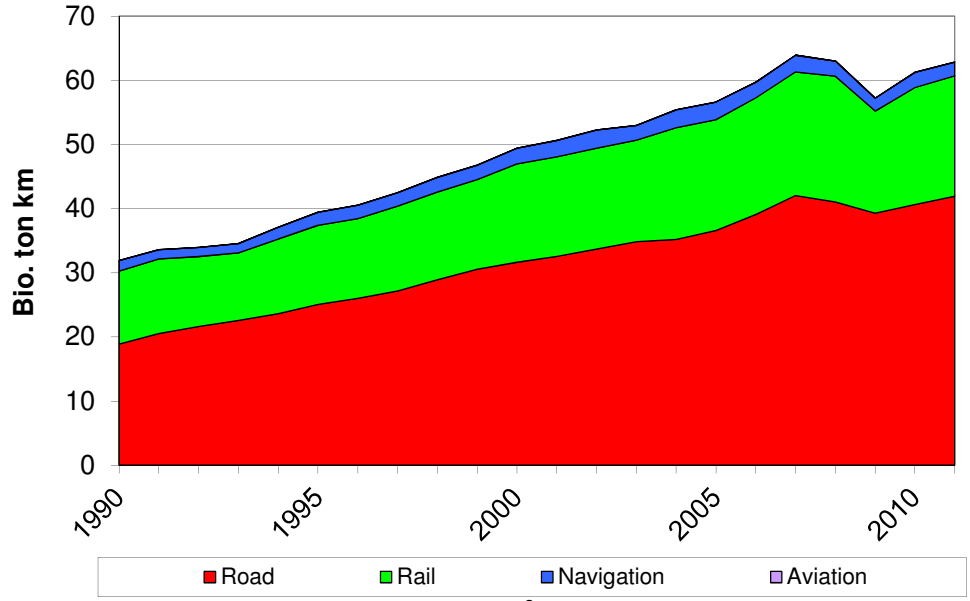

Fig. 2.8: Trend in inland freight transport[2] 1990-2011 (Source: Umweltbundesamt)

According to the Austrian greenhouse gas inventory, CO_2 emissions caused by transport have been increasing steadily during the recent years. The main sources are passenger cars and lorries. In contrast to the trends in transport demand, CO_2 emissions show a disproportionately high increase after the mid 1990ies. This is due to fuel export in the vehicle tank, which is caused by the fact that fuel prices have been slightly lower than in most neighbouring countries, that important routes for

[2] Net freight – without weight of lorries transported by rail (piggyback transport) and without weight of containers

long-distance freight traffic cross Austria and that the integration of eastern neighbour states into the European economic area led to additional transport demand. A recent study showed that about one third of the greenhouse gas emissions from transport were caused by this kind of fuel export in the vehicle tank in 2005, the main reason being long-distance freight transport. As the calculation of emissions has to be based on the fuel sold in Austria, this part of the fuel and the related emissions are also allocated to the Austrian inventory. The emission figures for the years after 2005 show a reduction of this kind of fuel export in the vehicle tank (see Figure 2.9).

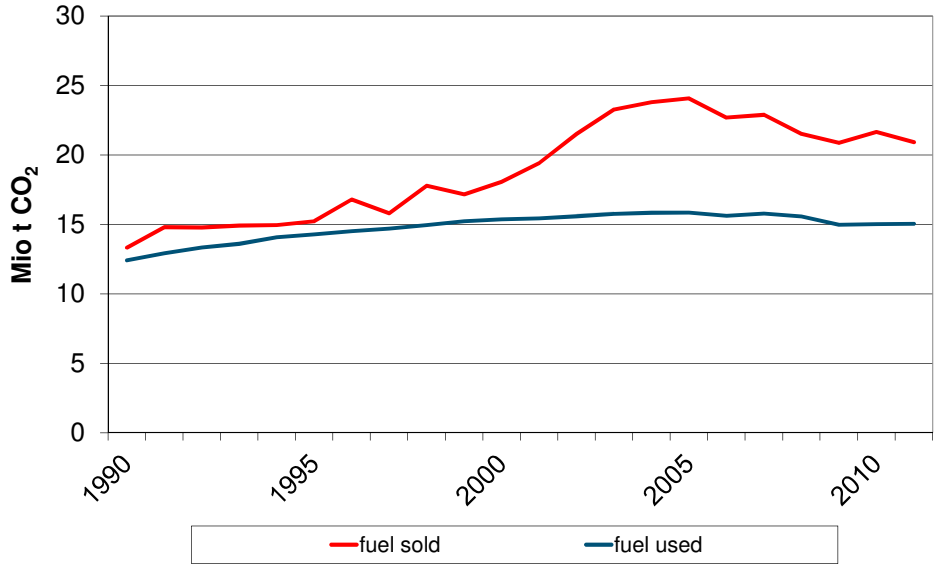

Fig 2.9: Carbon dioxide emissions of road transport – calculation based on fuel sales in Austria ("fuel sold") and on inland fuel use ("fuel used"). (Source: Umweltbundesamt)

More information on the driving forces for the emission trend in this sector can be found in Section 3.2.2. (Source: Umweltbundesamt)

2.8 Industry

With regard to the growth of its industrial sector, Austria ranks among the leaders within the EU countries. Gross value added of manufacturing industries (at constant prices) showed an increase of almost 60 % from 1990 to 2008. After the economic depression in 2009 in has reached the level of 2008 again in 2012. Compared to other industrialized countries basic materials industries still play a decisive role in Austria.

Almost one fifth of Austria's economic productivity is derived directly from manufacturing industries, 7 % from construction. The most important

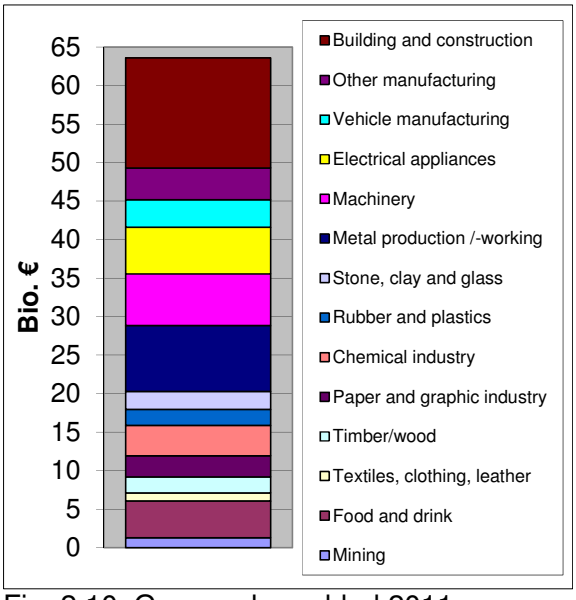

Fig. 2.10: Gross value added 2011 (Data: Statistik Austria)

branches of the production of goods are machines and steel construction, electrical and electronic appliances, chemicals, iron and metal goods, food and vehicles (cf. Fig. 2.10).

Austria's industry has been successful in the decoupling of growth of production and energy consumption since the mid 1970ies by energy-saving and efficiency-raising measures. Energy consumption in manufacturing industries and construction stayed at the level of the early 1970ies until the mid 1990ies, although gross value added increased by about 50 %. Steel industry has a strong influence on GHG emissions, as the production of iron and steel is responsible for almost half of the CO_2 emissions of the sector. In 2011, final energy consumption was 44 % above the 1990 level, whereas GHG emissions increased only about half as much as consumption (cf. Figure 2.11), which is mainly due to fuel switch, increased used of biofuels and efficiency measures. More information on the driving forces for the emission trend in this sector can be found in Section 3.2.2. CO_2 emission indicators can be found in Appendix A.

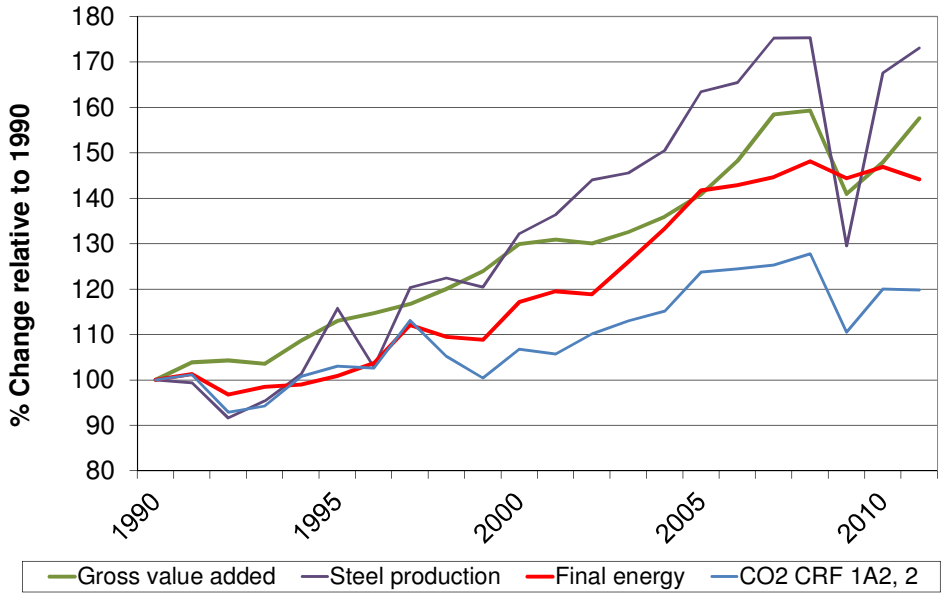

Fig. 2.11: Gross value added at 2005 prices, production of steel, final energy consumption and CO_2 emissions in manufacturing industries and construction (Data: Statistik Austria, Umweltbundesamt)

(Source: Statistik Austria 2013)

2.9 Waste

The total estimated amount of waste generated in Austria in 2010 was about 52 million tons. Excavation material accounted for about half of that amount. Compared to the early 1990ies the amount of waste has increased by about 10 million tons, to a large extent due to an increase of excavation material.

About 15 % of total waste is incinerated for energy recovery; 62 % is collected for conditioning, recycling and recovery; 23 % undergo other treatments.

Waste from households and similar sources amounted to 3.8 million tons in 2010 (about 450 kg waste per capita). In 2010, 0.4 % went – after sorting – without pre-treatment to sanitary landfills, compared to 63 % in 1989. Including residues from treatment, only about 1/10 of household waste was disposed of in landfills. As a result of separate collection and sorting of waste, 1.2 million tons of secondary material (glass, paper, metal, …) and 0.7 million tons of organic waste were collected in 2010. The share of secondary material collected separately for recovery/recycling has increased from 13 % in 1989 to almost one third in 2010, the share of biogenic waste collected separately for composting or fermentation from 1 % to 18 %.The share of household waste treated thermally has increased from about 5 % in 1989 to 40 % in 2010 (see also Figure 2.12). Due to the Landfill Ordinance the disposal of waste containing more than 5 % of total organic carbon (TOC) is prohibited and collection of landfill gas is mandatory. That is why methane emissions caused by waste management have decreased by about 60 % since 1990.

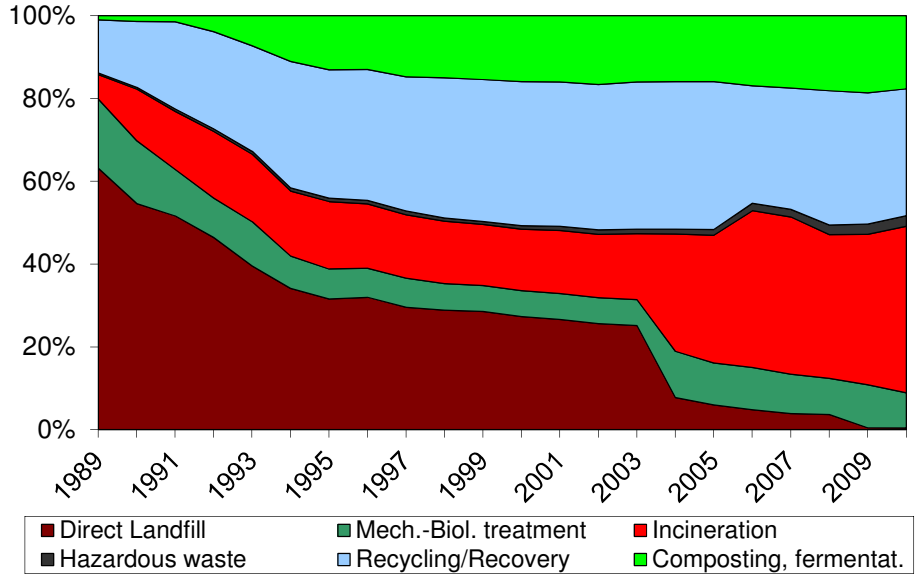

Figure 2.12: Treatment of household waste 1989–2010 (Source: Umweltbundesamt)

(Source: BMLFUW 2012)

2.10 Building stock and urban structure

About 39 % of Austria's total area is, in principle, available for settlement, with a smaller share of only 25 % in the Alpine region. Population density in this area is 260 persons/km². One fifth of all Austrians (1.7 million) live in Vienna, the only Austrian city with more than one million inhabitants. 9 % live in the four cities with more than 100,000 inhabitants each, these being Graz, Linz, Salzburg and Innsbruck. About half of all Austrians live in communes with more than 1,000 up to 10,000 inhabitants, and 16 % in communes with more than 10,000 up to 100,000 inhabitants (cf. Figure 2.13). Two thirds live in municipal communes, one third in rural communes.

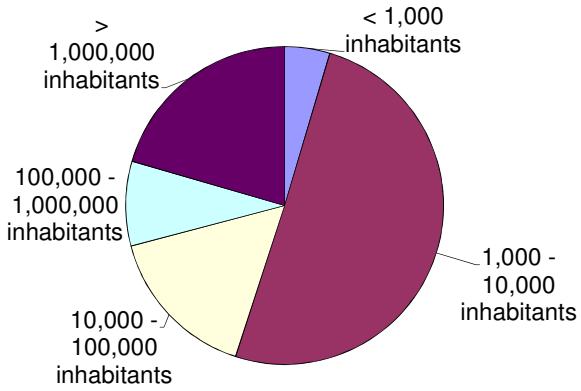

Figure 2.13: Population distribution according to size of communes (Data: Statistik Austria)

In recent decades, the number of households and dwellings increased to a much higher extent than population did. While in 2011 the number of households (3.65 million) was 24 % higher than in 1990, population growth was 9 % during the same time. The percentage of single households has grown from about 28 % in 1990 to 36 % in 2011; the tendency towards single households is projected to continue. On average, 2.3 people lived in a household in 2011.

While the number of main residences has increased by 24 %, useful floor space has increased even faster (+37 %). The share of dwellings with central heating (including single storey heating and district heating) has increased from less than 60 % in 1990 to more than 90 % in 2011.

In 2011 almost half of these dwellings (main residences) were located in buildings with only one or two dwellings, less than one third in buildings with 10 or more dwellings. 15 % of the dwellings were built before 1919; 20 % between 1919 and 1960; 30 % between 1961 and 1980; 24 % between 1981 and 2000 and 10 % after 2000. 8 % of dwellings had a useful floor space less than 45 m^2, 44 % 45 m^2 up to less than 90 m^2, 24 % 90 m^2 up to less than 130 m^2, and 24 % 130 m^2 and more. (Source: Statistik Austria, 2013)

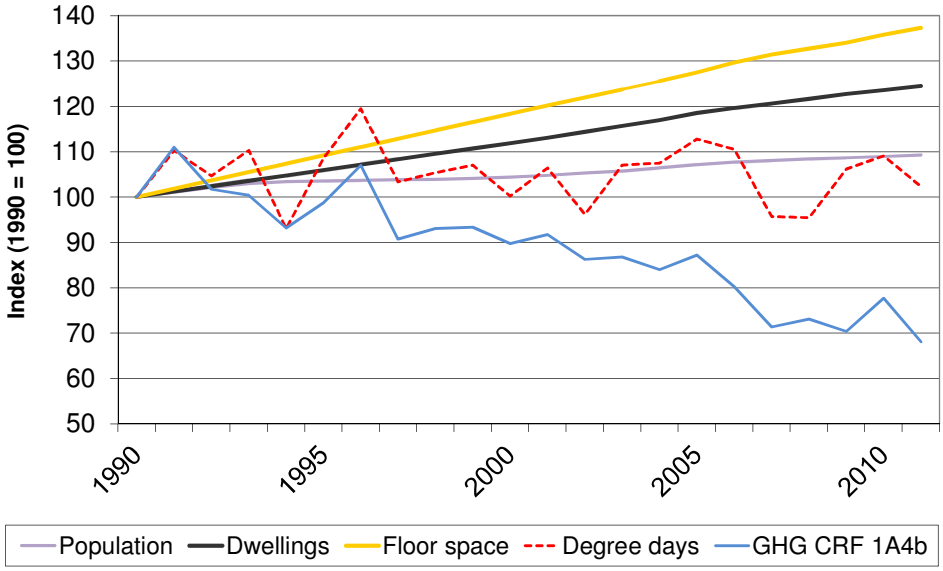

Fig. 2.14: Development of population, number of dwellings (main residences), floor space, heating degree days (Jan–Mar, Nov, Dec) and GHG emissions from households (Data: Statistik Austria, Umweltbundesamt)

More information on the driving forces for emission from households can be found in Section 3.2.2.

2.11 Agriculture and forestry

Area used for agriculture has a share of about one third of the Austrian total territory while forests make up 48 %. In the Alpine regions forestry and extensive grassland production with cattle stocking dominate, while arable farming is concentrated on the lowlands and basins and especially in the east of the country. In 2012 the share of agriculture and forestry in GDP was 1.6 %.

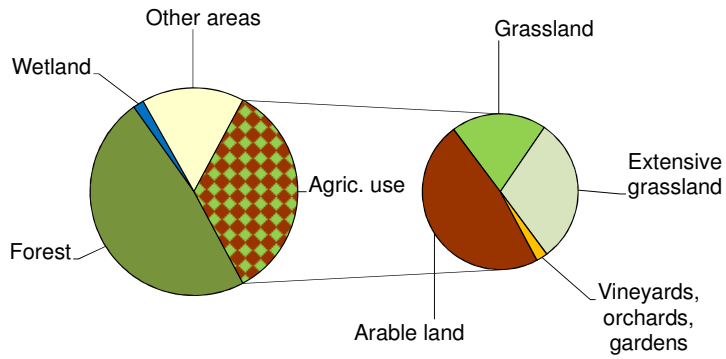

Figure 2.15: Land use in Austria 2010 (Data: Forest Inventory, Farm Structure Survey)

According to the 2010 Farm Structure Survey about 170,000 agricultural and forestry holdings are managed in Austria, of which more than one third are mountain farms. The number of holdings has decreased by more 20 % since 1999. Austrian agriculture and forestry are still small-structured; more than half of the holdings comprise less than 20 hectares and only 4 % more than 100 hectares. However, average size of holdings is continuously increasing. About two third of the holdings and of the agricultural area are situated in less favoured areas (mountainous areas, other less favoured areas and small-structured areas). Of the area used for agriculture the share of arable land is 48 %, grassland 20 %, extensive grassland 30 % and other types of agricultural land use (vineyards, orchards and house gardens, vine and tree nurseries) 2 %.

Output of agriculture in 2012 amounts to 7.2 billion €; the share of plant production is 45 %, of animal products 46 % and of other agricultural activities and services 9 %. The number of organic farms increased from about 1,500 in 1990 to almost 22,000 in 2012; more than 14% of arable land are managed according to organic criteria. Three quarters of all agricultural enterprises are participating in the Austrian agri-environmental programme “ÖPUL”; the results are reduced use of fertilisers, the increased application of organic methods and the expansion of crop rotation.

The number of cattle, which is most relevant for GHG emissions from agriculture, has decreased from 2.6 million in 1990 to about 2 million in 2011, the share of milk cows has decreased. Average milk production per cow, however, has increased by about two third to 6.227 kg per cow and year. Number of swine have decreased by one fifth to about 3 million. The number of horses, sheep and goats show increasing trends, but are of less relevance with respect to greenhouse gas emissions from agriculture. The use of synthetic fertilizer has decreased notably (see also Fig. 2.16).

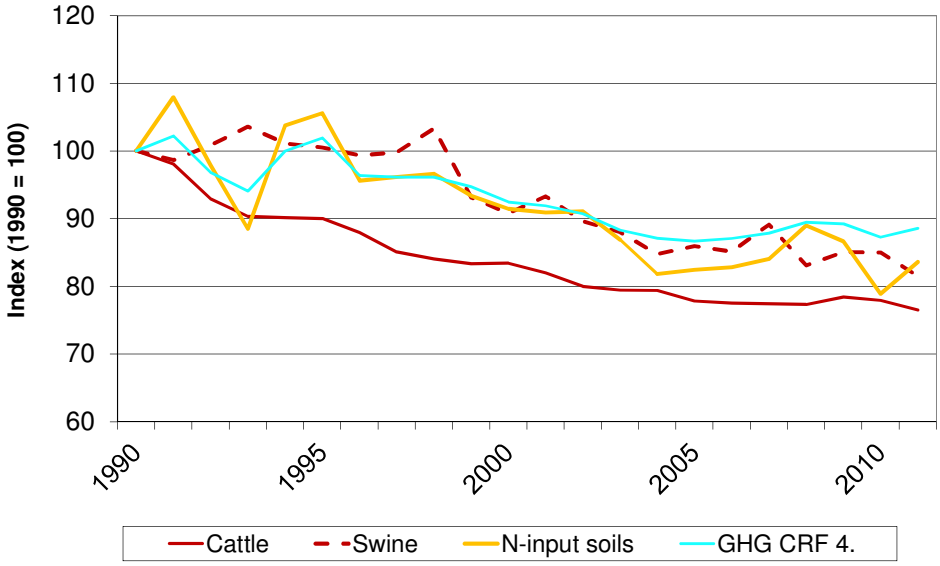

Fig. 2.16: Number of cattle and swine, N input into soils from fertilizer and manure, GHG emissions from agriculture 1990 to 2011 (Data: Umweltbundesamt)

Wooded area increased in average 4,300 hectares per year in the last years, mainly in agricultural areas and alpine pastures. Coniferous trees have a high share in the forest area with 64 %, most of them spruce; however, mixed forest stands with a higher percentage of leaf-wood have been further increased while Norway spruce monocultures further decreased since the fifth National Communication. During recent years, the average annual felling quantity increased significantly from 18.8 to 25.9 Mio m^3 o.b. However, this annual drain is around 85% of the average annual growth. As a result the standing stock in the Austrian forests has increased to more than 1.1 billion m^3 o.b.

Because of their protective functions, mountain forests are of great importance to Austria. About one fifth of forest area in Austria is classified as protection forest, which protects its own site, settlements, agricultural areas or other objects against natural hazards. Austrian forests represent the largest carbon reservoir and have been a net carbon sink during recent decades.

(Source: BMLFUW, 2013; BFW 2011)

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Chapter 3

Greenhouse Gas Inventory Information

3.1 Austrian Greenhouse Gas Inventory

The Austrian greenhouse gas inventory was compiled according to the recommendations for inventories set out in the UNFCCC reporting guidelines according to Decision 18/CP.8, with the revisions concerning the Land Use Change and Forestry Sector according to Decsions 13/CP.9 and 14/CP.11, the IPCC 1996 Guidelines for National Greenhouse Gas Inventories, which specify the reporting obligations according to Articles 4 and 12 of the UNFCCC as well as the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories and the IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry.

Austria, as many other European Countries, uses the CORINAIR calculation method (Core Inventory Air) for quantifying national emissions. The national project covering the entire present assessment of Air Emissions in Austria during the reported period is the Austrian Air Emission Inventory (*¨Osterreichische Luftschadstoff-Inventur – OLI*). The OLI figures for Austria's national emissions resulting from the project mentioned above have been transferred to the Revised IPCC 1996 Revised Guidelines format using CORINAIR standard procedures, in order to comply with UNFCCC reporting obligations to ensure comparability of the reported data. No corrections (neither for temperature nor for electricity production share from hydropower) have been applied. Bunker fuels have not been included in the national totals, but tabled separately. No CO_2 emissions have been attributed to feed stocks.

This report shows data from the inventory for the period 1990 to 2011 (NIR 2013 submitted to the UNFCCC secretariat in April 2013; Umweltbundesamt 2013a). CRF summary tables are shown in Annex A. Differences to figures reported in the last national communication are due to recalculations.

3.2 Emission Trend

Austria's total emissions of the greenhouse gases CO_2, N_2O, CH_4, HFCs, PFCs and SF_6 (excluding Land Use, Land-Use Change and Forestry) were 78.16 Tg CO_2 equivalent in 1990 and 82.84 Tg in 2011. The increase was mainly driven by the transport sector, which contributed 18 % to total emissions in 1990 and 26 % in 2011. About three quarters of the emissions result from fuel combustion. Of all CRF (sub)sectors, transport (1.A.3, 26 %) has the highest share in total emissions in 2011, followed by manufacturing industries and construction (1.A.2, 18 %), energy industries (1.A.1, 17 %), industrial processes (2., 14 %), "other sectors" (1.A.4, 13 %) and agriculture (4., 9 %). The share of most (sub)sectors has been at a comparable level in 1990, with the exception of transport and "other sectors", the latter showing a noteworthy decrease.

CO_2 emissions per capita amounted to 8.4 t in 2011 and total greenhouse gas emissions per capita to 9.9 t CO2 equivalent.

Table 3.1: GHG emissions 1990 and 2011, in Tg CO_2 equivalent

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990					2011				
	CO_2	CH_4	N_2O	F-Gases	Total	CO_2	CH_4	N_2O	F-Gases	Total
Total without LULUCF	**62.06**	**8.30**	**6.20**	**1.60**	**78.16**	**70.46**	**5.36**	**5.29**	**1.73**	**82.84**
Total with LULUCF	**52.09**	**8.30**	**6.24**	**1.60**	**68.23**	**66.91**	**5.36**	**5.34**	**1.73**	**79.35**
1. Energy	**54.17**	**0.67**	**0.56**		**55.40**	**60.83**	**0.46**	**0.69**		**61.99**
A. Fuel Combustion (Sectoral Approach)	54.07	0.46	0.56		55.09	60.60	0.22	0.69		61.51
1. Energy Industries	13.79	0.00	0.05		13.84	13.86	0.01	0.12		13.99
2. Manufacturing Industries and Construct.	12.69	0.01	0.08		12.77	14.83	0.01	0.15		15.00
3. Transport	13.77	0.06	0.19		14.03	21.52	0.01	0.21		21.75
4. Other Sectors	13.79	0.39	0.23		14.41	10.34	0.19	0.20		10.73
5. Other	0.04	0.00	0.00		0.04	0.05	0.00	0.00		0.05
B. Fugitive Emissions from Fuels	0.10	0.21	IE,NA		0.31	0.23	0.24	IE,NA		0.47
2. Industrial Processes	**7.58**	**0.01**	**0.91**	**1.60**	**10.10**	**9.45**	**0.02**	**0.05**	**1.73**	**11.25**
3. Solvent and Other Product Use	**0.28**		**0.23**		**0.51**	**0.17**		**0.15**		**0.32**
4. Agriculture		**4.19**	**4.36**		**8.56**		**3.55**	**4.03**		**7.58**
5. Land Use, Land-Use Change and Forestry	**-9.97**	**0.00**	**0.04**		**-9.93**	**-3.54**	**0.00**	**0.05**		**-3.49**
6. Waste	**0.03**	**3.43**	**0.13**		**3.59**	**0.00**	**1.33**	**0.38**		**1.71**

Austria's total greenhouse gases showed an increase of 6 % from the base year to 2011 (CO_2: +14 %). Figure 3.1 presents the trend in total GHG emissions 1990-2011 in comparison to Austria's Kyoto reduction target of 13% from the base year 1990. Emissions had left the path to the Kyoto target in the mid-1990ies and had started to increase considerably. A reversal of the trend has been achieved after 2005, but Austria had to make use of the flexible mechanisms of the Protocol to reach the target.

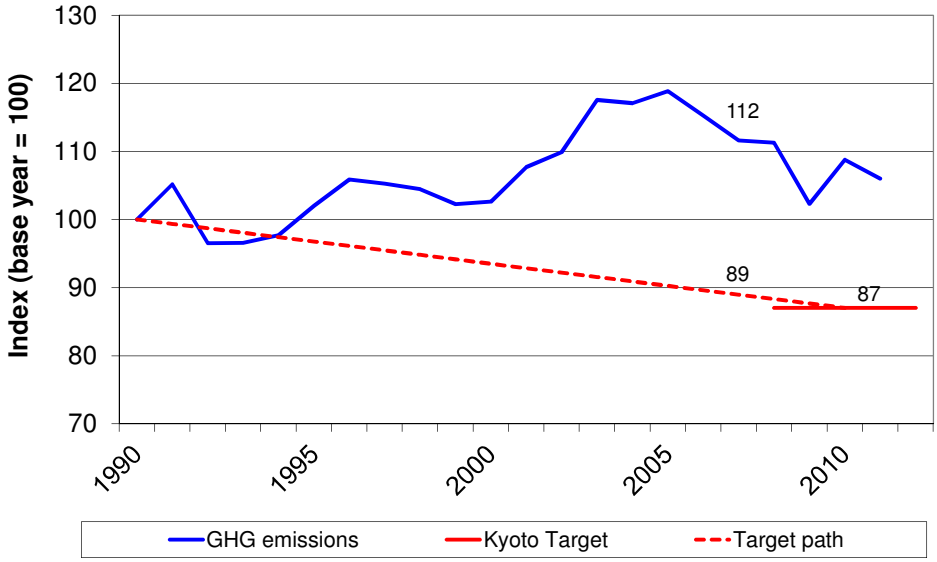

Figure 3.1: Trend in total GHG emissions 1990-2011 (excluding land-use change and forestry) and Kyoto Target

3.2.1 Trend by Gases

Emissions are clearly dominated by CO_2 with a share of 85 % in 2011; the share of CH_4 and N_2O has been decreasing since 1990 and reached 6 % for each of them. The share of fluorinated gases has been very low (about 2 %) all over the time. (Cf. Fig. 3.2)

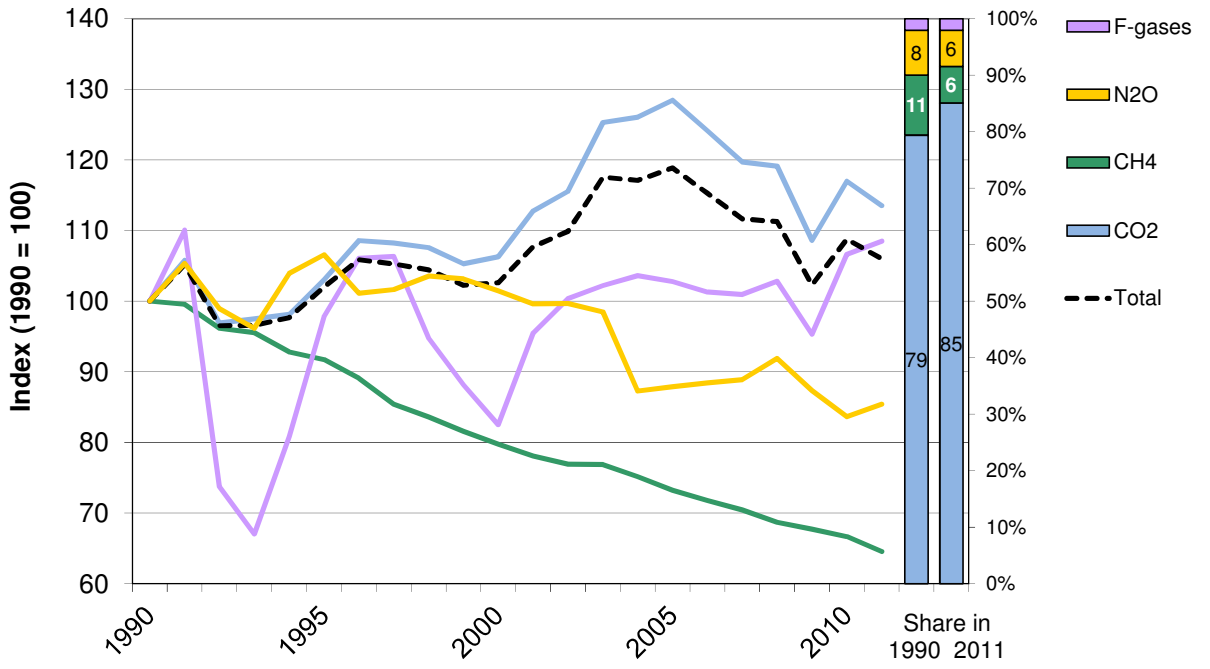

Figure 3.2: GHG emission trend (excluding land-use change and forestry), split into gases

Emissions of **carbon dioxide** showed an increasing trend from 1990 (62,1 Tg) to 2005 (79,7 Tg) and a decreasing trend since then (2011: 70,5 Tg). In 2011 CO_2 emission were 14 % above the 1990 value. The increase was mainly driven by increasing emissions in the transport sector, namely by road transport (cf. Fig. 3.3). Emissions calculated according to fuel used in Austria show a different picture. Starting from a comparable level in 1990 (61.1 Tg) emissions increased less pronounced until 2005 (71.5 Tg) and reached 64,6 Tg in 2011, which is 2 % above the 1990 value. One important reason for the increase of CO_2 emissions is therefore fuel export in the vehicle tank.

In 2011, the transport sector (1.A.3, 31 %) had the highest share in total emissions, followed by manufacturing industries and construction (1.A.2, 21 %), energy industries (1.A.1, 20 %), “other sectors” (1.A.4, 15 %) and industrial processes (2., 13 %). Emissions from all other sectors together are less than 1 % of total emissions. Summing up emissions from fuel combustion and processes, manufacturing industries and construction account for more than one third of Austrian CO_2 emissions.

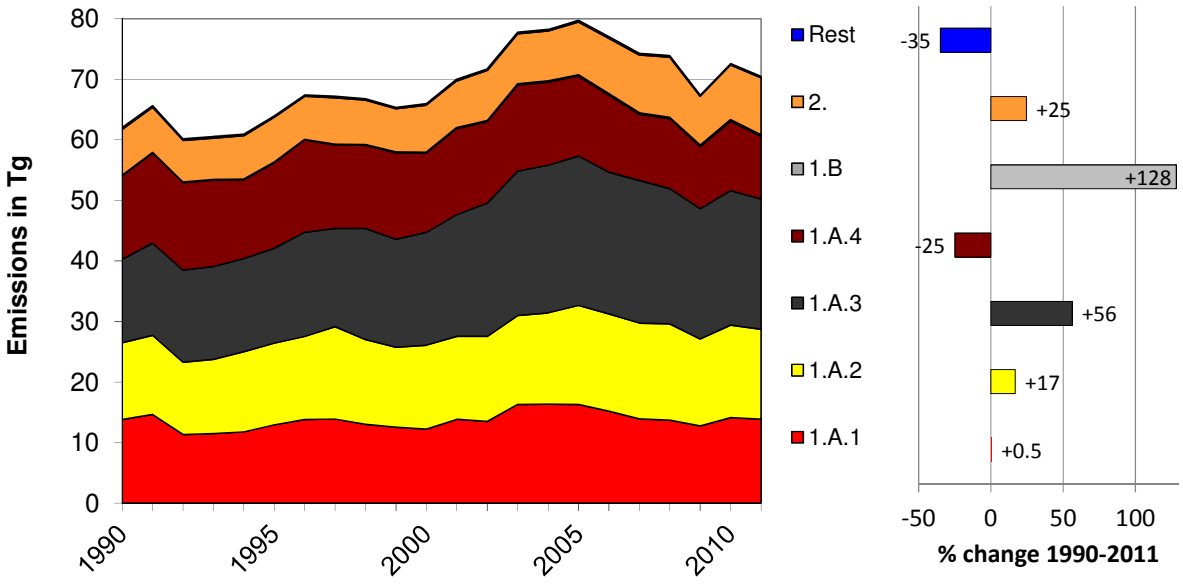

Figure 3.3: CO_2 emission trend 1990-2011

Emissions of **methane** decreased steadily during the period from 1990 to 2011, from 395 to 255 Gg. In 2011 CH_4 emissions were 35 % below the level of the base year. The decrease as well as total emissions are dominated by the emission trends in the sectors waste management and agriculture (see Figure 3.4).

In 2011, agriculture (CRF sector 4.) accounted for two third of CH_4 emissions, waste (6.) for one quarter. Minor contributions come from fuel combustion (1A) and fugitive emissions from fuels (1.B) with a share of 4 % each. Emissions from other sectors together are less than 1 % of total emissions.

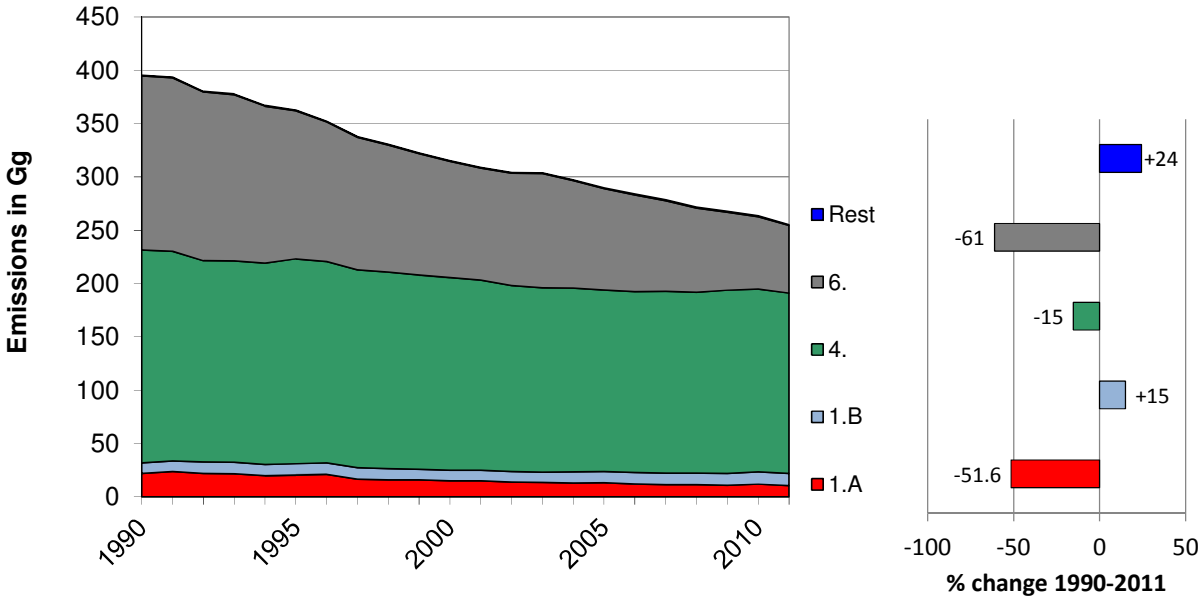

Figure 3.4: CH_4 emission trend 1990-2011

Emissions of **nitrogen dioxide** in Austria fluctuated in the 1990ies, but were at the same level in 2000 as in 1990. After 2000 emissions showed a decreasing trend,

resulting in 17.1 Gg in 2011 compared to 20.0 Gg in the base year (-15 %). The decrease is mainly due to lower N_2O emissions from agricultural soils and emission reduction measures in the chemical industry (cf. Fig. 3.5).

In 2011, agriculture (CRF sector 4.) accounted for about three quarters of N_2O emissions, followed from waste (6.) with 7 %, transport (1.A.3) and "other sectors" (1.A.4) with 4 % each. The share of industrial processes (2.) has been reduced to 1 % in 2011 from 15 % in 1990. The remaining 8 % of total emissions stem from energy industries (1.A.1), manufacturing industries and construction (1.A.2) and solvent and other product use (3.) at comparable shares.

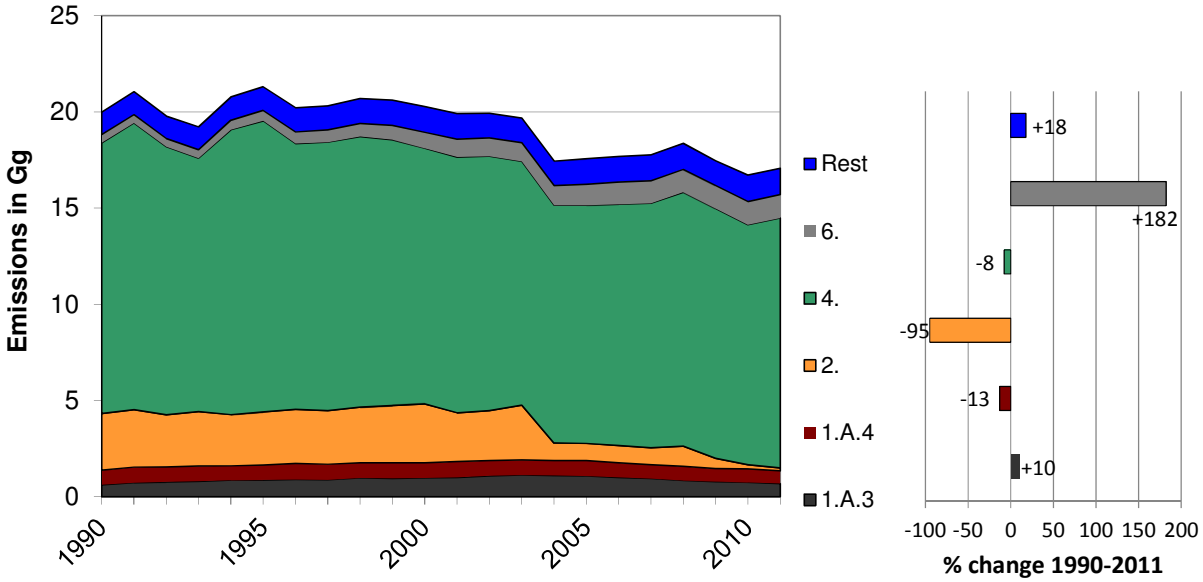

Figure 3.5: N_2O emission trend 1990-2011

Total emissions of **F-gases** showed considerable fluctuations after 1990 and were 8 % above the 1990 level in 2011. The share of the gases has changed greatly (cf. Fig. 3.6).

HFC emissions increased remarkably during the period from 1990 to 2011: From 0.02 to 1.35 Tg CO_2 equivalent. HFCs have been increasingly used as substitutes for HCFCs (Hydrochlorofluorocarbons; these are ozone depleting substances), the use of which has been banned for most applications. The increase is mainly due to their use in refrigeration and air conditioning equipment.

PFC emissions decreased by more than 90 %, from 1.08 to 0.06 Tg CO_2 equivalent. PFCs are side products of aluminium production, which was terminated in Austria in 1992, since then the main source of PFC emissions is semiconductor manufacture.

Starting with 0.49 Tg CO_2 equivalent, emissions of SF_6 reached a maximum of 1.23 Tg in 1996 and dropped to 0.32 Tg in 2011, which is about one third below the level of 1990. The decrease starting in the late 1990ies is due to technological improvements in light metal foundries, reduced consumption in semiconductor manufacture and the ban of certain uses of SF_6.

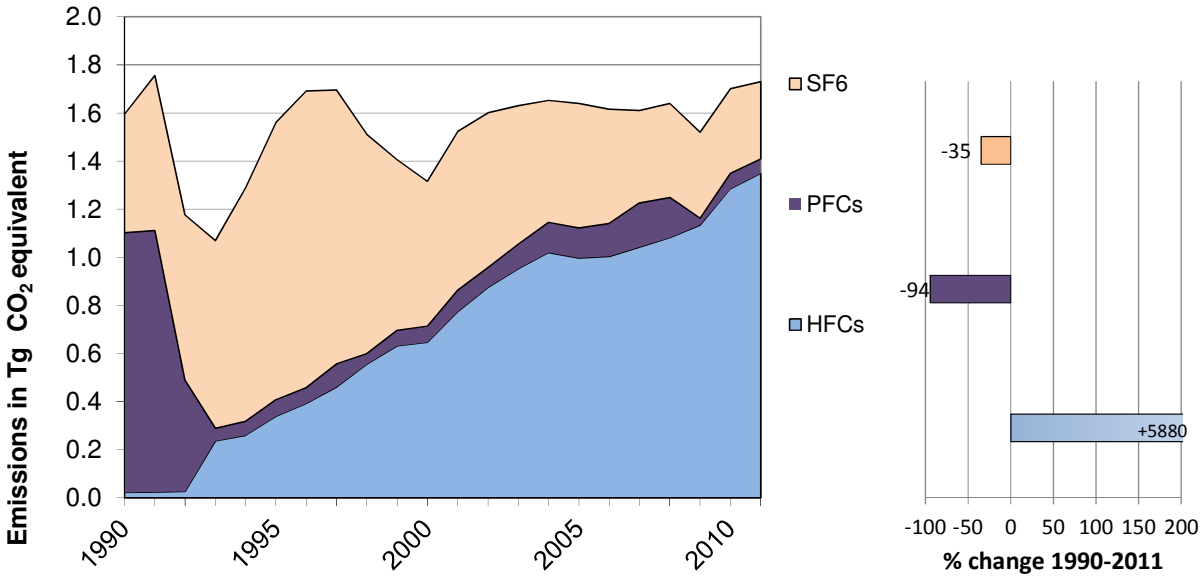

Figure 3.6: Emission trend of F-gases

3.2.2 Trend by sector

Whereas CRF sectors 1.A.1 to 1.A.4 had almost equal shares of total emissions in 1990 (16–18 % each), emissions from transport (1.A.3) have considerably increased to 2011 and emissions from "other sectors" (1.A.3) have shown a decrease (in share and absolute figures). Emissions from industrial processes (2.) have slightly increased. Emissions from agriculture (4.) and waste (6.) have decreased, their share is below 10 % in 2011 (cf. Fig. 3.7).

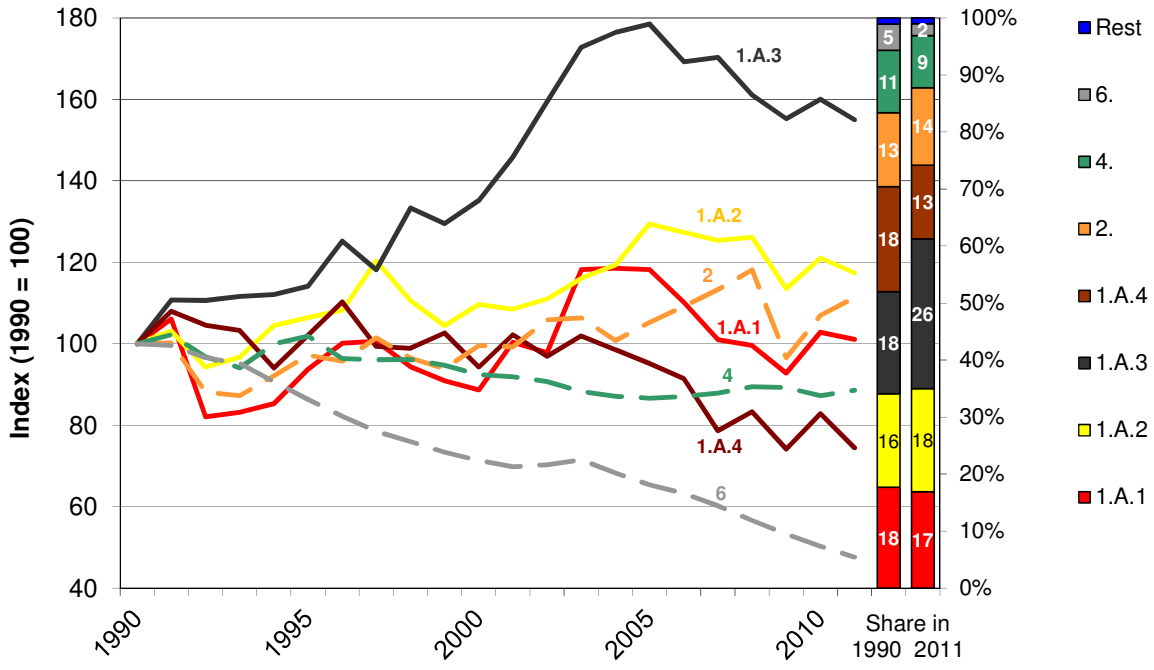

Figure 3.7: GHG emission trend (excluding land-use change and forestry), split into sectors

The trend analysis shown below is based on decomposition analysis. Method and results are described in more detail in Umweltbundesamt, 2013c.

GHG emissions from **energy industries (1.A.1)** with a CO_2 share of more than 99 % show rising emissions until 2005 and a decrease since then. Emissions in 2011 have been at the same level as in 1990. They are dominated by public electricity and heat production (1.A.1.a) with about three quarters of the emissions and a slight emission decrease. According to decomposition analysis emissions of public electricity and heat production would have doubled due to higher electricity demand as most important factor as well as due to increased production share of thermal plants and more district heating demand. These effects have been compensated by more efficient production, increased share of biomass, reduced carbon intensity of fossil fuels (i.e. fuel switch to gas) and increased electricity imports (cf. Fig. 3.8).

Emissions of the refinery (1.A.1.b) account for about 20 % of this sectors emissions and have increased. The increase of refinery emissions is mainly due to the increased demand for more energy intensive products, i.e. sulphur free fuels and light fraction products.

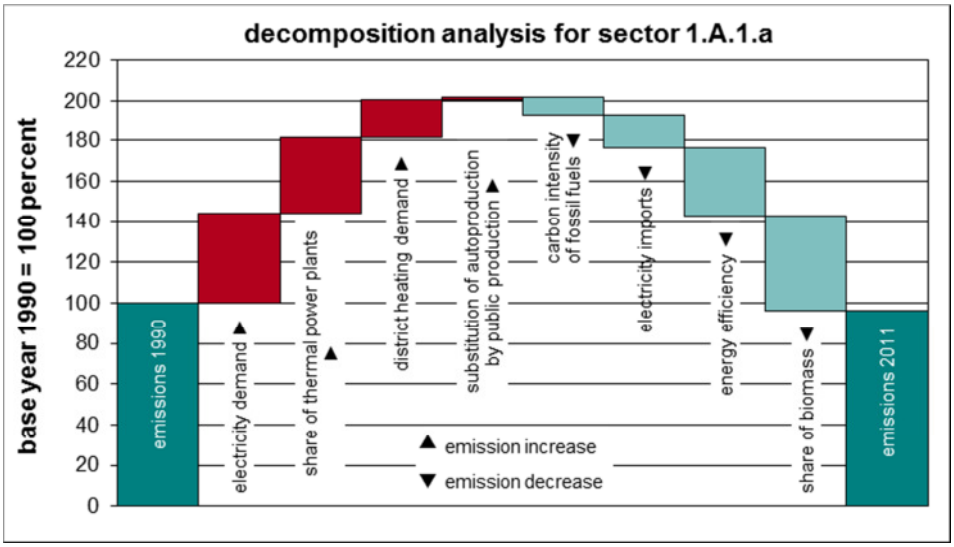

Figure 3.8: Decomposition analysis of sectoral GHG emissions – sector 1.A.1.a

Almost half of the emissions of **manufacturing industries (1.A.2 and 2.)** in Austria are caused by the iron and steel industry. The 73 % increase in steel production from 1990 to 2011 would have caused a comparable GHG emission increase, which has been halved by more efficient production and to a smaller extent by reduced carbon intensity of fossil fuel and more electricity purchase (cf. Fig. 3.9). Emissions from iron and steel production increased therefore by only 36 %.

Energy related emissions of the other subsectors of 1.A.2 have increased by 18 % from 1990 to 2011. Driving factor was the increase in value added, which would have led to an emission increase of more than 50 %; more biomass use and reduced carbon intensity of fossil fuels, however, could compensate the increase by about two third. Process related emissions have decreased by 22 %, which is mainly due to the introduction of catalytic reduction of N_2O emissions from nitric acid production.

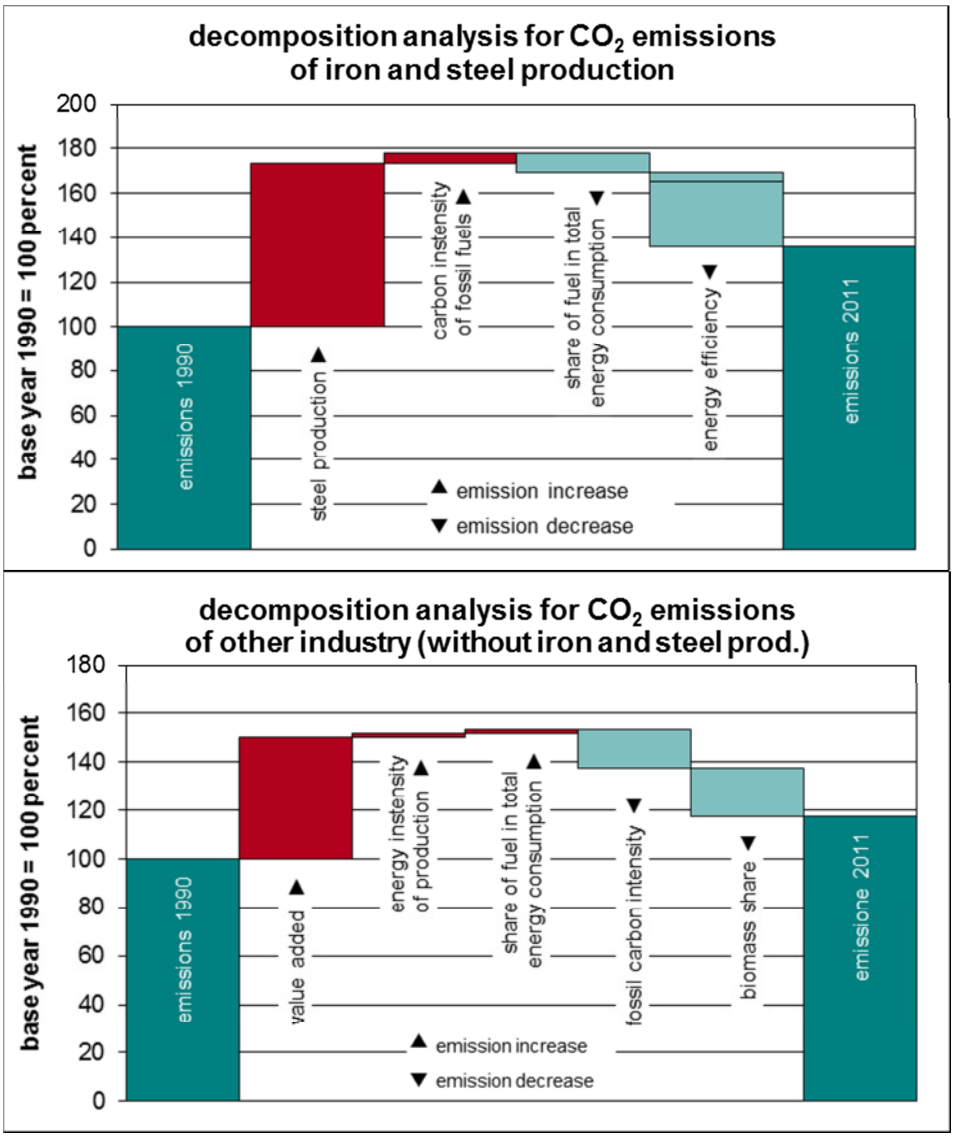

Figure 3.9: Decomposition analysis of sectoral GHG emissions – sectors 1.A.2 and 2.

Emissions from **transport (1.A.3),** mainly CO_2 (98 %), have increased by 55 % from 1990 to 2011. This is due to the increase of road fuel export in the vehicle tank, especially in freight transport, and to the increase of transport demand. In addition there is a comparatively small effect of the increased share of road transport. Use of biofuels and improved energy efficiency due to technical improvements could only marginally slow down the increase (cf. Fig. 3.10). This description is valid for passenger and freight transport, the magnitude of net increase of emissions, however, is only about one third for passenger transport and considerably more than 100 % for freight transport.

In 2011, cars were responsible for slightly more than half of the emissions of this sector, heavy and light duty vehicles for 42 %. About 2 % stem from pipeline compressors, less than 1 % from transport on rail and national waterways.

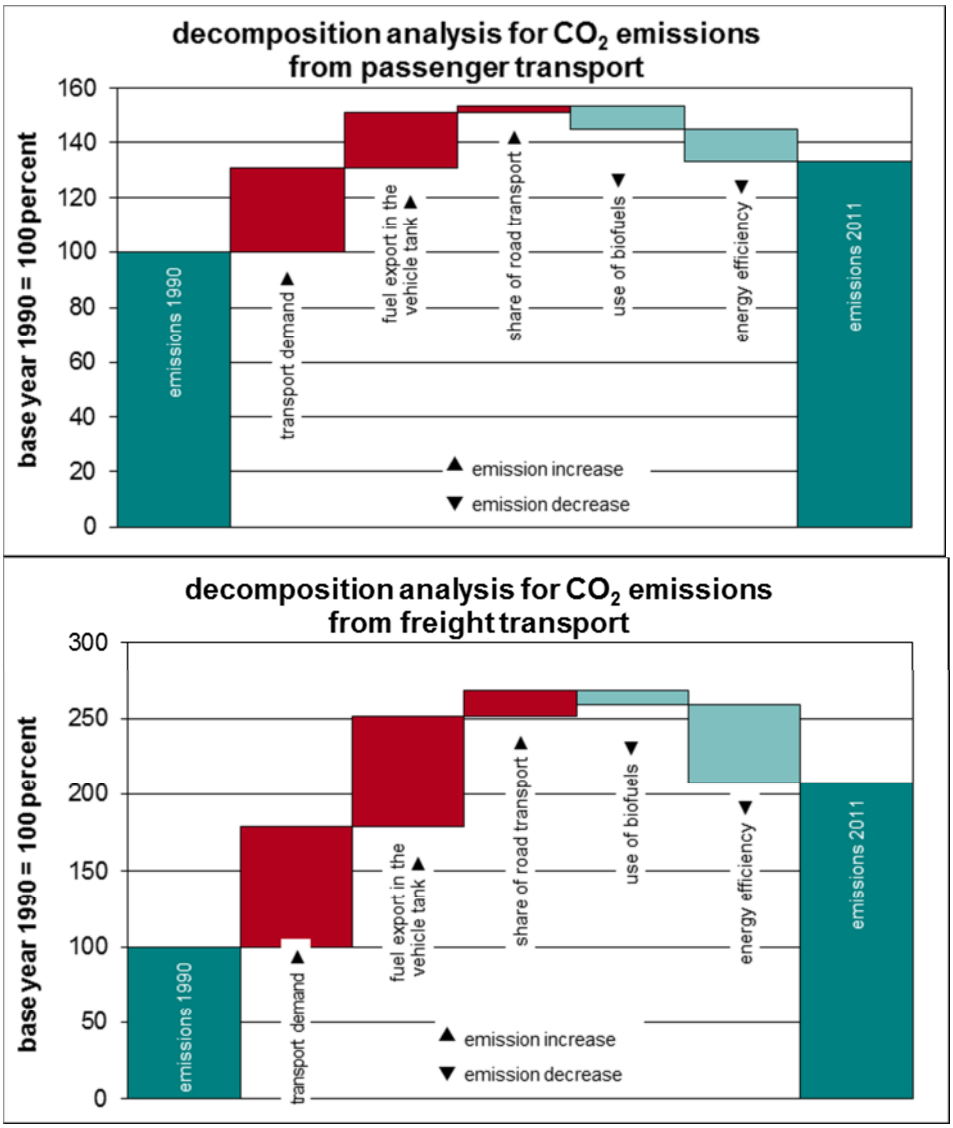

Figure 3.10: Decomposition analysis of sectoral GHG emissions – transport (1.A.3)

Emissions from **"other sectors" (1.A.4)**, mainly CO_2 (96 %), have decreased by 26 % from 1990 to 2011. Space heating in private households was the source for two third of the emissions in that sector in 2011, energy demand in public and private services makes up for another quarter. About one tenth comes from fuel combustion in agriculture and forestry, the only subsector where emissions from mobile sources make up a relevant share.

Emissions from space heating in private households have decreased by about one third. Improved energy efficiency of buildings and, to a smaller extent, increased biomass use, reduced carbon intensity of fossil fuels and a reduced share of fuels in final energy consumption (i.e. increased share of district heating and electricity as well as of ambient energy like solar thermal heating and heat pumps) would have led to an even higher emission decrease, if the increase in number and size of dwellings would not have halved that effect (cf. Fig. 3.11).

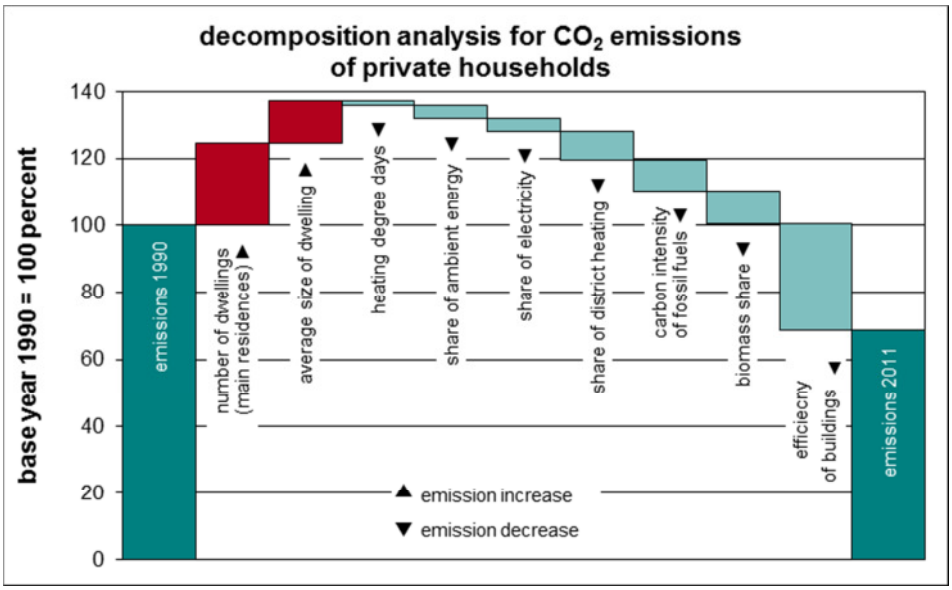

Figure 3.11: Decomposition analysis of sectoral GHG emissions – households (1.A.4.b)

Agriculture (CRF 4.) causes emissions of methane and nitrogen dioxide, the latter with a share slightly above 50 % in 2011. Emissions from that sector have decreased by 11 % from 1990 to 2011. Slightly more than 40 % of the emissions in 2011 stem from enteric fermentation and from soils respectively; manure management has the remaining share of 16 %. Main drivers for the emission decrease was the reduction in the number of cattle (–24 %) and the reduced use of mineral fertilizer (–24 %); measures for environmentally sound agriculture have contributed to the decrease. The decrease in cattle number has been partly compensated by higher emissions per cattle due to e.g. increased milk yield (cf. Fig. 3.12).

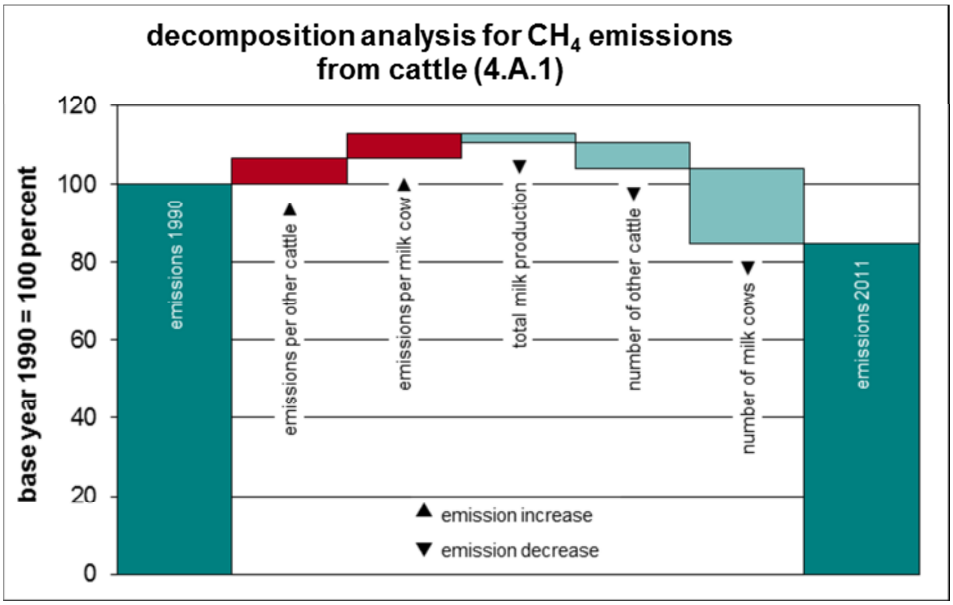

Figure 3.12: Decomposition analysis of sectoral GHG emissions – cattle (4.A.1)

Methane represents more than three quarters of emissions from **waste (CRF 6.)**, the rest is almost exclusively nitrogen dioxide. Emissions of the sector have decreased to less than 50 % from 1990 to 2011. Solid waste disposal sites are the most important

source of emissions in that sector with a share of 73 % in 2011. Since 2004 waste with a carbon content higher than 5 % must not be deposited on landfills; together with improved landfill gas recovery this regulation has caused a decrease of emissions from landfills by 62 %. Emissions of N_2O from waste water handling have increased by about one third, as the share of households attached to sewage systems has increased from 71 % in the early 1990ies to 95 % in 2010 and due to enhanced de-nitrification in the wastewater treatment plants.

3.2.3 Land-use, land-use change and forestry

Land use change and forestry (CRF 5.), which is not included in the national totals shown above, is a net sink in Austria. CO_2 removals from that category amounted to 9.97 Tg CO_2 in the base year and 3.54 Tg in 2011, which is an decrease of 64 %. N_2O emissions increased from 0.04 Tg CO_2 equivalent in 1990 to 0.05 Tg in 2011. If land use change and forestry is included in national total greenhouse gas emissions, total emissions increase from 68.23 Tg in 1990 to 79.35 Tg in 2011.

The main CO_2 sink is subsector forest land (5.A) with net removals of 5.36 Tg CO_2 in 2011. The other subsectors (5.B to 5.E) are sources of emissions of some 100 Gg each (in total 1.87 Tg CO_2 in 2011). Net caron stock changes in forest biomass have a major impact on the overall results in sector 5. These changes vary considerably between single years due to variations of influencing factors like weather conditions, wind throws, prices and timber demand.

Emissions of N_2O arise from subsector cropland (5.B). There are no significant emissions of CH_4 from sector 5.

3.2.4 Kyoto Protocol Commitment

When comparing the inventory data with the Kyoto Protocol target for the commitment period 2008–2012 and the Austrian target of -13 % under the EU burden sharing agreement, the use of carbon sinks and Kyoto mechanisms JI/CDM have to be taken into account as well as the allocated emissions under the EU Emission Trading System. The emissions in the years 2008–2011 and the expected emissions in 2012 including units from the flexible instruments will not exceed Austria's assigned amount.

3.3 National Inventory System

As a Party to the United Nations Framework Convention on Climate Change (UNFCCC), Austria is required to produce and regularly update National Greenhouse Gas (GHG) Inventories. The *Umweltbundesamt* is identified as the single national entity with overall responsibility for the national inventory by law. The responsibilities for the inventory planning, preparation and management are specified and are all allocated within the *Umweltbundesamt*.

The national greenhouse gas inventory is prepared by the inspection body for GHG inventories within the *Umweltbundesamt*, an inspection body accredited according to the International Standard ISO 17020 *General Criteria for the operation of various types of bodies performing inspections*. The Quality Management System (QMS) also includes the necessary procedures to ensure quality improvement of the emission inventory. These comprise documentation and attribution of responsibilities of any discrepancy found and of the findings by UNFCCC review experts in particular.

The inventory preparation, including identification of key categories, uncertainty estimates and QC procedures, is performed according to the 2000 Intergovernmental Panel on Climate Change (IPCC) Good Practice Guidance and Uncertainty Management of Greenhouse Gas Inventories. The inventory management as part of the QMS includes a control system for data and calculations, for records and their archiving as well as documentation on QA/QC activities. This ensures the necessary documentation and archiving for future reconstruction of the inventory and for the timely response to requests during the review process.

Part of the legal and institutional arrangements in place as basis for the national system concerns the data availability for the annual compilation of the GHG inventory. The main data source for the Austrian inventory preparation is the Austrian statistical office (*Statistics Austria*). The compilation of several statistics is regulated by law; the compilation of the national energy balance is regulated by contracts only. Other data sources include reporting obligations under national and European regulations and reports of companies and associations.

Detailed information on the national inventory system has been reported in Austria's Initial Report (BMLFUW 2006) according to Decision 13/CMP.1. The Austrian national system was reviewed during the in-country review of the initial report of Austria (February 2007). Para 10 of the review report (FCCC/IRR/2007/ AUT) states that the national system has been developed in line with the relevant guidelines and can fulfil the requirements of the Kyoto Protocol as well as other obligations regarding its air emissions inventory that Austria has to comply with.

The inventory preparation at *Umweltbundesamt* is supported by a quality management system that embeds an inventory improvement plan. This centralized improvement management guarantees the cost-effective allocation of resources to programmes specific for inventory improvement. Improvement programmes are formulated in a continuous process in all inventory sectors and cover the quality of country-specific emission factors, activity data and models.

Examples for these programmes in the latest years are: The cooperation with other European countries in developing the "handbook of emission factor" for road transport; the close cooperation with research institutes for the continuous improvement of emission factors and models for Agriculture; the cooperation with Statistics Austria that allows feedback from *Umweltbundesamt* to the energy statistics improving consistency and transparency; and the continuous improvement of assessing sources and sinks in land use and land-use changes to fully comply with the reporting under Article 3.3 of the Kyoto protocol.

More information on the national system, inventory preparation and improvement can be found in Section 1.2 ff of the Austrian National Inventory Report 2013 (Umweltbundesamt 2013a).

3.4 National Registry

The registry administrator designated by Austria to maintain the national registry is Umweltbundesamt GmbH. The registry is operational since June 2005. In June 2012 the national registry migrated to the Consolidated System of EU Registries (CSEUR), which is a common platform for the EU registry and the national registries of the EU member states plus Iceland, Liechtenstein and Norway. Detailed information on this change has been reported in Chapter 13 of the Austrian National Inventory Report 2013 (Umweltbundesamt 2013a).

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Chapter 4

Policies and Measures

4.1 Policy-making Process

Decisions related to policies and measures can be taken at different levels: Legislative measures at the Federation level and the level of the *Länder* ("federal provinces"), administrative measures at federal and *Länder* level, and decision-making of districts and municipalities. The Federal Constitution Act contains detailed provisions on the distribution of legislative power between the Federation and the *Länder*. For different issues, the Constitution Act prescribes either legislative and executive power of the Federation, or legislative power for the Federation and executive power for the *Länder*, or legislative power of the Federation with respect to fundamental principles and legislative power of the *Länder* with respect to implementation issues, or legislative and executive power of the *Länder*. With regard to climate change, legislative responsibility for important policies is shared among the different levels. Private business affairs of Federation, *Länder* and municipalities (e.g. procurement) are managed independently.

The Federation

Legislation at the Federation level usually starts as a government proposal by drafting a bill in one of the ministries – although, in a "normal", but rarely practised, procedure on grounds of the constitution, the parliament takes the initiative for legislation. The ministry co-ordinates its proposal with other ministries and takes into consideration the opinions of different interest groups (consultation phase). Subsequently, the bill is submitted to the Council of Ministers (government). Since unanimity is required in the Council of Ministers, consensus on a bill needs to be provided both politically (i.e. between the parties represented in the government) and technically (between ministries involved). The bills accepted by the Council of Ministers are passed as government bills to the Parliament. The first chamber of the Parliament (Nationalrat) is being constituted every five years after general elections and has the primary legislative power for federal laws. The second chamber (Bundesrat) comprises Members nominated by the nine Länder parliaments and has to vote as well on all federal laws, but its power to over-rule votes of the first chamber is strictly limited.

The implementation of laws at the Federation level is the responsibility of the appropriate ministers, who are either named in the law in question or whose responsibility derives from the Federal Ministries Act. In practice, the implementation of laws is the domain of the administration, i.e. of the ministries and their subordinate administrative units. To a great extent, the *Länder* implement federal laws by way of "indirect federal administration" where the *Länder* authorities are acting in place of federal authorities and are subject to instructions from the federal ministers.

Some examples of federal jurisdiction with respect to climate change are: issues of trade, industry and mining, emissions trading, taxation, price regulation and crisis management for energy supply, transport (e.g. regulations on motor vehicles, infrastructure issues with respect to national railways, roads and waterways).

The *Länder* (Federal Provinces)

The parliaments of the nine *Länder* ("Landtage") are responsible for legislation in those matters, for which the Federal Constitution Act does not assign responsibilty to the Federation. Administration in the *Länder* is subordinate to the *Länder* governments. The *Länder* governments are elected by the *Länder* parliaments; in the majority of the *Länder*, the governments are proportionally comprised of Members of the parties represented in the *Länder* parliament.

Some examples of *Länder* responsibility with respect to climate change are: issues of building construction and small-scale heating systems; road construction and maintenance on regional level; public transport; land-use planning.

However, Article 15a of the Federal Constitution Act opens the possibility to come to agreements among the *Länder* or between *Länder* and the Federation in order to harmonise policies under the respective legal areas of jurisdiction. No party can be forced to enter into such an agreement.

In some important climate change-related policies, legislative power is distributed among the Federation and the *Länder*, e.g. energy policy, waste management and agriculture.

The Municipalities

Local councils as well as mayors and councillors in charge are subject to democratic voting. Municipalities have executive power within the boundaries set by the Federal Constitution Act and by legislation of the Federation and the *Länder*. The Federal Constitution Act provides for autonomy in matters of local interest, which can be pursued within the municipal borders (e.g. building inspection, fire precaution, local planning). With respect to private business affairs, municipalities act as economically autonomous organisations. This authorisation is widely used, e.g. to hire staff, construct buildings and run enterprises for ensuring the needs of everyday life such as drinking-water supply, waste disposal or nursery schools.

Policies and measures with respect to climate change at the municipal level range from land-use planning, public transport, local road construction and parking restrictions to public buildings and procurement.

4.2 Domestic and regional Programmes, legislative Arrangements, enforcement and administrative Procedures

Administrative Procedures

The Federal Ministry for Agriculture and Forestry, Environment and Water Management has a co-ordinating function with respect to the overall climate change policy in Austria. However, responsibility for measures to reduce greenhouse gas emissions and to fulfil other obligations of the UNFCCC and the Kyoto Protocol is distributed among several federal ministries and other territorial authorities (*Länder*,

municipalities). In order to support the co-ordination of climate change related measures, different committees have been established in the past.

The *Interministerial Committee to Coordinate Measures to Protect Global Climate* (IMK Climate) was founded in 1991 during the preparations for the UNFCCC. It is established at the Federal Ministry of Environment and consists of representatives of the federal ministries concerned by the subject matter, representatives of the Austrian system of social partnership and a common representative of the *Länder*. The IMK serves to exchange information on national and international climate change issues and to discuss and agree on proposals that are intended for adoption by the council of ministers of the federal government. On an ad hoc basis the IMK is supplemented by expert groups for certain issues, for example for the preparation of the climate strategy.

After the negotiation of the Kyoto-Protocol and after Austria took over the commitment to reduce its GHG emissions by 13% within the EU burden sharing agreement for the first KP commitment period, the *Kyoto-Forum* was established at the Federal Ministry of Environment in 1999 as an initiative to combine the efforts of the different levels of state. The *Kyoto-Forum*, comprising high-level representatives of the *Länder* and of the associations of municipalities and towns, was set up to support and supervise the strategy for reaching the Kyoto-target in a combined effort of the provinces and the federation.

Based on the new *Climate Change Act* (see below), two new groups on climate change were founded by law in 2011: the *National Climate Change Committee* (NKK) and the *National Climate Change Council* (NKB). The NKK comprises high level representatives of the *Länder*, six federal ministries involved in climate change (Environment, Finance, Economic, Transport, Health, Justice) and the four "Social Partners" (Trade Unions – ÖGB, Chamber of Labour – AK, Chamber of Commerce – WKÖ, Chamber of Agriculture – LKÖ). In practice, this new committee is taking over former functions of the IMK and the Kyoto-Forum, when it comes to design and elaboration of climate change plans and long-term strategies.
The NKK is supported by the so called *National Climate Change Council* (NKB), which is composed of, i.a., representatives from science, energy and industry interest groups, environmental NGOs and the six political parties represented in the first chamber of the Parliament (Nationalrat).
Both groups are co-chaired by the Head of Environment Department of the Federal Ministry of Agriculture, Forstry, Environment and Water Management (BMLFUW) and one representative of the *Länder*, alternating on a rotation basis.

Programmes

After extensive discussions in these committees and in sectoral working groups, Austria's *Climate Strategy* for the first commitment period of the Kyoto Protocol was adopted by the federal government and the council of provincial governors in 2002, describing domestic measures with the aim to reach the national Kyoto target. After three years of implementation, the effects of the *Climate Strategy* have been evaluated, followed by an *Amendment to the Climate Strategy* that has been adopted by the Austrian Federal Government in 2007.

Most *Länder* (e.g. Vienna, Upper Austria, Lower Austria, Salzburg) have formulated their own regional climate change programmes, taking into account specific regional circumstances, needs and areas of responsibility. These programmes ideally supplement the national programme, which can only describe at an abstract level framework conditions and guidelines for provincial action.

The Minister for the Environment and the Minister for Economic Affairs initiated a stakeholder process to establish a new Energy Strategy for Austria in April 2009, in response to the legally binding European commitments on renewable energy and climate change (2020 targets). Numerous working groups, incorporating government institutions, social partners and other interest groups (including environment NGOs) were set up for elaboration of policies and measures, which shall ensure to improve energy efficiency, to increase the share of renewable energy sources to 34% by 2020 and to bring down greenhouse gas emissions to levels compatible with the European legal framework in the period 2013-2020. The Energy Strategy was presented by the two Ministers in March 2010 and adopted by the government thereafter, on time to deliver a National Renewable Energy Action Plan (NREAP) to the European Commission by end of June 2010, according to Directive 2009/28/EC.

In early 2012, after entry-into-force of the *Climate Change Act*, discussions on a new mitigation programme were launched under the NKK, aiming to bring forward policies and measures that can ensure compliance under the *EU Effort Sharing Decision*. According to that legally binding Union act, Austria is committed to reduce its GHG emissions up to 2020 in non-ETS sectors by 16% relative to 2005. The first part of that new programme has been adopted by the federal government and the *Länder* in June 2013, covering measures ready to implement in the course of 2013 and 2014. A follow-up of discussions on the programme is scheduled for 2014.

Legislative arrangements and enforcement

The legislative arrangements for the implementation of the national Climate Strategy are different for each of the strategy's elements. As described in the first section, areas of responsibilty are spread among ministries as well as between the Federation, *Länder* and municipalities. That is why there is no uniform legal basis for national measures to mitigate climate change. The legal basis for the multiple measures ranges from, e. g., the Environmental Support Act and the Green Electricity Law at Federation level to the Technical Construction Regulations for buildings on *Länder* level. Administrative procedures for implementation and monitoring are as well different for the diversity of measures. Some information is given on a measure by measure basis in the relevant subsections of this chapter. Enforcement rules are laid down in the respective legal acts as appropriate. All legal acts are published and made available to the public.

Some important pieces of legislation with respect to climate change mitigation are mentioned below.

Climate Change Act ("Klimaschutzgesetz")

In November 2011, the Parliament adopted a new Climate Change Act ("Klimaschutzgesetz", KSG), which fixes sectoral targets and administrative responsibilities to fulfil international and European climate change commitments. The law defines processes on how to develop climate strategies and provides for appropriate (aforementioned) institutional arrangements.

The Austrian Environmental Support Act

The Austrian Environmental Support Act was enacted in 1993 (Umweltförderungs-gesetz, BGBl. Nr. 185/1993 as amended). One of the four pillars of this legal instrument is the Domestic Environmental Support Scheme, which has the main objective to provide subsidies for companies to implement measures in the field of energy efficiency, climate and environment protection. The second climate change-related pillar of the law is the *Austrian JI/CDM Programme*, which aims to contribute to achieving the Austrian reduction commitment under the Kyoto Protocol through the application of the project-related flexible mechanisms, Joint Implementation, Clean Development Mechanism and (AAU-backed) Green Investment Schemes. The total budget available for purchase of emissions reductions amounts to 611 million €.
Kommunalkredit Public Consulting (KPC) is in charge of the management of the Environmental Support Scheme and the JI/CDM Programme. Information on the effects of these programmes is given below in section "Cross-cutting Policies and Measures".

4.3 Policies and Measures and their Effects

This section provides information on implemented, adopted and planned policies and measures, which contribute to achieving the greenhouse gas mitigation goals of the Convention and Austria's quantified emission limitation and reduction commitment under the Kyoto Protocol.

In 2012, new emission projections have been elaborated by the Environment Agency Austria within the framework of the project EMIPRO (Umweltbundesamt 2013). To the extent possible, policies and measures described in this chapter have been taken into account in the projections. The results are shown in detail in chapter 5 of this report.

The descriptions by sector in the following paragraphs need to be read in conjunction with the PaMs summary table at the end of this chapter. The PaMs summary table provides quantifiable reduction effects for the years 2010, 2015 and 2020, and other information requested and outlined in the UNFCCC reporting guidelines. In addition, ex-post data on reduction effects or on relevant indicators are provided in the textual description, where available. To this end, it has to be noted that the level of sophistication for both – ex-post and ex-ante assessment of PaMs – varies between different sectors and between different types of measures (e.g. voluntary, fiscal, economic, education, research, etc.).

With few exceptions, reduction effects are given for groups of policies and measures and not for all PaMs individually. Even if effects could be specified for individual policies and measures, those cannot be simply summed up in order to express the total effect of PaMs within a sector. There are major strengthening and weakening impacts between policies and measures. This should be taken into account when comparing reduction effects.

All emissions are reported in carbon dioxide equivalent values and have been converted from each gas on the basis of global warming potentials (GWP) as agreed upon by the Conference of the Parties.

4.3.1 Cross-cutting Policies and Measures

M1. EU Emission Trading Scheme

The emission trading scheme of the European Union (EU ETS, Directive 2003/87/EC as amended) is implemented in Austrian law with the Emissions Allowance Trading Act (Emissionszertifikategesetz 2011 - BGBl. I Nr. 118/2011). ETS became effective EU-wide on 1 January 2005 and covers stationary sources of greenhouse gases in the energy intensive industry and energy production sectors.

Austria's National Allocation Plan for the pilot phase of the EU Emissions Trading Scheme (2005-2007, NAP 1) was prepared and approved by the Commission in fall 2004. The total amount of emissions allowances that has been allocated to around 200 Austrian installations was about 33 million allowances per year.

The Allocation Plan for the second trading phase (2008-2012, NAP 2) was approved by the European Commission in April 2007. The total amount of allowances (30.7 million per year) was considerably reduced in comparison to the first phase. 2 million allowances (400,000 per year) have been auctioned by the government. One per cent of the total amount of allowances has been kept in the reserve for new entrants. In 2011, emissions sources capped be the ETS were responsible for 37 % of the total emissions (based on verified emissions) in Austria. Within the affected sectors (energy industries, manufacturing industry, industrial processes), about 80 % of emissions are covered by ETS.

From 2013 onwards, a fully harmonised system for allocation of free allowances is being applied, based on the revision of the ETS Directive (2009/29/EC). National Allocation Plans have been replaced by strictly harmonised rules on free allocation for stationary installations covered by the scheme, combined with a Union-wide cap, which is characterised by a linear factor that provides for the reduction of GHG emissions by 21% to be achieved in 2020 relative to 2005. So called "National Implementation Measures" need to strictly follow the rules for free allocation, laid down in the "Benchmarking Decision" by the European Commission. For most activities, free allocation is calculated on the basis of product or heat benchmarks, which are derived from the 10 % most efficient installations in Europe.

For industry activities that face a risk of "carbon leakage", temporary free-allocation amounts to 100 % of the benchmark value for the period 2013-2020, before application of a cross-sectoral correction factor[1]. In all other cases (e.g. district heating installations), free allocation amounts to 80% in 2013 and is being reduced annually in a linear manner to reach a level of 30 % in 2020 (prior to application of the cross-sectoral correction factor). No free allocation may be granted for electricity production in order to avoid any windfall profits.

Union-wide, five per cent of the allowances are kept in a reserve for new entrants (new installations or extensions).
All remaining allowances are being auctioned in a harmonised way. Revenues are re-allocated to Member States following a fixed distribution. According to the Directive, at least 50 % of revenues should be used by Member States for climate change related purposes (domestic and international).

In Austria, around 220 installations are covered by EU ETS from 2013 onwards. Free allocation amounts to 22.75 million allowances in 2013 and will go down to 18.46 million allowances in 2020, according to *National Implementation Measures* by Austria, which were accepted by the European Commission in late 2013 (together with those from all other Member States).

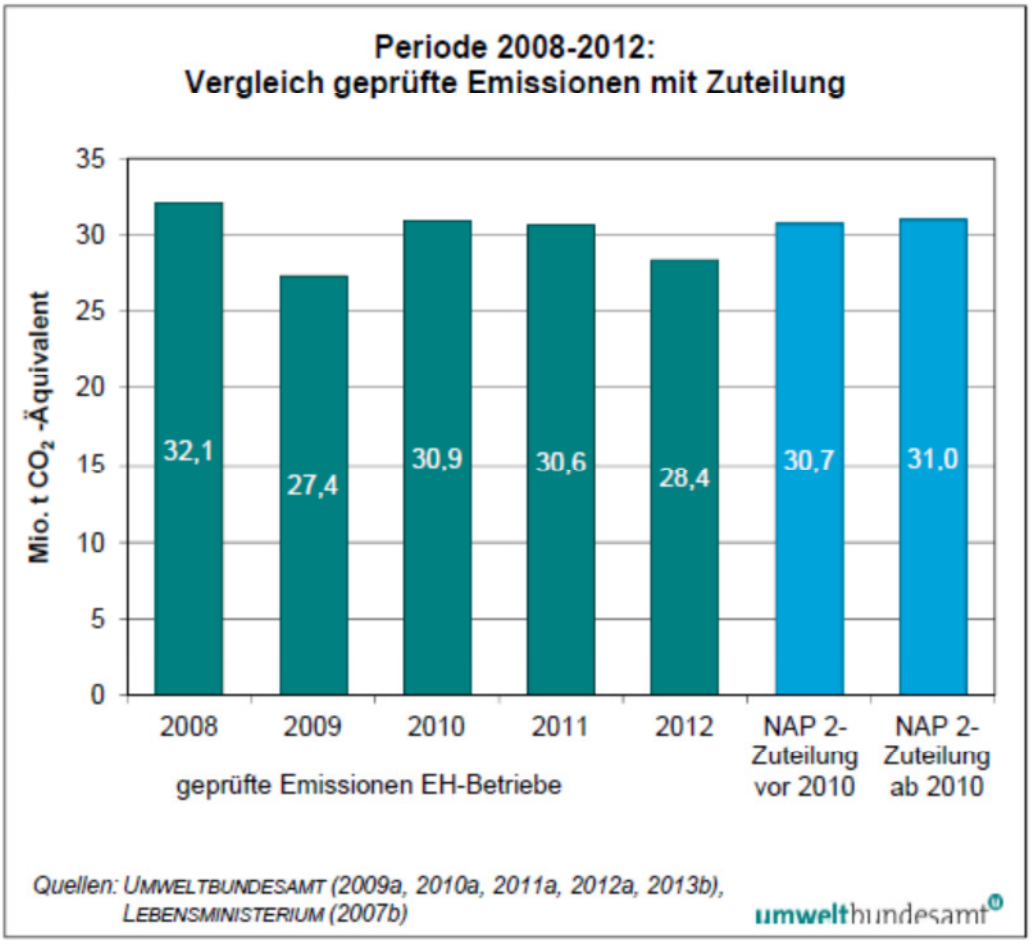

Figure 4.1: Emission trading – national allocation and total verified emissions in the second trading period 2008-2012 (Source: Umweltbundesamt, 2013c)

[1] This factor has been published by the European Commission in September 2013 and amounts to 0,9427 in 2013 and is being reduced in a linear manner to reach 0,8244 in 2020. The reasoning of this factor is to prevent free allowances to exceed a certain share of the total amount of allowances.

M2. The Domestic Environmental Support Scheme

The main objective of the Domestic Environmental Support Scheme (BGBl. Nr. 185/1993 as amended) is to provide economic incentives to promote the implementation of measures in the field of energy efficiency, climate and environmental protection. Funding according to the environmental support scheme in 2008–2012 has been provided for more than 12 000 entrepreneurial projects, whereof over 90 % were related to climate change. These projects have brought about an emission reduction of around 1.9 Tg CO_2 equivalents. The environment related investment costs for the years 2008-2012 amounted to € 2 353 million.

In addition, private investments in insulation and other energy related improvements of residential buildings ("Sanierungsscheck", see also PaMs in buildings sector) resulted in a further GHG emission reduction of 280 000 tons CO_2-equivalent annually.

Table 4.1 lists supported projects in the period between 2008 and 2012 by sectors:

Table 4.1: The Environmental Support Scheme 2008-2012 – overview (including subsidies for renovation investments in residential buildings)

sector	Number of projects	Environment related investment costs (€)	Subsidy (€)	CO_2-reduction (t/a)
Entrepreneurial projects:				
Energy and water supply	1.072	1.011.587.185	147.369.878	955.807
Manufacturing industry and construction	3.179	691.913.432	112.911.246	459.008
Trade	1.613	162.851.415	30.322.051	113.039
Service buildings (incl. accommodation)	5.988	544.918.048	97.606.555	228.714
Other services	1.889	237.531.222	40.610.966	161.865
Other	727	129.963.822	23.740.052	126.055
Subtotal	*14.468*	*2.778.765.124*	*452.560.748*	*2.044.488*
Private projects:				
Residential Buildings (2009, 2011, 2012)	47.174	1.673.701.696	184.381.301	280.004
Total	**61.642**	**4.452.466.820**	**636.942.049**	**2.324.492**

The Environmental Support Scheme is managed by *Kommunalkredit Public Consulting - KPC*, commissioned by BMLFUW. According to the last annual report (Umweltförderungen des Bundes 2012), companies received € 76.7 million of support for 2 316 projects in 2012, whereof € 66.3 million or 86 % were of relevance for GHG mitigation. 1 125 projects with a support of € 37.9 million fell into the

category of renewable energy use and 1 141 projects (€ 25.9 million funding) involved energy efficiency measures.

Further information can be found on the webpage and in the annual reports of *Kommunalkredit Public Consulting* (http://www.publicconsulting.at).

M3. Austrian Climate and Energy Fund (KLI.EN)

According to the Climate and Energy Fund Law ('Klima- und Energiefondsgesetz' BGBl. I Nr. 40/2007), the objective of the KLI.EN is to contribute to meeting Austria's climate change commitments by funding of climate and energy related projects.

The Climate and Energy Fund relies on the power of role models. From 2007 to 2012 it has supported more than 57,000 climate mitigation projects and invested a total of € 730 million resulting in an economic impact of more than € 1.8 billion. The Climate and Energy Fund investments will deliver benefits in the short, medium (until 2030) or long (until 2050) term. The aim is a long-term transformation to a climate-friendly energy system. The projects supported by the Climate Fund have a direct impact on Austria's economy: every Euro invested results in € 2.50 of total investment. The Climate Fund spurs innovation and growth in areas that will determine Austria's energy and climate future.

The Climate and Energy Fund focuses on three key areas:

- research in and development of renewable energy systems,
- development and testing of new transport and mobility systems,
- acceleration of climate mitigation measures and their success on the market (market penetration).

New energy technologies and transport systems require public acceptance. The Climate and Energy Fund has developed the "Model Regions" concept to help climate-friendly energy and mobility systems to be successful at the regional level. The idea of its "Flagship Projects" funding programme is to help new technical developments to be actually tested and implemented. Model Regions and Flagship Projects have model character and prove that GHG mitigation is practicable for everyone. Sustainability and efficiency continue to be the cornerstones of all Climate Fund activities. The Fund has made its mission to continuously reduce greenhouse gas emissions and improve energy efficiency. The near-future challenge to face is to accelerate market efficiency.

The role of communities

1,113 communities with more than 2.5 million inhabitants in total have one common vision: an energy system that makes them independent from fossil fuels, provides them with sustainable energy and contributes to climate change mitigation for future generations. They are incorporated into 106 "Climate and Energy Model Regions" and systematically cooperate to realise their vision with intelligent concepts and implementation projects. They are pioneers of a new energy system for Austria.

According to EU calculations, cities and suburban regions emit 80 percent of the world's greenhouse gases, while simultaneously consuming 75 percent of the world's total energy. Those who want to meet climate change mitigation targets, have to seek the turn in the cities. Therefore the Climate and Energy Fund supports comprehensive transport, energy or building technology initiatives to make 18 cities "smarter" and healthier.

Research Activities Tripled

The Climate Fund is effective: in the last four years approximately 550 projects have been funded within the "New Energies 2020" energy research programme, thus resulting in an investment total of around euro 300 million. The range of projects is wide, from making mobile phone base stations more environmentally-friendly over optimising solar systems to developing local electro-mobility infrastructure. Since 2008 the amount of research work done in the energy sector has increased by around 200 % as a result of the efforts made under the Climate and Energy Fund. The new "e!Mission.at" energy research programme will continue this success story.

M4. The Austrian JI/CDM Programme

Based on the amendment of the Environmental Support Act the programme was launched in August 2003 (see Section 4.2.3). The total budget of the programme amounts to 611 million Euros. BMLFUW is entitled to buy as much as 80 million Kyoto units on the markets, comprising JI- and CDM-projects as well as AAUs from Green Investment Schemes (GIS). The programme is managed by Kommunalkredit Public Consulting (KPC). Meanwhile, a sufficient number of projects has been contracted in order to meet Austria's target under the Kyoto-Protocol and the EU agreement on joint fulfilment for the first commitment period.

KPC has already contracted around 75 Tg of CO_2 equivalents by the end of 2013. Further information can be found on the webpage and in the annual reports of Kommunalkredit Public Consulting (http://www.publicconsulting.at – see Carbon Management).

4.3.2 Energy

4.3.2.1 Energy Supply

Source Categories of the Common Reporting Format affected[2]: 1.A.1 (energy industries)
GHG affected: CO_2, CH_4, N_2O

The subsector energy supply includes emissions from electricity generation and district heating (including waste incineration for energy generation e.g. in Combined

[2] According to the projections chapter emissions from the categories 1.B Fugitive Emissions from fuels and 1.A.5 Other are also attributed to the energy sector, but there are no measures designated for these subsectors and therefore no further description is provided.

Heat and Power (CHP) plants), as well as from oil and gas exploitation and storage, emissions from refineries and consumption of the energy sector. Data exclude emissions from power plants in the manufacturing industry ("autoproducers"), which are covered in the sector industry. Stationary installations included in the national allocation plan for the period 2008 - 2012 were responsible for more than 85 % of the emissions in the subsector energy supply.

CO_2 emissions from this subsector in Austria show a relatively stable trend since 1990, although with high annual fluctuations related to hydro power production. The European Emission Trading Scheme (EU ETS) is the central policy for GHG mitigation in this subsector. Other important (and to some extent overlapping) measures are the promotion of the use of renewable energies and the increase of energy efficiency by various policy instruments.

The most important driving force for the activities in this subsector is electricity consumption with an increase of almost 45 % between 1990 and 2011 (Source: Umweltbundesamt, 2013c). The CO_2 emissions from energy supply depend considerably on annual climatic conditions. The amount and the share of electricity production from renewable hydropower vary annually with respective impacts on emissions from caloric electricity generation. In 2011, 62.9 % of public electricity was produced by hydropower, whereas electricity production from fossil fuels made up 28.7 % and wind power contributed about 3.7 % to electricity production (see Figure 4.2).

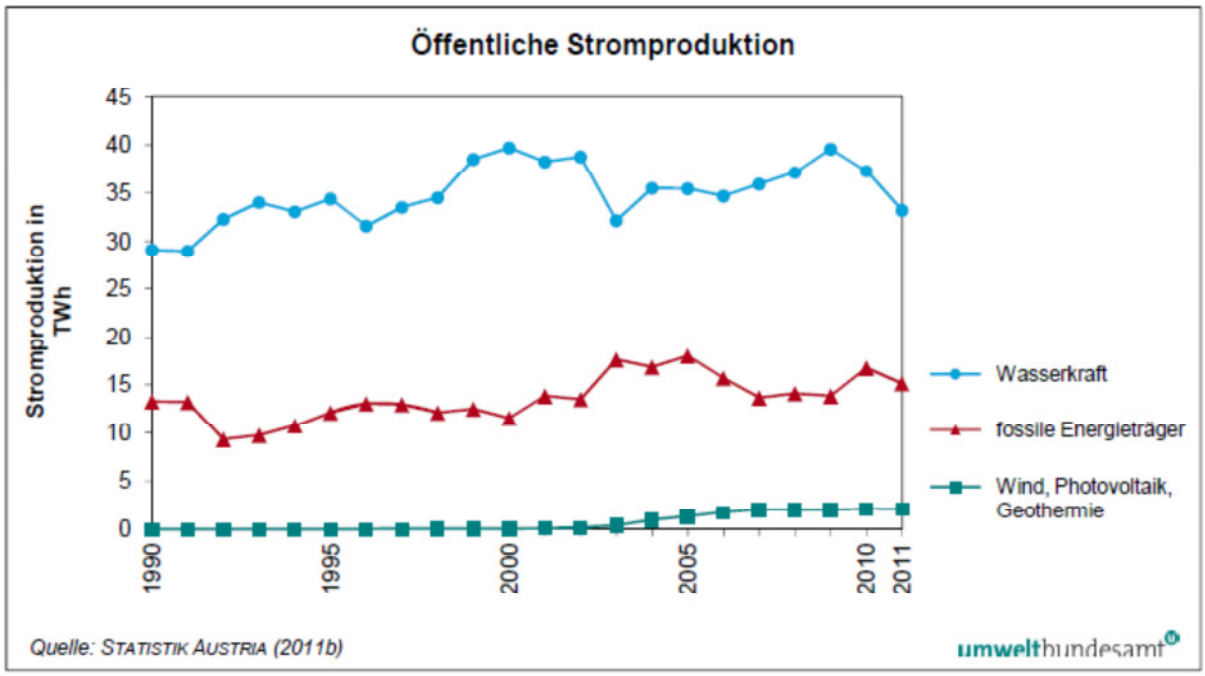

Figure 4.2: Public electricity production, 1990-2011 (Source: Umweltbundesamt, 2013c)

CO_2 emissions from district heating also depend on annual climatic conditions and correspond to temperature-induced heating energy demand during the winter season. The use of biomass in regional district heating systems has already gained a considerable share in Austria. In 1990 renewables (mainly biomass, including the biogenic content share of waste) contributed only 8 % to heat production in district heating systems. This share increased to remarkable 47 % in 2011. This is to a large

extent due to existing public support schemes, granted both by the federal government and the *Länder*, and in many cases co-funded by the European Union.

M5. Green Electricity Act

The Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources was implemented in Austria with the Green Electricity Act, which entered into force in July 2012. The legal instrument does not only address the main issues raised by the Directive, but also incorporates the system for promoting electricity production from renewable energy sources by granting fixed feed-in tariffs for various forms of biomass transformation and power production by wind, water, geothermal energy and photovoltaic.

The Green Electricity Act from 2012 set the following targets for additional electricity production from supported renewables for the year 2020 (compared to 2010):

- Hydropower: 1 000 MW
- Windpower: 2 000 MW
- Biomass and Biogas: 200 MW
- Photovoltaics: 1 200 MW

At this point of time it is expected that this targets can be met. The prior Green Electricity Act set targets for additional electricity production from supported renewables for the year 2015 (compared to 2010). These targets were:

- Hydropower: 700 MW
- Windpower: 700 MW
- Biomass and Biogas: 100 MW
- Photovoltaics: 500 MW

The former law also included the target to reach a share of 15 % of electricity from supported renewables in 2015, based on final electricity consumption. Depending on the final electricity consumption it is expected that around 17 % to 18 % of the final electricity consumption will be provided by supported renewable energy sources.

The financial incentive (average market price deducted) was € 350 million in 2010 and € 308 million in 2011. Under the new law, additional € 50 million were distributed over various technologies for 2012. In addition to feed-in-tariffs, investment grants for small and medium hydropower are provided via the law. For Photovoltaics, investment grants are provided via the Climate and Energy Fund (see above) and/or local authorities.

The feed-in-tariffs are set by the Federal Ministry of Economy, Family and Youth in cooperation with the BMLFUW and the Federal Ministry of Labour, Social Affairs and Consumer Protection. The tariffs can be set for two or more years and are being published by the Federal Ministry of Economy, Family and Youth.

Table 4.2: Supported green electricity 2002-2012

Supported Green Electricity [in GWh]											
Energy source	***2002***	***2003***	***2004***	***2005***	***2006***	***2007***	***2008***	***2009***	***2010***	***2011***	***2012***
Wind	203	366	924	1.328	1.738	2.019	1.988	1.915	2.019	1.883	2.386
Biomass solid	95	99	313	553	1.086	1.631	1.900	1.958	1.987	1.969	1.983
Biogas	20	42	102	220	358	440	503	525	539	520	554
Biomass liquid	3	2	18	33	54	71	36	39	30	12	0
Photovoltaic	3	11	12	13	13	15	17	21	26	39	101
Other	88	78	76	65	55	54	52	46	45	41	32
Total (without hydro)	**412**	**598**	**1.445**	**2.212**	**3.304**	**4.230**	**4.496**	**4.503**	**4.647**	**4.464**	**5.057**
Small hydro	4.243	3.386	3.995	3.561	1.806	1.527	945	644	1.258	988	1.095
Total (including hydro)	**4.655**	**3.984**	**5.440**	**5.773**	**5.110**	**5.757**	**5.441**	**5.147**	**5.905**	**5.452**	**6.152**

M6. District Heating from Renewables

The Federal Environmental Support Scheme supported entrepreneurial projects in 2012 with a total budget of around € 78 million, of which € 35.8 million were spent for heating and cooling from renewable energy sources (without electricity production from RES and manufacturing of bio-fuels). The fund focuses on biomass and biogas district heating, entrepreneurial biogas development (e.g. in agriculture), biomass central heating systems, solar panels and energy efficiency measures. The major share of finance (2012: € 33 million) is dedicated to biomass heating and district heating systems. Furthermore, in order to achieve high efficient projects, district heating systems, applying for investment aid have to run through a quality management system. In financial terms the district heating systems are co-financed by the regions and often also by the European structural funds.

Information as regards the Domestic Environment Support Scheme (BGBl. Nr.185/1993 as amended) is also provided under “Cross-cutting Policies and Measures”.

4.3.2.2 Buildings (Energy Demand)

Source Categories of the Common Reporting Format affected: 1.A.4. (other sectors)
GHG affected: CO_2 (almost exclusively), CH_4, N_2O

The subsector buildings (residential and commercial) mainly represents emissions from individual heating and hot water preparation in buildings (dwellings, commercial and public services), being responsible for around 90 % of total emissions covered under ‘other sectors’ (1.A.4). Other sources of 1.A.4. (agriculture, forestry, fischery) are dealt with in section 4.3.7 (Agriculture).

Direct emissions from buildings have been lower by almost 25 % in 2011 compared to 1990. Climate adjusted data (with balance for heating degree days) show quite stable emissions over the period between 1990 and 2003 and a considerable decrease since 2004, even though the number of dwellings increased substantially by 24 % between 1990 and 2011, mainly due to population growth and a trend to single households. Consequently, the average number of persons per dwelling went

down while average dwelling area increased by 10 % since 1990. Total net dwelling area increased by 37 %. Also trade and public service sectors showed a significant rise in demand for building net area.

The decreasing trend in GHG emissions from direct heating activities in buildings can be largely attributed to policies and measures, but there are also other factors influencing the development of emissions such as mild winters (e.g. in 2007, 2008, 2011) or disproportionately low heating oil sales caused by fuel price fluctuations and purchase and investment decisions taken by consumers.

Policies and measures relating to this subsector generally aim at reducing the energy consumption by improving energy efficiency in space heating, hot water preparation and electricity demand and by use of energy sources that are less carbon-intensive or even carbon-neutral. Hence, the strategy to reduce GHG emissions is based on the following pillars:

- Thermal improvement of existing building stock
- Enhanced technical standards for new buildings
- Increasing share of renewable energy sources such as biomass and solar or ambient heat
- Increased use of district heating
- Increasing boiler efficiency
- Switching to fuels with lower (fossil) carbon content
- Raising consumer awareness

M7. Improved building standards

The 2002 Directive on Energy Performance of Buildings was amended in 2010 (2010/31/EC) and had to be implemented by Member States in national law by 2013. The methodological basis for calculating the energy performance and the energy performance certificate, as requested under the EU Directive, are regulated in the national guideline 'Energieeinsparung und Wärmeschutz' of the Austrian Institute for Construction Technique (OIB RL 6). The implementation of the energy performance certificate is regulated in a federal law with respect to private law aspects ('Energieausweis-Vorlagegesetz') and in Technical Construction Regulations of the *Länder* with respect to technical issues, following the guidelines of OIB RL 6. The use of the energy certificate for purposes of the real estate market is compulsory since 2013 in order to provide transparency for the consumers on energy performance of buildings and flats offered on the market.

The amended 2010 Directive formulates a clear target to develop "nearly zero energy standards" for new buildings, effective by end of 2020. Remaining energy demand shall be largely covered with renewable energy sources. Ambitious efficiency standards shall also apply for existing buildings that undergo substantial renovation.

Provinces are responsible in Austria for building standards and therefore established a process for implementation of the Directive in technical terms. By early 2013, the provinces, in a coordinated manner, submitted a "National Plan" in accordance with the Directive to the European Commission, which constitutes the new step-wise approach to high efficiency standards for residential buildings, both for new

construction and renovation. The second part of the plan comprising standards for service buildings (public & commercial) was still pending by end of 2013.

M8. Financial Support for climate-friendly construction and renovation

Specific schemes can give relevant incentives for more sophisticated energy solutions, optimised thermal insulation or even 'zero-energy-houses' by shifting and fine tuning of housing subsidies. The relevant policy instruments and programmes are: the Housing Support Scheme of the Länder and the Renovation Cheque of the federal government as well as the ministerial programme klima:aktiv (BMLFUW).

With regard to the Housing Support Schemes, an agreement according to Article 15a of the Federal Constitution Act between the *Länder* and the Federation came into effect in 2006 (BGBl. II Nr. 19/2006) and provided for further improved standards as a prerequisite for receiving subsidies and for a shift of subsidies in favour of the thermal renovation of existing dwellings. The agreement also stipulates that only certain heating systems (mainly based on renewables) shall be eligible for financing under the housing support schemes. The installation of oil heating systems, as well as gas-fired systems without solar combination, does not qualify for any financial assistance. The agreement between Federation and *Länder* has been amended 2009 (BGBl. II Nr. 251/2009), according to technical improvements, and further measures have been included with respect to public buildings.

Based on the agreement, a common reporting format, including performance indicators in terms of CO_2 emission reductions and associated costs, has been implemented. The annual reports by the *Länder* show remarkable GHG reductions of several hundred thousand tonnes per year, resulting from measures taken in the framework of the agreements. Those reductions also match well with GHG emissions trends in the residential buildings sub-sector, derived from Austria's annual GHG Inventory Reports. A detailed description of the Housing Support Scheme has already been given in the 4th and 5th National Communications.

M9. Renovation Cheque

Housing Support Schemes of the *Länder* are supplemented by the *Renovation Cheque* of the federal government for private dwellings and service buildings. It was initiated in 2009 as part of a package to stimulate the economy after the financial crisis ("Konjunkturpaket") and proved to be well accepted and efficient. It was therefore extended until 2016. The feral government also supports private households' investments in new heating systems based on renewable energy sources (biomass, solar) as a separate programme under the Climate and Energy Fund (see cross-sectoral measures).

4.3.3 Transport

Source Categories of the Common Reporting Format affected: 1.A.3 (transport)
GHG affected: CO_2, N_2O

The sector transport comprises emissions from road, rail, inland waterways, national aviation, emissions from pipeline compressors and emissions from military machines.

CO_2 emissions from transport have grown from 1990 to 2012 by 55 %. The major source of GHG emissions in this sector is road transport. In 2012, road transport was responsible for around 96 % of total transport emissions. 54 % of road transport emissions stem from passenger transport and 42 % from freight transport. Emissions trends in the transport sector depend on a variety of driving forces, among them increasing passenger transport, showing an increase from 80 billion passenger kilometres (pkm) in 1990 to 105 billion in 2012, and increasing freight transport with a rise from 32 billion tonne kilometres (tkm) in 1990 to 128 billion in 2012. These figures are based on fuel sold in Austria for the entire transport sector; inland transport has increased at a considerable lower rate, e.g. inland freight transport increased to 60 billion tkm in 2012 (see Section 2.7). Important routes for long-distance freight transport cross Austria and the integration of eastern neighbouring states to the European economic area has led to additional transport demand especially on in- and outbound routes as well as transit routes. Also of particular importance for the extraordinary growth in the transport sector is 'price-related fuel export in the vehicle tank'[3], which is particularly due to the somewhat lower fuel prices in Austria in comparison to the neighbouring countries (primarily Germany and Italy), but also caused by Austria's specific geographical location and other structural economic circumstances (i.e. relatively high export share of manufacturing industry). About two thirds of fuel export is caused by freight transport. CO_2 emissions from fuel sold in Austria but used outside the country, both by lorries and by private cars, accounted for 5.9 Tg CO_2 equivalents in 2011.[4] Hence, 27 % of the total emissions in the sector transport can be attributed to 'fuel export in vehicle tank'.

Other factors influencing the emission trend are economic development, changing living patterns, and technical progress, e.g. energy efficiency improvements. It should be noted that increased car use – together with the trend to purchase fuel intensive cars (such as SUVs) – and the decreasing occupancy rate jeopardise the improvements in vehicle efficiency. An important step to counteract the current CO_2-emissions trend was taken by the enhanced introduction and use of biofuels (Umweltbundesamt 2009c).

Policies and measures to mitigate environmental impacts of the transport sector are mainly focusing on road transport, as this mode contributes the major part of pollutant and CO2 emissions. Therefore, it is very important to identify and assess the key influencing drivers in the sector, which leads to the following key areas of action:

[3] also termed as so called ‚fuel tourism'

[4] According to the IPCC reporting guidelines, emissions from transport fuel sold within Austria need to be captured by the national inventory on greenhouse gas emissions.

- decreasing transport volume on road transport both for passenger and freight transport;
- enhancing use of alternative vehicles and fuels;
- improving energy and fuel efficiency of vehicles.
- reducing share of 'fuel export in the vehicle tank';

Policies and measures in the transport sector aim to stabilise and to reverse the emission trend of the past by introducing a mix of different instruments, such as regulatory, fiscal and awareness raising instruments, under participation of all levels of policy-making (Federal Level, *Länder*, municipalities).

M10. Fuel consumption based taxation ('Normverbrauchsabgabe' - NoVA)

This measure has already been described in previous National Communications. Information below is giving an update on new developments on this important tax.

Passenger car registration tax in Austria is based on standard fuel consumption of passenger cars, providing a clear incentive to buy energy efficient vehicles. The tax has been adjusted at several occasions in past years. The actual tax rates range from zero to 16 %, based on the net selling price of new cars. A zero rate applies to cars with a standard fuel consumption of less than three litres of petrol or less than two litres of diesel. Cars consuming at least 11 litres of petrol or at least 10 litres of diesel are subject to the 16 % rate. In addition, a bonus/malus system has been implemented as of July 2008. On the one hand, all passenger cars that meet already the requirements under EURO 6 standards for NOx emissions get a bonus of € 200. In addition, if the CO_2 emissions of the new cars are less than 120 g/km, an additional bonus of € 300 is granted. On the other hand, a penalty (malus) of 25 €/g CO_2 is due for cars that emit more than 180 g/km. This threshold was lowered to 160 g/km in January 2010 and to 150 g/km by January 2013. A bonus of € 500 is also granted for hybrid-vehicles and cars using fuels like natural gas, biogas, biodiesel, ethanol or hydrogen. The incentives have produced significant results insofar as the share of alternative and low-carbon vehicles has increased up to 40 % of all new cars in 2013, while only 10% of the newly registered cars have CO_2 emissions above the threshold.
The highly energy and fuel efficient electric cars are exempt from fuel consumption based tax and from the annual vehicle registration tax with a view to stepped-up market penetration of these vehicles.

M11. Implementation of the renewable energy targets for transport in Austria

According to Directive 2003/30/EC minimum shares for transport fuels from renewable energy sources shall be implemented by Member States. In 2004, the Biofuel Directive was transposed into Austrian national law with an amendment (BGBl. II Nr. 417/2004) to the Fuel Ordinance. This amendment stipulates that all companies that put fuels on the market must, from 1 October 2005, replace 2.5 % of the total energy quantity by biofuels. From 2007, this percentage was increased to 4.3 %, and since October 2008 to 5.75 %. Together with the amendment to the Fuel Ordinance, the Mineral Oil Tax has been revised. Accordingly, tax concessions will

be granted for petrol with a biofuel share of at least 4.6 % and for diesel with a biofuel share of at least 6.6 % (both with a sulphur content of less than 10 mg per kg of fuel). The use of pure biofuels as motor fuel is exempt from tax.

In 2012, about 500 000 tons of biodiesel, 106 000 tons of bioethanol, and 17 000 tons of straight vegetable oil (SVO) were distributed within the Austrian territory. Thus, the share of renewable energy used within the transport sector attained a level of 6.77 % (measured by the energy content). Biodiesel, bioethanol and SVO represent the set of renewable energy fuels which were mainly distributed by blending them with fossil petrol to an extent of 5 % and fossil diesel to an extent of 7 % (measured by volume). All together, the use of biofuels in Austria resulted in GHG emissions savings of 1.7 Tg CO_2 equivalent in 2012.

M12. Action programme *klima:aktiv mobil*

The programme *klima:aktiv mobil* has been launched by the Federal Ministry of Agriculture, Forestry, Environment and Water Management to promote climate and environmentally friendly mobility, particulary mobility management, alternative fuels and vehicles, e-mobility, eco-driving, cycling and demand-oriented public transport. *klima:aktiv mobil* offers companies, property developers and fleet operators, cities, municipalities and regions, the tourism and leisure sector, youth groups and schools technical advice and financial support for the development and implementation of GHG mitigation measures in transport. The *klima:aktiv mobil* funding programme for projects involving capital expenditure – which is also supported by the *Climate and Energy Fund* (see cross-cutting PaMs)– is the central pillar of *klima:aktiv mobil* activities.

The *klima:aktiv mobil* programme achieved impressive results during its first programme period (until 2012):

- More than 4 000 projects – initiated by 2 800 companies, 500 cities, municipalities and regions, 500 tourism organisations and 200 schools – are avoiding around 540 000 tons of CO_2 per year.
- € 56 million of public funding spent for environmentally friendly mobility projects induce investments of € 412 million thus securing and creating 4 600 green jobs.
- 12 400 alternative vehicles for fleets of companies and municipalities were financially supported, including 10 900 e-vehicles as well as 1 700 charging stations.
- 112 bicycle projects, including bicycle infrastructure, logistics and awareness, were funded, including the expansion of the bicycle infrastructure in all nine Austrian Federal States and major cities.
- 1 000 driving trainers were upgraded to certified eco-driving trainers

Based on the positive results of the first programme period, the *klima:aktiv mobil* programme has been extended until 2020.

M13. Enhanced fuel efficiency of cars

On 23rd April 2009 a new EU regulation (No. 443/2009) on CO_2 emission values of passenger cars entered into force. By 2015, passenger cars newly registered in the

EU may not exceed average CO_2 values of 130 g/km (responsibility per fleet of car manufacturer). The regulation will significantly reduce specific CO_2 emissions per kilometre by 2015 and the value of the EU new car fleet average will be 20% lower compared to 162 g/km in 2009 prior to the regulation. Furthermore, the regulation sets a CO_2 limit value for the car fleet in 2020 of 95 g/km that is most likely to be met by introducing hybrid technology and electric vehicles.

In 2011 the EU adopted regulation No. 510/2011, aiming at reducing CO_2 emissions from light commercial vehicles by setting a limit value of 175 g/km to be met by 2017 and of 147 g/km by 2020.

It is expected that these combined measures will result in GHG reductions in Austria of around 1.7 Tg annually by 2020.

M14. National plan on electric mobility

In July 2012 the Federal Government adopted the "National Implementation Plan on Electric Mobility in and from Austria" developed by the high-level steering group involving three Federal Ministries – the Ministries of Economy, Environment and Transport – and more than 200 experts. It was developed to support the implementation of the goals and strategies of the National Energy Strategy 2010, the Climate Strategy 2007 and the EU´s 10% target for renewable energy in the transport sector by 2020. It includes 65 measures to be implemented in the short-term in order to foster market penetration of these highly fuel- and energy-efficient vehicles. The overall objective is that 250 000 electric vehicles (BEV, PHEV, REX) will be on the roads in Austria by 2020 resulting in CO_2 emission reductions of 430 000 tonnes annually from road transport. It will also foster the use of renewable energy and "green" electricity in transport.

4.3.4 Waste management

Source Categories of the Common Reporting Format affected: 6.
GHG affected: CH_4, CO_2 and N_2O

In the sector waste management mainly CH_4 emissions from solid waste disposal on land (6.A), but also CO_2 and N_2O and CH_4 emissions from wastewater handling (6.B), compost production and waste treatment (mechanical, biological, physical) (6.D), as well as waste incineration (without energy generation) (6.C) are considered. Waste incineration with energy generation is covered in the subsector energy supply.

In 1990, GHG emissions from waste management sources in Austria amounted to 3.6 Tg CO_2 equivalents. In 2011, emissions amounted to 1.7 Tg CO_2 equivalents and the trend analysis projects a further significant reduction (emissions decrease to 1.4 Tg CO_2 equivalents in 2015 and to 1.1 Tg in 2020). Emissions occurring from solid waste disposal on land are responsible for about 73 % of total emissions in this sector and were considerably reduced in recent years. By 2011, methane emissions from landfills decreased to a value of 38 % compared to 1990. Although N_2O emissions from waste water handling are expected to increase in future years, this

will not change the declining trend according to latest emission scenarios. The share of emissions from compost production and waste incineration (without energy generation) is minor.

All measures in this sector aim at reducing the GHG emissions from landfills. Methane emissions from landfills are a consequence of Total Organic Carbon (TOC) of waste disposed on landfills. Therefore, the reduction of total organic compounds and the minimisation of the total volume of landfills are crucial elements when deciding on appropriate policy actions. Consequently, policies and measures follow as leading principles:

- prevention of waste
- ban on landfilling of untreated solid waste
- waste recovery (recycling and incineration with energy recovery)
- remediation of former uncontrolled landfill sites

These principles are fully in line with the Austrian Waste Management Act (AWG 2002, BGBl. I Nr. 102/2002 as amended) as well as with the Landfill Ordinance (see below) and the Remediation of Contaminated Sites Act (BGBl. Nr. 299/1989, as amended). Other programmes to launch waste prevention and recovery have been described in previous National Communication.

The following PaMs are included in the 'with measures' scenario in the projections chapter of this report. The single measures implemented could not be quantified. Nevertheless, the progress between 1990 and 2011 can be made visible by comparing annually deposited biodegradable waste and CH_4 emission values (Figure 4.3).

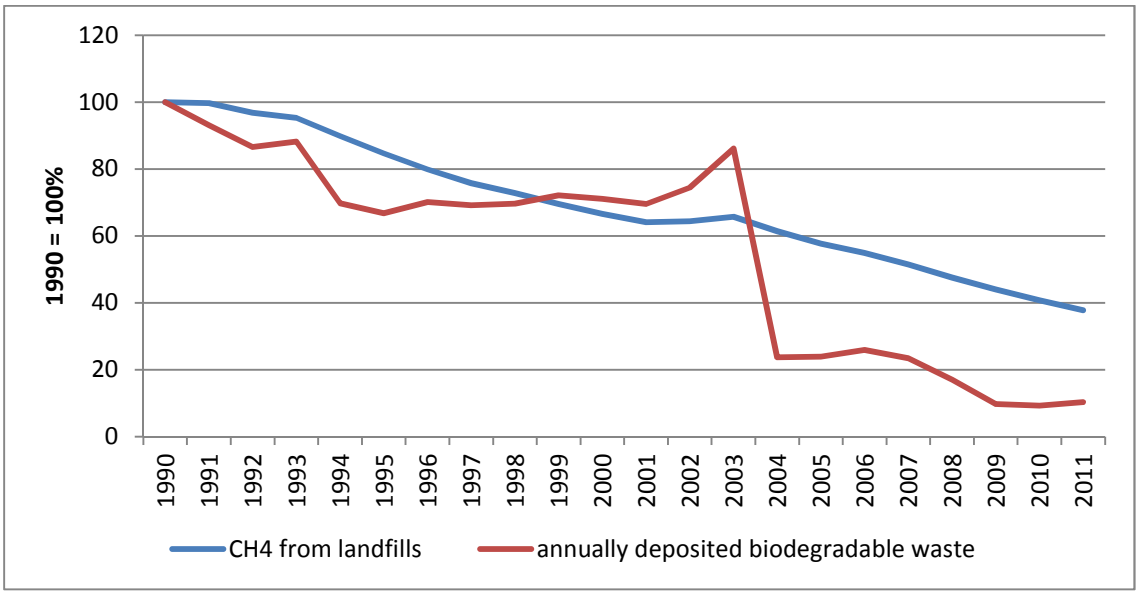

Figure 4.3: Methane emissions from landfills and annually deposited biodegradable waste. PLEASE NOTE that the amount of biodegradable waste in this figure is a theoretical value achieved by factors applied to certain waste codes. All measures to ban landfilling of biodegradable waste have been fully implemented since 2009.

M15. Landfill Ordinance (deposition of untreated biodegradable waste)

The Austrian Landfill Ordinance (BGBl. Nr. 164/1996) according to the Austrian Waste Management Act (BGBl. I Nr. 102/2002 as amended) was fully implemented until end of 2008. A detailed description of the content of the Austrian Waste Management Act ('Abfallwirtschaftsgesetz') and the Landfill Ordinance was outlined in the 4th National Communication.

According to this Ordinance the deposition of untreated biodegradable waste is banned since 2004, with the possibility to grant an extension until 2008 for *Länder* that did not have appropriate alternatives (mainly incineration plants) in place. As a consequence, methane emissions from landfills have decreased constantly. All measures have been fully implemented in a manner that no more biodegradable waste has been deposited since 2009. Waste is predominantly incinerated and to a small extent mechanically-biologically treated. Although there is some residual TOC in certain waste streams which contributes to the theoretical value of 10% in Figure 4.3 as shown above, there is no evidence that this causes a relevant methane production under landfill conditions.

M16. Landfill Ordinance (collection and drainage of landfill gas)

A second important measure to reduce greenhouse gas emissions from landfills is the mandatory collection and drainage of landfill gas originating from landfills according to § 31 of the Austrian Landfill Ordinance 2008 (BGBl. II Nr. 39/2008 as amended). This measure has been mandatory for new landfills since 01.01.1997 and for existing landfills with a transition period until 01.01.2004. Present gas formation is caused by the former deposition of untreated biodegradable wastes until end of the year 2008. The landfill gas has to be used or subjected to treatment (a detailed description of the content of Austrian Waste Management Act and the Landfill Ordinance was outlined in the 4th National Communication).

M17. Remediation of Contaminated Sites Act

The Remediation of Contaminated Sites Act (ALSAG – BGBl. Nr. 299/1989, as amended) contributes to a considerable reduction of greenhouse gas emissions from former landfills and waste dumps.
Uncontrolled historic landfills from the 1960's till the late 1980's have been a source of methane emission. In that time, waste management regulations have not met the high environmental standards of today. In a period of 15 to 20 years, one ton of municipal waste generates approximately 100 to 200 m^3 landfill gas with 55 – 60 Vol.% methane.

Due to ALSAG, the methane emissions from uncontrolled historic landfills and waste dumps have been continuously reduced since 1990. ALSAG enables the realization of remediation activities such as landfill mining, methane-oxidation-covers and other innovative technologies. All these measures contributed to an annual reduction of approximately 0.3% of the overall GHG-balance in Austria (Source: Altlastensanierung in Österreich - Effekte und Ausblick, BMLFUW 2007).

4.3.5. Industry

Source Categories of the Common Reporting Format affected[5]: 1.A.2. (manufacturing industries and construction), 2 (industrial processes)
GHG affected: CO_2, N_2O

This sector covers emissions from combustion and industrial processes from manufacturing industries and construction. F-gas emissions are examined separately as a subsector of the sector industry. The plants included in the national allocation plan for the period 2008-2012 were responsible for around 78 % of the emissions in this sector in 2011. From 2013 this share will increase to well above 80 % due to the extension of the ETS scope for the trading period 2013-2020 (inclusion of, e.g., chemical industry, aluminium production, gypsum).

Industry emissions increased since 1990 due to considerable production growth of certain energy intensive activities. The economic downturn in 2009 resulted in a decline of emissions. CO_2 emissions in 2011 still were well below pre-crisis levels. Policies and measures for the manufacturing industry aim at decoupling emissions from production. To this end, activities need to provide for:

- improvements in final energy efficiency, and
- fuel shift from coal to gas or renewable sources.

In Austria's iron ore and steel sector, which is responsible for about 47 % of industry's CO_2 emissions (energy and process related, 2011), production of steel (in tons) increased by 73 % between 1990 and 2011. In the same period, CO_2 emissions went up 36 %, which shows a relevant decrease in energy intensity of the sector. In all other industry sectors (dominated by pulp and paper, minerals, chemicals, machinery, food, construction) the value added of production increased by 50% since 1990, while GHG emissions showed an upwards trend of only 3 % (2011). The main drivers for this trend were a shift in energy use from coal (-30 %) and fossil liquids (-17 %) to natural gas (+46 %) and biomass (+132 %), as well as a structural changes in mineral and chemical industries (Source: Umweltbundesamt, 2013c).

A mix of promotional and economic instruments is envisaged in order to make sure that industry is able to cut emissions in a cost-effective way. The main instruments are the EU Emissions Trading Scheme (ETS) and financial incentives of the Environmental Support Scheme for installations in subsectors not included in ETS. Both instruments are described under "cross-cutting policies and measures".

[5] Emissions from solvents and other product use are also considered in the sector industry. There are some enforced laws and regulations concerning the sector solvents and other product use (CRF 3) as can be seen in the PaM summary table (Annex 1) and in the chapter on projections. A detailed textual description is not provided here as (i) solvents are one of the minor sources with less than 1 % of total GHG emissions in Austria and (ii) there is no target set for this sector in the national climate strategy.

4.3.6. Fluorinated Gases

Source Categories of the Common Reporting Format affected: 2.F (consumption of halocarbons and sulphur hexafluoride), 2.E (production of halocarbons and SF_6), 2.C (metal production)
GHG affected: HFC, PFC, SF_6

Lacking any primary aluminium production in Austria, there are neither PFC emissions from CRF sector 2.C.3 nor SF_6 used in aluminium and magnesium foundries (2.C.4). Production of halocarbons and SF_6 (2.E) is also not taking place in Austria, but those gases are being used for a wide range of applications and are considered in this subsector. Among the applications is the use of HFC and PFC as refrigerants in refrigeration and air conditioning systems (2.F.1), the use of HFC as blowing agents in the production of foams (2.F.2), the use of HFC and PFC as fire extinguishing agents (2.F.3), the use of HFC as propellants in aerosols (2.F.4), the use of HFC as solvents (2.F.5), the use of HFC, PFC and SF_6 as etching gases in semi-conductor manufacturing (2.F.7), the use of SF_6 as insulating gas in electrical equipment (2.F.8), and other uses of SF_6 (2.F.9) in soundproof windows, tyres and research.

Emissions of fluorinated gases showed an uneven trend during the past decade. Although fluorinated gases are not used in large amounts (1–1.8 kt per year) they contribute approximately 1.5 % of the total GHG emissions due to their high GWPs. Implemented and adopted policies and measures have prevented a strong increase of emissions, as predicted in previous business-as-usual scenarios (NC3). Nevertheless, the emissions of the subsector fluorinated gases (sector industry without manufacturing industry and construction) are expected to slightly increase in future years due to the forecast of SF_6 emissions from the disposal of sound-proof windows as outlined in the projections chapter.

M18. Regulatory measures to ban F-Gases

The Austrian Ordinance on fluorinated gases, based on the Chemicals Act (BGBl. I Nr. 53/1997, as amended), was adopted in 2002 (BGBl. II Nr. 447/2002) and amended in 2007 (BGBl. II Nr. 139/2007). A description of the Austrian Ordinance has been provided in the NC4. On European level the European Parliament and the Council of the European Union adopted the Regulation on certain fluorinated greenhouse gases (842/2006/EC) and the Directive relating to emissions from air-conditioning systems in motor vehicles (2006/40/EC).

M19. New EU regulation to phase-out F-Gases

In order to reduce the emissions of fluorinated greenhouse gases considerably until the year 2030, the European Commission proposed a revised F-gas regulation in November 2012, which is expected to enter into force in the first half of 2014. This regulation will introduce a quota system for HFCs and several more stringent measures, compared to Regulation 842/2006. The proposal by the EU Parliament to introduce fees for quota allocated to EU-producers and EU-importers of F-gases is supported by Austria. In addition, Austria supports the introduction of bans on F-

gases in foams and aerosols (two sectors already covered by national higher standards) in the framework of this Regulation.

Further incentives

In applications not completely covered by the Austrian and EC legislation, the Federation and the *Länder* are capable to refrain from the use of products equipped with fluorinated gases within public procurement guidelines, either for deliveries (e.g. cooling equipment) or construction services. There are also financial incentives to the market for 'phase-out' of F-gases, e.g. in the framework of Housing Support Schemes of the Länder (residential buildings sector) or the Environmental Support Scheme.

4.3.7 Agriculture

Source Categories of the Common Reporting Format affected: 4 (Agriculture)
GHG affected: CH_4, N_2O, (CO_2: indirect effect on energy demand)

Agricultural production primarily contributes to climate change with its CH_4 and N_2O emissions. Austrian greenhouse gas emissions from agricultural activities show a decreasing trend of 11.5 % from 1990 until 2011. The main driving forces behind the decreasing trend were the steady decline of the number of animals (particularly cows) and the considerably reduced manure disposal. Due to the EU Rural Development Programme (RDP) and its included agri-environmental programme, the use of mineral fertilizer declined considerably. The amount of mineral fertilizer sold shows some fluctuation from 2007 onwards. Another aspect strengthening the recent developments is the increased demand for biomass, e.g. for production of biofuels.

The main objective of Austrian agricultural policy is a high quality food supply by way of a sustainable and country-wide agriculture. The future challenge for agricultural policy is to increase the tightly focused promotion of the manifold services that agriculture provides in order to achieve environmental objectives. The aim is also to optimize the use of the common strategic framework of different EU funds in order to define development objectives which go beyond sectoral boundaries and to integrate the multi-functional structure of the rural region. The agri-environmental programme's high level of acceptance has been strengthened and organic farming further developed as a model for eco-friendly agriculture.

In summary, implemented and adopted measures are expected to contribute to a slightly decreasing trend in the longer-term, compared to the year 2011. Main drivers are the declining trend in N_2O emissions from manure management and – to a lesser extent – from agricultural soils.

M20. Organic farming and environmentally sound farming

Austrian farmers managed to maintain the high quality of their products (food & feed), while today´s agriculture at the same time is challenged to minimise negative impacts on the environment and be as compatible as feasible with other social and economic demands. This is reflected, inter alia, in a high share of organic farming in Austria. In 2010, almost 21 000 farmers in Austria, who manage 19.7 % of total agricultural land, fulfilled the ambitious EU requirements for organic farming (EU-27 average 2010: 5.7 % of agricultural land).

An environmentally friendly agricultural production must cope with a record of low greenhouse gas emissions, also beyond organic farming in a narrow sense. A lot of measures within the Austrian Programme for Environmentally sound Farming (ÖPUL) directly or indirectly contribute to GHG emissions reduction, e.g. manure management and reduced use of mineral fertilisers, mulching and direct sowing, nitrogen management by, i.a., plantation of legumes, coverage of manure storage-sites, etc. According to latest statistical data (2011), more than 110 000 farmers in Austria (managing 89 % of agricultural land) participated in the ÖPUL programme, which is now under revision to cope with the EU's Common Agriculture Policy for the period 2014-2020 (see below).

M21. Common Agricultural Policy (CAP)

Most of the policies and measures in the sector agriculture are strongly interconnected. A core feature in this policy sector is the EU´s Common Agriculture Policy (CAP). A brief description of the CAP, together with the climate change related impacts in Austria, was given in previous National Communications. The latest CAP reform for the period 2014-2020 was adopted at European level by the European Parliament and the Council in the second half of 2013 and is currently being prepared for implementation in Austria in the first half of 2014.

M22. Agricultural raw materials for biofuels

According to the ongoing EU climate and energy policy, each Member State is obliged to achieve a transport target of 10% substitution of non-renewable energy sources by renewables in 2020 at the latest. Agricultural raw materials constitute a major alternative source.
Several EU pieces of legislation (mainly Directives 2009/28/EC and 2009/30/EC on the promotion of the use of energy from renewable sources) and corresponding national acts (Ordinance concerning Agricultural Raw Material for Biofuels and Bioliquids, BGBl. II Nr. 250/2010 together with Fuel Ordinance 2012, BGBl. II Nr. 398/2012) are of interest in this regard. A central element of both Directives is the obligation to apply sustainability criteria with respect to biofuels and their raw materials.

4.3.8 Land use, Land-Use Change and Forestry

Source Categories of the Common Reporting Format affected: 5 (Land-Use Change and Forestry)
GHG affected: CO_2

Nature conservation has a long tradition in Austria. Management is characterised by a long-term forestry policy that takes issues of biodiversity conservation into account. The principle of sustainable management of forests is laid down in § 1 of the Austrian Forest Act, the need for re-afforestation in § 13. The Austrian Forest Act also puts a ban on deforestation (§ 17). Laws on nature conservation and landscape protection and on national parks have been enacted at *Länder* level. Forest biodiversity is also supported by the Natural Forest Reserves Programme.

In order to balance the various interests in forest utilisation and to assure the many benefits of the Austrian forest in the long term, the Federal Minister of Agriculture, Forestry, Environment and Water Management initiated the Austrian Forest Dialogue. It is a structured participative, transparent and on-going public dialogue on the forests. As an important result of the Austrian Forest Dialogue, the Austrian Forest Programme identifies all the fundamental issues, targets and actions for the Austrian forest for the future. It contains specific political proposals for action with regard to all the major forest issues, with the aim of assuring and continuously optimising sustainable management, preservation and development of the Austrian forests. The programme's fields of action include inter alia "Contribution of Austrian Forests to Climate Protection", "Biological Diversity in Austrian Forests" and "Austria's International Responsibility for Sustainable Forest Management".

Forestry already plays a key role in the Austrian Climate policy, following the recommendations of the IPCC, which states that a sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks, while producing an annual yield of timber, fibre or energy from forest, will generate the largest sustained mitigation benefit.

Hence, Austria has a leading position in the use of biomass for energy purposes, with several policies and measures, such as the Domestic Environmental support scheme, the Austrian Climate and Energy Fund (KLI.EN), the ministerial programme klima:aktiv (BMLFUW), the Support Scheme of regional authorities ('Wohnbauförderung' – WBF), the Green Electricity Act and the promotion of combined heat and power directed to further increase the share of renewables, in particular woody biomass in the energy system. Those policies and measures are described in detail in the respective chapters of this communication.

In 2010 renewables contributed more than 30% to the gross domestic energy consumption in Austria (Statistik Austria, 2011), with approx. 40% originating from woody biomass. The demand for woody biomass has increased by around 5% annually between 2005 and 2012. According to the WEM and WAM scenarios the total domestic consumption of woody biomass will be around 190 PJ in 2020, resulting in a total biomass demand for energy purposes of around 24 Mio m^3. However, sustainable production of biomass represents only one of the diverse

functions of Austrian forestry, which contribute to climate change mitigation and adaptation.

M23. Maintenance and extension of vital forests

It has been a guiding principle of Austrian forest management policy for more than 100 years to use forests in an economically sustainable manner, balancing the relevant ecological, economic and social functions. Austria is one of the most densely wooded countries in Central Europe with forests covering more than 47 % of the federal territory, which is almost two thirds higher than the European average. According to the Austrian Forest Inventory 2007/2009 (AFI 2007/2009) the forest as a characteristic element of the Austrian landscape has grown to cover a total area of 4 million hectares. Ever since the beginning of the Austrian Forest Inventory in 1961 a continuous increase in forest cover has been observed in Austria. Compared with the first inventory period 1961/1970, the forest cover has increased by almost 300 000 hectares to date. Based on the latest forest inventory, sustainability of the Austrian forest cover is guaranteed.

Austrian forest management mainly focuses on the targets to maintain biodiversity, productivity, regeneration capacity and vitality of forests and to improve adaptation to changing – specifically climatic – conditions. Therefore, the preservation of forest gene resources is important in Austria. The preservation of a high genetic diversity is necessary for adaptability and adaptation of forests to environmental conditions, especially in the light of climate change. Forest stands of high genetic values should be represented as much as possible in all growth areas, and their presence should be guaranteed in the long term. An effective measure to ensure comprehensive adaptability is *in situ* conservation. Thereby, forests are preserved at their natural site in order to disturb the constant genetic adaptation processes as little as possible. The goal of the *in situ* conservation measure 'gene reserve forests' is to ensure that the genetic information is passed from one generation to the next using natural regeneration.

In order to be able to cope with the diverse interest in the utilisation of forests in future, all the national institutions, public and private interest groups, and all forest stakeholders are called upon to further develop a responsible forest management. For this purpose, the Federal Minister of Agriculture, Forestry, Environment and Water Management has developed an Austrian Forest Programme. This PaM was already described in the 5th National Communications.

4.4 Further Information with Respect to the Kyoto Protocol

Austria is aware of the need to reduce *greenhouse gas emissions from aviation and shipping*. Austria supports EU work on that subject in ICAO and IMO. The EU, with active support from Austria, succeeded to include aviation CO2 emissions into the EU emissions trading scheme from 2012 onwards, resulting in a limitation of emissions below historic levels in 2004-2006. The EU scheme includes emissions from flights within the EU as well as between EU and third countries, but following the results of the General Assembly of the International Civil Aviation Authority (ICAO) in

October 2013, the geographical scope of the Directive will be revised upon a new proposal of the European Commission, subject to on-going discussions between the European Parliament and the Council. Appropriate action has been proposed by the European Commission also for maritime transport (monitoring and reporting on GHG emissions of ships).

According to paragraph 36 of the Annex to decision 15/CMP.1, each Party to the Kyoto Protocol shall provide information not reported elsewhere under these guidelines on how it strives to implement policies and measures under Article 2 of the Protocol in such a way as to minimize adverse effects, including the adverse effects of climate change, effects on international trade, and social, environmental and economic impacts on other Parties, especially developing country Parties and in particular those identified in Article 4, paragraphs 8 and 9, of the Convention, taking into account Article 3 of the Convention.

The adverse effects of climate change are dealt with in more detail in chapter 6 on vulnerability assessment, climate change impacts and adaptation measures.

The Kyoto Protocol is, in principle and in general, designed to minimize adverse effects on specific sectors, specific industries or specific trade partners of a Party, including effects on international trade, and social, environmental and economic impacts on other Parties. This is due to the fact that it does not limit action to a single gas or sector, that the use of its flexible mechanisms guarantees that possible impacts are distributed on various fields of action, that the Clean Development Mechanism aims at both promoting sustainable development in countries with continuing development needs and at reducing greenhouse gas emissions, and that it requests action to support the least developed countries.

By striving to implement all the features that the Protocol contains, Austria is naturally working to minimize any adverse effects due to the reduction of greenhouse gas emissions.

Austria is acting together with other Parties in the EU to jointly fulfil the commitments under the Protocol. Key climate policies and measures (e.g. the EU Emissions Trading System, EU-ETS) are established at an EU level. While these policies are executed at the national level, they are not monitored and assessed by individual Member States, but by the EU as a whole. The EU reports in detail on how it strives to minimize adverse effects in its annual national inventory report in chapter 15, to which we hereby refer for further information.

Austria also seeks to ensure that response measures designed and implemented entirely at the national level are as targeted and effective as possible. Since 2013, we have compulsory, government-wide impact assessments concerning environmental, economic and social consequences of policies and measures – including, where appropriate, effects on other countries. In addition, there are legally-binding standards for Austrian JI/CDM projects. The stringent social and environmental criteria include favoured project categories, a focus on environmental co-benefits, on social standards and on technology transfer.

We note that effects (impacts) of climate change response measures can be both positive and negative, and that maximising positive economic, social and

environmental impacts (co-benefits) is an important aspect in incentivising global climate action. In this context, we would welcome specific information from developing country Parties on positive and negative impacts of response measures taken by other Parties that they are experiencing nationally, as well as assessments of impacts of their own response measures.

Table 4.3: Summary of policies and measures by sectors

No. of PaM	Name of PaM	Objective and/or activity affected	GHG affected	Type of instrument[6]	Status[7]	Implem. entity or entities	Estimate of mitigation impact by gas [Tg CO2 equ.] [8]			Policy instruments related
							2010	2015	2020	
1. Cross-cutting Policies and Measures										
M1.	EU Emission Trading Scheme (ETS)	Limit CO2 emissions from energy intensive stationary installations and aviation	CO2, N2O	Ec, Reg, flexible mechanism	impl.	Federation, EU	NE	NE	NE	Dir. 2003/87/EC Dir. 2008/101/EC Dir. 2009/29/EC BGBl. I Nr. 118/2011 (EZG 2011)
M2.	The Domestic Environmental Support Scheme (UFI)	Financial support to GHG mitigation projects (energy efficiency, renewables, waste,…)	CO2, CH4, N2O	Fi	impl.	Federation	0.4	0.3	0.25	BGBl. I Nr. 185/1993 as amended
M3.	Austrian Climate and Energy Fund (KLI.EN)	Financial support for R&D (RES, mobility), market penetration of new technologies	CO2	Fi, Res	Impl.	Federation	NE	NE	NE	BGBl. I Nr. 40/2007
M4.	Austrian JI/CDM Programme	Public purchase of ERUs and CERs	CO2, CH4, N2O, F-gases	flexible mechanism	impl.	Federation	14	NE	NE	BGBl. Nr. 185/1993 as amended
2. Energy										
2.1 Energy Supply										
M5.	Green Electricity Act	Feed-in tariffs promoting power generation from renewable energy sources	CO_2	Ec, Reg	impl.	Federation	NE	0.4	0.4	-Dir 2001/77/EC - BGBl. I Nr. 149/2002 as amended - Dir 2003/87/EC (Green Electricity Plants result in a reduced production in large fossil fuel plants affected by the ETS)

[6] Ec = Economic, Fi = Fiscal, Vo = Voluntary, Reg =regulatory, Inf = Information, Ed = Education, Res = Research, P = Planning, O = Other

[7] Impl. = implemented, adopt. = adopted, planned

[8] When there is no quantification available for the given measures: NE = not estimated; When an estimation cannot be applied to one of the years: NA = not available

No. of PaM	Name of PaM	Objective and/or activity affected	GHG affected	Type of instrument[6]	Status[7]	Implem. entity or entities	Estimate of mitigation impact by gas [Tg CO2 equ.] [8]			Policy instruments related
							2010	2015	2020	
M6.	District Heating from Renewables	Subsidy for biomass district heating systems (Environment Support Scheme, co-finance by *Länder*, EU structural fund)	CO_2	Fi	impl.	Federation, *Länder*, EU	0.2 (included in M2.)	NE	NE	BGBl. I Nr. 185/1993 as amended
2.2 Energy Demand (Buildings)										
M7.	Improved building standards	Improving energy standard of new and renovated buildings; "nearly zero energy houses" by 2020	CO2	Reg	adopted	*Länder*, Federation	NE	NE	NE	Dir. 2010/31/EC
M8.	Financial support for climate-friendly construction and renovation	Housing support for highly efficient new houses and thermal renovation; renewable energy systems for heating and hot water	CO2	Fin	impl.	*Länder*, Federation	0.4	0.6	1.2	BGBl. II Nr. 251/2009
M9.	Renovation Cheque	Subsidy for thermal renovation in private residential and commercial buildings	CO2	Fin	impl.	Federation	0.1	0.4		BGBl. I Nr. 185/1993 as amended
3. Transport										
M10.	Fuel consumption based taxation (NOVA)	Tax giving a clear incentive to buy energy efficient, low polluting cars; Greening of NOVA in 2008 for alternative fuel & hybdrid vehicles	CO2	Fi	Impl.	Federation	NE	NE	0.1	BGBl. I Nr. 695/1991 BGBl. I Nr. 46/2008 as amended
M11.	Implementation of the renewable energy targets for transport in Austria	Increase share of biofuels in the market	CO2	Reg	Impl.	Federation	1.7	NE	2.1	Dir. 2003/30/EC as amended BGBl. II Nr. 398/2012

No. of PaM	Name of PaM	Objective and/or activity affected	GHG affected	Type of instrument[6]	Status[7]	Implem. entity or entities	Estimate of mitigation impact by gas [Tg CO2 equ.] [8]			Policy instruments related
							2010	2015	2020	
M12.	klima:aktiv *mobil* programme	Mobility management in companies, in public administration, leisure- & tourism-traffic, in schools, for cities, communities & regions	CO2, CH4, N2O	Fi, Inf, Ed	impl.	Federation, *Länder*	0.25	0.5	NE	BGBl. I Nr. 40/2007 (KLI.EN)
M13.	Enhanced fuel efficiency of cars	Raising the market share of advanced engine technologies with low fuel consumption (passenger and light commercial vehicles)	CO2, N2O	Reg	Impl.	EU	NE	0.8	1.7	Reg. (EU) No. 443/2009 to limit CO2 emissions of new passenger cars and Reg. (EU) No. 510/2011 to limit CO2 emissions of new light duty commercial vehicles
M14.	National plan on electric mobility	65 measures to increase market share of electric vehicles in and from Austria	CO2, N2O	Res, Fi, Inf	adopted	Federation (Min. Econ, Env. and Transport)	NA	NE	0.4	National plan, stakeholder involvement
4. Waste Management										
M15.	Landfill ordinance (deposition of untreated biodegradable waste)	Reduction of the deposition of untreated deposited waste	CH_4	Reg	impl.	*Länder*	NE	NE	NE	- Council Dir 1999/31/EC - BGBl. Nr. 164/1996 as amended - BGBl. I 102/2002 as amended - BGBl. II Nr. 39/2008 as amended
M16.	Landfill ordinance (collection and drainage of landfill gas)	Mandatory collection and drainage of landfill gas originating from mass-waste landfills	CH_4	Reg	impl.	*Länder*	NE	NE	NE	- Council Dir 1999/31/EC - BGBl. Nr. 164/1996 as amended - BGBl. II Nr. 39/2008 as amended
M17.	Remediation of Contaminated Sites Act	Finance and manage the clean-up of former landfills and old waste dumps	CH_4	Fi	impl.	Federation	NE	NE	NE	- BGBl. Nr. 299/1989 as amended
5. Industry										
(see cross-cutting Policies and Measures)										

No. of PaM	Name of PaM	Objective and/or activity affected	GHG affected	Type of instrument[6]	Status[7]	Implem. entity or entities	Estimate of mitigation impact by gas [Tg CO2 equ.] [8]			Policy instruments related
							2010	2015	2020	
6. F-Gases										
M18.	Austrian F-Gas Ordinance	Reducing and/or phasing-out the use of HFCs, PFCs and SF6 in all relevant applications on the basis of the Federal Chemicals Act	HFC, PFC, SF6	Reg	impl.	Federation	NE	NE	0.07	- Council Reg (EC) No 842/2006 - BGBl. II Nr. 447/2002 as amended
M19.	New EU F-Gas Regulation	Aims to reduce emissions of fluorinated greenhouse gases (mainly) in stationary applications through application-specific requirements covering all stages of the life cycle of F-Gases.	HFC, PFC, SF_6	Reg	adopted	EU	NA	NE	NE	- Regulation by theCouncil and the Parliament adopted in Jan. 2014 (not yet published)
7. Agriculture										
M20.	Organic farming and environmentally sound farming	increase share of farmland used for organic farming to 20 % (within the given budget of the programme for rural development)	CO2, CH4, N2O	Fi, Inf	implemented	Federation	NE	NE	NE	Reg.(EU) No. 1305/2013 Reg.(EU) No. 1306/2013 Reg.(EU) No. 1307/2013 Reg.(EU) No. 1308/2013
M21.	Common Agricultural Policy (CAP) 2014-2020	reduction of environmental impacts from agricultural activity - rural development - horizontal issues - direct payments for farmers - market measures	CO2, CH4, N2O	Fi, Ec	adopted	EU, Federation	NA	NE	NE	Reg.(EU) No. 1305/2013 Reg.(EU) No. 1306/2013 Reg.(EU) No. 1307/2013 Reg.(EU) No. 1308/2013
M22.	Agricultural raw materials for biofuels	Promotion of raw materials for production of biofuels	CO2, N2O	Fi, Ec	implemented	Federation	NA	NA	NA	BGBl. II Nr. 250/2010
8. Forestry and LULUCF										

No. of PaM	Name of PaM	Objective and/or activity affected	GHG affected	Type of instrument[6]	Status[7]	Implem. entity or entities	Estimate of mitigation impact by gas [Tg CO2 equ.] [8]			Policy instruments related
							2010	2015	2020	
M23.	Maintenance and extension of vital forests	Maintaining biodiversity, productivity, regeneration, capacity and vitality of forests	CO2	Res, Reg, Inf	impl.	Federation, *Länder*	1.3	NE	NE	Austrian Forest Act

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Chapter 5

Projections and the Total Effect of Policies and Measures

5.1 Projections

5.1.1 Introduction

The latest national greenhouse gas (GHG) emission projections have been developed in the years 2012/2013. They include results for a "with measures" scenario (WM) and a "with additional measures" scenario (WAM) up to 2030. The former takes account of climate change mitigation measures that were implemented and adopted before February 2012. The latter takes into account planned policies and measures (PaMs) with a realistic chance of being adopted and implemented in time to influence the emissions (see also Chapter 4). Both emission control scenarios presented in this report are in line with the projections reported in March 2013 under the EU Monitoring Mechanism (Decision 280/2004/EC). Hence, for a more detailed description of the methodology used that report should be consulted (Umweltbundesamt 2013b).

5.1.2 Projection results

Figures for **total emissions** comprise emissions from CRF sectors 1, 2, 3, 4, and 6. Land use change and forestry (CRF 5.) is not included. Emissions in the scenario "with measures" are expected to decrease from 82.8 Tg CO_2 equivalent in 2011 to 81.6 Tg in 2020 and to increase to 84.0 Tg in 2030. This is a decrease of 1.5 % and an increase of 1.4 % respectively, compared to 2011 (see Fig. 5.1 and Table 5.1). The increase after 2020 is driven by the projected rise of emissions from fuel combustion. The scenario "with additional measures" shows a sharper decrease from 82.8 Tg in 2011 to 77.5 Tg in 2020 (-6.4 %), but also a slight rise of emissions afterwards to 78.1 Tg in 2030 (-5.8 % 2011–2030).

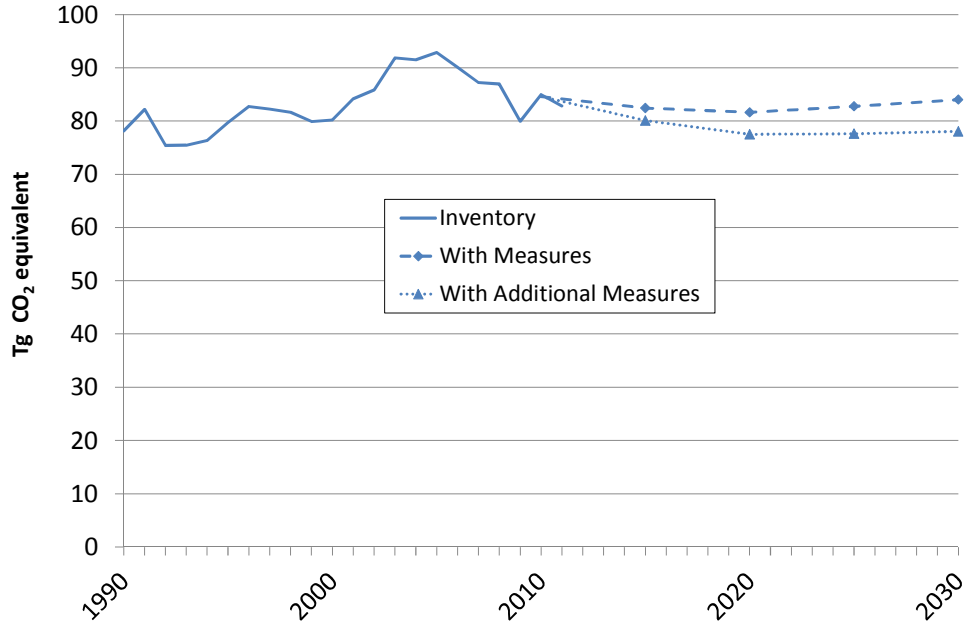

Figure 5.1: Actual and projected total GHG emissions in Austria (without LULUCF)

Table 5.1: Total actual and projected GHG emissions in Austria (without LULUCF) by gas

	Inventory data			With Measures				With Additional Measures			
	1990	**2000**	**2011**	**2015**	**2020**	**2025**	**2030**	**2015**	**2020**	**2025**	**2030**
CO_2	62.06	65.97	70.46	70.55	69.98	71.31	72.72	68.39	66.22	66.53	67.12
CH_4	8.30	6.62	5.36	5.21	5.02	4.88	4.80	5.19	4.97	4.83	4.75
N_2O	6.20	6.29	5.29	5.18	5.14	5.06	4.98	5.07	4.91	4.83	4.75
F-gases	1.60	1.32	1.73	1.50	1.49	1.51	1.53	1.46	1.40	1.42	1.44
Total	**78.16**	**80.20**	**82.84**	**82.44**	**81.64**	**82.76**	**84.03**	**80.10**	**77.50**	**77.62**	**78.06**

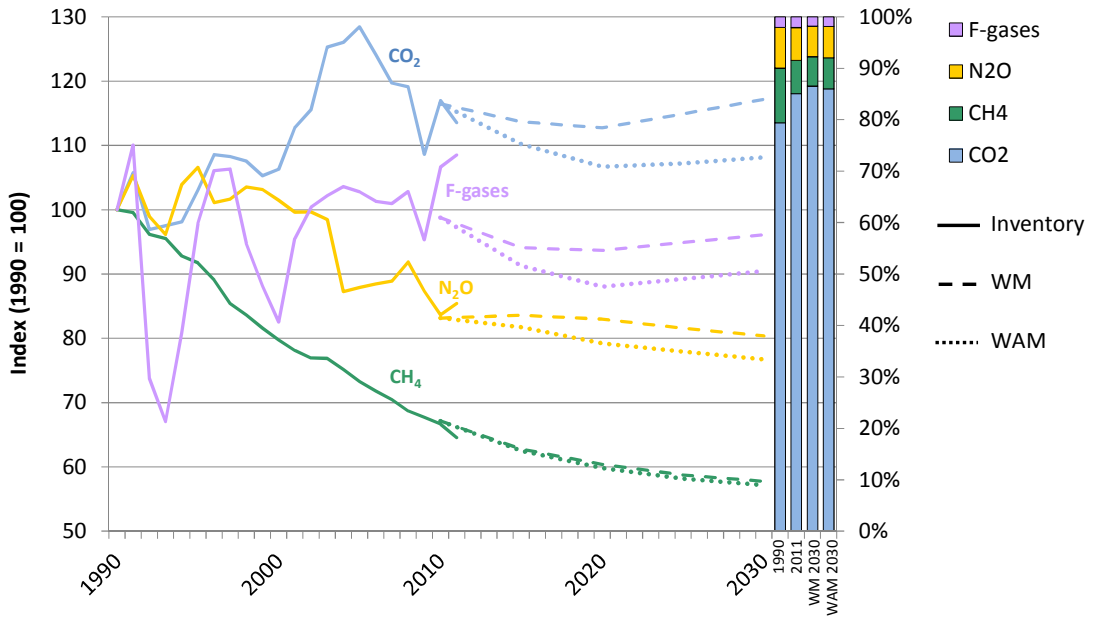

Figure 5.2: Trend of GHG emissions 1990–2030 relative to 1990 by gas and share of gases in 1990, 2011 and 2030

No significant change is projected for the share of the greenhouse gases. Past trends of decreasing CH_4 and N_2O will continue, but the share of CO_2 is expected to expand by not more than 1–2 percentage points. The share of F-gases is expected to stay at a level of about 2 %.

Both scenarios are affected by the rising emissions from industry (after 2015) and energy supply (after 2020), which cannot be completely compensated by the decline of emissions from residential, commercial and other sources and from the waste sector. Transport emissions are projected to stagnate after 2020; in the short term a decrease can only be reached “with additional measures”. No distinctive changes are projected for agriculture (cf. Fig. 5.3).

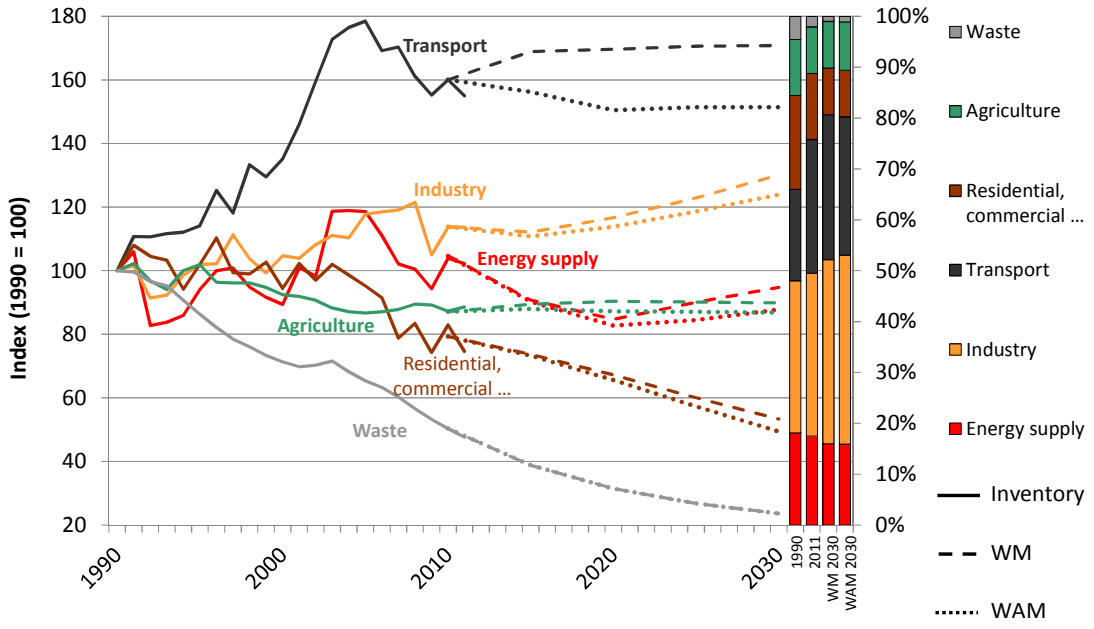

Figure 5.3: Trend of GHG emissions 1990–2030 relative to 1990 by sector and share of sectors in 1990, 2011 and 2030

Emissions from **energy supply (CRF 1.A.1 and 1.B)** are projected to decrease until 2020 in both scenarios (-17/-19 % from 2011) due to a fuel shift from oil and coal to gas and renewables. Installed capacities of hydro power, wind and biomass plants are expected to increase throughout the next years. After 2020 the effect of implemented measures slowly diminishes. Increasing electricity demand (+34 % 2010–2030 in the WM scenario and 4 percentage points less in WAM) leads to an upward turn of emissions in both scenarios (cf. Table 5.2). Measures for the support of green electricity after 2020 in the "with additional measures" scenario can slow down the emission increase. No changes in the production capacity of the oil refinery are expected and thus emissions are projected to remain constant. Emissions from fossil fuel exploration and fugitive emissions from refining, storage and transport are projected to increase (about 20 % 2010–2030), but contribute less than 10 % to the emissions of this sector. The share of this sector in total emissions decreases slightly to 16 % in 2030 (2011: 17 %).

Table 5.2: Actual and projected emissions from energy supply (1.A.1 und 1.B) by gas, in Tg CO_2 equivalent

	Inventory data			With Measures				With Additional Measures			
	1990	**2000**	**2011**	**2015**	**2020**	**2025**	**2030**	**2015**	**2020**	**2025**	**2030**
CO_2	13.89	12.39	14.09	12.42	11.54	12.29	12.97	12.36	11.26	11.49	11.97
CH_4	0.21	0.21	0.25	0.31	0.33	0.34	0.34	0.31	0.33	0.34	0.34
N_2O	0.05	0.05	0.12	0.12	0.12	0.11	0.10	0.11	0.12	0.12	0.11
Total	**14.15**	**12.65**	**14.46**	**12.84**	**11.99**	**12.74**	**13.41**	**12.78**	**11.71**	**11.95**	**12.42**

Emissions from the **industry sector (CRF 1.A.2, 2. and 3.)** are projected to remain stable until 2015 and to increase afterwards in both scenarios (cf. Table 5.3). The "with measures" scenario shows an increase of 15 % from 2011 to 2030, the "with

additional measures" scenario +9 %. The projected increase of sectoral GDP is the main driver for emissions. Subsectors with a high share of emissions are the production of iron and steel, the production of non-metallic minerals, the pulp and paper industry and the chemicals industry. Measures for increased energy efficiency slow down the emission increase in the "with additional measures" scenario. A large share of this sector's emissions is covered by the EU Emissions Trading System, which leaves limited space for additional national regulation. Emissions of F-gases are expected to stay at a relatively constant level. Emissions from the use of solvents show a slight increase until 2020 and a slight decrease afterwards, but their share in the emissions of this sector is less than 1 %. With a share of 36–37 % in total emissions the industry sector becomes by far the most important sector for emissions in 2030 (2011: 32 %).

Table 5.3: Actual and projected emissions from the industry sector (CRF 1.A.2, 2. and 3.) by gas, in Tg CO_2 equivalent

	Inventory data			With Measures				With Additional Measures			
	1990	**2000**	**2011**	**2015**	**2020**	**2025**	**2030**	**2015**	**2020**	**2025**	**2030**
CO_2	20.55	21.83	24.45	24.34	25.42	26.85	28.50	24.09	24.85	25.94	27.16
CH_4	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.03	0.03	0.03	0.03
N_2O	1.23	1.32	0.35	0.34	0.34	0.35	0.36	0.34	0.34	0.34	0.35
HFCs	0.02	0.65	1.35	1.15	1.15	1.18	1.21	1.11	1.06	1.09	1.12
PFCs	1.08	0.07	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
SF_6	0.49	0.60	0.32	0.28	0.27	0.26	0.25	0.28	0.27	0.26	0.25
Total	**23.39**	**24.49**	**26.57**	**26.21**	**27.28**	**28.75**	**30.43**	**25.91**	**26.62**	**27.74**	**28.99**

In the "with measures" scenario, emissions from **transport (CRF 1.A.3)** show a distinct increase until 2015 and still a slight increase afterwards (cf. Table 5.4). The increase is due to rising economic and transport activities from 2010 onwards after the sharp emission decrease in 2008 and 2009 caused by the economic downturn. From 2015 onwards, increased use of biofuels, higher fuel efficiency standards of the fleet – in addition to electro-mobility initiatives – are expected to help stabilize the increasing trend. In the "with additional measures" scenario an increase of the fuel tax is the main driver for the reduction of emissions until 2020. Road transport continues to dominate the emissions of this sector with a share of more than 96 % in both scenarios. Emissions from pipeline compressors increase by two thirds between 2010 and 2020, but with a share of just 2 % they do not have a significant impact on the trend of the sector. The transport sector stays on the second highest rank of emitters with a share of 29 % (WM) or 27 % (WAM) in total emissions 2030 (2011: 26 %).

Table 5.4: Actual and projected emissions from transport (1.A.3) by gas, in Tg CO_2 equivalent

	Inventory data			With Measures				With Additional Measures			
	1990	**2000**	**2011**	**2015**	**2020**	**2025**	**2030**	**2015**	**2020**	**2025**	**2030**
CO_2	13.77	18.62	21.52	23.51	23.66	23.82	23.86	21.73	20.98	21.13	21.15
CH_4	0.06	0.04	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
N_2O	0.19	0.30	0.21	0.18	0.13	0.11	0.10	0.17	0.12	0.10	0.09
Total	**14.03**	**18.97**	**21.75**	**23.69**	**23.80**	**23.93**	**23.96**	**21.91**	**21.11**	**21.24**	**21.25**

Emissions from **residential, commercial and other sources (CRF 1.A.4 and 1.A.5)** show a continuously decreasing trend in the "with measures" as well as in the "with additional measures" scenario: -10/-12 % 2011–2020 and -29/-34 % by 2030 (cf. Table 5.5). Despite growing numbers of households and occupied living space, GHG emissions are reduced due to the shift from fossil fuels to renewables on the one hand (biomass, solar heat und heat pumps) as well as a slight transfer to other sectors (district heat) and due to a slight reduction of total energy consumption on the other hand (increased insulation in new buildings, better insulation through renovation measures, improved efficiency of primary heating systems). The sector also comprises mobile sources, mainly from agriculture and forestry, causing less than 10 % of the sectors emissions 2011; these sources do not show a declining emission trend. The sector's share in total emissions has decreased from 18 % in 1990 to 13 % in 2011 and is projected to lie at only 9 % in 2030.

Table 5.5: Actual and projected emissions from residential, commercial and other sources (CRF 1.A.4 and 1.A.5) by gas, in Tg CO_2 equivalent

	Inventory data			With Measures				With Additional Measures			
	1990	2000	2011	2015	2020	2025	2030	2015	2020	2025	2030
CO_2	13.82	13.12	10.38	10.27	9.36	8.35	7.39	10.21	9.14	7.96	6.84
CH_4	0.39	0.26	0.19	0.18	0.16	0.15	0.14	0.18	0.16	0.14	0.13
N_2O	0.24	0.24	0.21	0.19	0.18	0.17	0.17	0.19	0.18	0.17	0.16
Total	**14.44**	**13.63**	**10.78**	**10.65**	**9.71**	**8.67**	**7.70**	**10.58**	**9.48**	**8.27**	**7.13**

Emissions from a**griculture (CRF 4.)** are projected to increase slightly in the "with measures scenario" until 2020 (+2 % from 2011) and to stabilize afterwards (cf. Table 5.6). The trend is mainly influenced by livestock numbers and milk yield. Several measures of the Austrian agri-environmental programme, taken into account in the "with additional measures" scenario, are projected to lead to a decrease of emissions after 2011 (about 1–2 % until 2020 and 2030). The sector has a share of 9 % of total GHG emissions in 2011 and that share is not expected to change until 2030.

Table 5.6: Actual and projected emissions from agriculture (CRF 4.) by gas, in Tg CO_2 equivalent

	Inventory data			With Measures				With Additional Measures			
	1990	2000	2011	2015	2020	2025	2030	2015	2020	2025	2030
CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CH_4	4.19	3.79	3.55	3.67	3.73	3.78	3.82	3.65	3.69	3.73	3.78
N_2O	4.36	4.12	4.03	3.98	4.00	3.93	3.87	3.87	3.77	3.71	3.65
Total	**8.56**	**7.91**	**7.58**	**7.65**	**7.73**	**7.71**	**7.69**	**7.53**	**7.46**	**7.45**	**7.43**

Both scenarios show a further decline of emissions from the **waste sector (CRF 6.)**: -34 % from 2011 until 2020 and -50 % until 2030 (see Table 5.7). Decreasing carbon content of the waste which had historically been deposited in landfills and treatment of waste prior to deposition due to more recent regulations is responsible for the declining emissions from the subsector "solid waste disposal on land", which had a share of about three quarters of the sector's total emissions in 2011. Slightly rising emissions from the subsector "waste water handling" (with a share of about one sixth of the sectors emissions in 2011) do not significantly change the overall trend, emissions of other subsectors are of minor importance. The share of the waste

sector in total emissions has already more than halved to 2 % since 1990 and is projected to fall to 1 % until 2030.

Table 5.7: Actual and projected emissions from the waste sector (CRF 6.) by gas, in Tg CO_2 equivalent

	Inventory data			With Measures				With Additional Measures			
	1990	2000	2011	2015	2020	2025	2030	2015	2020	2025	2030
CO_2	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CH_4	3.43	2.29	1.33	1.01	0.74	0.57	0.45	1.01	0.74	0.57	0.45
N_2O	0.13	0.26	0.38	0.38	0.38	0.39	0.39	0.38	0.38	0.39	0.39
Total	**3.59**	**2.56**	**1.71**	**1.39**	**1.13**	**0.96**	**0.85**	**1.39**	**1.13**	**0.96**	**0.85**

Emissions from l**and use, land-use change and forestry (CRF 5.)** show an increasing trend until 2020 and are projected to change from a net sink of 3.5 Tg CO_2 equivalent in 2011 to a net source of 3.5 Tg in 2015 and of 5.0 Tg in 2020 (see Table 5.8). Modeled data is available for subsector 5.A.1 ("forest land remaining forest land"), which is quantitatively the most import subsector. Data is consistent with the information provided in the National Inventory Report 2013 on the Forest Management Reference level and based on the projections provided in the submission of the Austrian Forest Management Reference Level submitted in 2011 (Austria 2011) and in the 5th National Communication. The reported values for sector 5.A.1 were significantly revised for the national inventory report submitted in 2012 on the basis of the results provided in the new national forest inventory 2007/09, the introduction of estimates for forest soil carbon pools and several improvements in the estimates. The 5.A.1 projections were adjusted to ensure consistency with these improvements. No projections are currently available for the period beyond 2020. The 2020 value has thus been assumed to remain constant for the period up to 2030. No projections are available for other subsectors, the emissions/removals reported in the national inventory report submitted in 2013 for the year 2010 are carried forward for the years up to 2030.

Table 5.8: Actual and projected emissions from land use, land-use change and forestry (CRF 5.) by gas, in Tg CO_2 equivalent

	Inventory data			With Measures				With Additional Measures			
	1990	2000	2011	2015	2020	2025	2030	2015	2020	2025	2030
CO_2	-9.97	-14.97	-3.54	3.48	4.98	4.98	4.98	3.48	4.98	4.98	4.98
CH_4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N_2O	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Total	**-9.93**	**-14.94**	**-3.49**	**3.53**	**5.03**	**5.03**	**5.03**	**3.53**	**5.03**	**5.03**	**5.03**

Emissions from **international bunkers** are expected to increase by about one third from 2011 until 2020 and by two thirds until 2030 (see Table 5.9). The increase is due to the increased transport demand in international aviation; the share of emissions from international maritime transport is negligible in Austria.

Table 5.9: Actual and projected emissions from international bunker fuels by gas, in Tg CO_2 equivalent

	Inventory data			With Measures				With Additional Measures			
	1990	2000	2011	2015	2020	2025	2030	2015	2020	2025	2030
CO_2	0.92	1.75	2.21	2.38	2.74	3.10	3.50	2.39	2.75	3.11	3.50
CH_4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N_2O	0.01	0.02	0.03	0.03	0.03	0.04	0.04	0.03	0.03	0.04	0.04
Total	**0.94**	**1.78**	**2.24**	**2.41**	**2.77**	**3.14**	**3.54**	**2.42**	**2.78**	**3.15**	**3.54**

5.2 Assessment for Aggregate Effects of Policies and Measures

Chapter 4 shows a comprehensive listing of policies and measures contained in the Austrian Climate Strategy. Implemented and adopted policies and measures represent an important part of the whole strategy. It has to be mentioned, however, that the highly fragmented responsibilities for climate change mitigation among the Federation, '*Länder'* and Municipalities still cause some difficulties for coherent monitoring and evaluation of the effects of policies and measures.

The approach to derive the total effect of planned policies and measures is to take the difference of the 'with measures' and the 'with additional measures' scenario described in the previous section. Planned measures lead to a reduction increasing from 2.3 Tg CO_2 equivalent in 2015 to 6.0 Tg in 2030.

Table 5.10: Aggregate effect of planned policies and measures by gas (sum of aggregate effects)

	2015	2020	2025	2030
CO_2	2.2	3.8	4.8	5.6
CH_4	0.0	0.0	0.0	0.1
N_2O	0.1	0.2	0.2	0.2
F-gases	0.0	0.1	0.1	0.1
Total	**2.3**	**4.1**	**5.1**	**6.0**

A "without measures" scenario has not been calculated for Austria with the models used for the "with measures" and "with additional measures" scenario. Various measures for the mitigation of GHG emissions are in place for a long time, and it would be difficult to examine the emission path that would have evolved without any measures. An indicator based approach was therefore chosen to monitor and evaluate progress with policies and measures and to calculate an approximate estimate of the aggregate effect of policies and measures.

For this approach the respective indicators were calculated as mean of the years 1990–1995. This indicator was then used to calculate GHG emissions for the years 2010, 2015, 2020, 2025 and 2030 by multiplying with the respective projected 'activity'. This approach assumes that without policies and measures the GHG intensity would have remained constant since 1995 and emissions would follow the development of activities only. Thus, the effect of implemented and adopted policies and measures in the years 1990-1995 was assumed to be virtually zero. To calculate the aggregate effect of policies and measures, emissions from the 'with measures' scenario were subtracted from the indicator based emissions.

The aggregate effect of PaMs in the transport sector was estimated by the CO_2 intensity of driven passenger car kilometers and of ton kilometers for freight transport. In the residential sector the CO_2 intensity of households (stock of permanently occupied dwellings) and in the service sector the CO_2 intensity of the gross value added were used. The aggregate effect of PaMs in energy industries was estimated by the specific CO_2 emissions of the total output of the public power sector (power and CHP plants). Emission trends of manufacturing industries are heavily influenced by iron and steel production; that is why the CO_2 intensity of steel production together with the CO_2 intensity of the gross value added for the rest of industry were used.

Policies and measures affecting methane emissions can be mainly identified in the Waste sector and involve strict legislation concerning waste deposition and CH_4 recovery. The respective indicator is CH_4 generated by municipal waste. As no projection for the quantity of municipal waste until 2030 was available, growth was assumed to be equal to population.

For N_2O emissions no effect could be calculated because of the lack of a suitable indicator.

For fluorinated gases a 'without measures' scenario has been calculated based on the same assumptions as the 'with measures' scenario but excluding assumptions on the effects of Austrian and EC policies. The aggregate effect of policies and measures affecting fluorinated gases was calculated by subtracting the 'with measures' emissions from the 'without measures' scenario. The time horizon for that scenario was 2020, the value for 2020 is carried forward until 2030.

The calculated effects of policies and measures are summarized in Table 5.11.

Table 5.11: Aggregate effect of implemented and adopted policies and measures by gas (indicator based approach)

	2010	2015	2020	2025	2030
CO_2	26.8	37.9	43.9	51.4	57.8
CH_4	2.0	2.5	2.8	3.0	3.2
N_2O	-	-	-	-	-
F-gases	0.7	1.0	1.4	1.4	1.4
Total	**29.5**	**41.4**	**48.1**	**55.8**	**62.4**

These numbers may include effects that are not directly attributable to policies and measures. There are effects which may have contributed to the decrease of the GHG intensity of activities (e.g. autonomous efficiency improvement of motor vehicles and heating systems), whereas some effects might have contributed to an increase (e.g. trend to bigger cars and more engine power, to larger dwellings and higher room temperature, due to increasing prosperity and decreasing service price). Assuming that autonomous efficiency improvements have a stronger impact than effects that lead to an emission increase, the estimates should be seen as an upper limit on the total effect of implemented policies and measures. Nevertheless, they give a good proxy on how emissions would have grown from 1995 onwards without the implemented measures and other incentives for GHG emission reductions.

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

Austria's efforts to make use of the Kyoto Protocol flexible instruments are supple¬mental to domestic efforts. From the beginning, the main policy focus was put at domestic measures in different sectors, as listed in Chapter 4 of the current and of the previous national communications. The previous section shows that adopted and implemented as well as planned measures lead to an emission reduction of considerable more than 20 Tg CO_2 equivalent in 2010, and the effect is expected to double within the following 20 years.

Some developments with significant impact on emission trends could not be foreseen at the time when the Kyoto Protocol was signed and the EU-burden sharing was agreed. For example, emissions from road fuel sold in Austria but consumed abroad have reached a significant share of the emissions from transport after 2000. This is one reason why the Austrian JI/CDM programme has gained increasing importance; in quantitative terms, the contributions from the programme have been about 14 Tg CO_2 equivalents annually in the average 2088–2012. Nevertheless the JI/CDM programme is only one of the many elements of the Austrian Kyoto Strategy.

In short, domestic measures have been the basis and main instruments for the development of the national strategy and the use of mechanisms was mainly intended to compensate for unexpected developments. This is underlined by the fact that the contributions from the JI/CDM programme are significantly lower than the estimated effect of domestic measures.

5.4 Methodology

5.4.1 Models

Emission projections for CO_2, CH_4, N_2O and F-gases are generally calculated by the Environment Agency Austria (Umweltbundesamt) within the framework of the project EMIPRO (Umweltbundesamt 2013b). Basically, the same methodologies as for the national GHG inventory are applied. These methodologies are reported in Austria´s National Inventory Report 2013 (Umweltbundesamt 2013a). The projections have been calculated on the basis of the historical emission data of the Austrian Emission Inventory submission April 2012 (Umweltbundesamt 2012), with emission data up to the data year 2010. Historical data of emissions presented in tables below represent the actual emission data according to the latest inventory submission, consistent with Chapter 3 of this report.

Some emission factors for fuels (e.g. for refinery fuel gas, refinery coke) or waste were derived from plant specific data. Input data regarding sectoral activity projections (industrial production, passenger-km, livestock numbers, etc.) and the forcast demand of energy is derived from several modeling exercises and performed by different institutions as outlined below. Resulting figures for energy demand in the Austrian economy are split according to the subsectors of the Austrian greenhouse

gas emission inventory. Increasing energy efficiency, technological progress, policies and economic developments (e.g. energy prices, taxes, etc.) are based on endogenous assumptions or to some extent exogenous variables.

The underlying sectoral forecasts of activities are based on the use of various models and methods and have been carried out in close collaboration with several institutions. The following list provides a brief overview; a detailed explanation can be found in Umweltbundesamt 2013b:

- The energy forecast (Umweltbundesamt 2013c) is based on the National Energy Balance of Statistics Austria and on the macro-economic model DEIO of the Austrian Institute of Economic Research, which combines a private consumption module with an energy and environment module (WIFO 2013), supported by several institutions with their bottom-up models:
    - Austrian Energy Agency with the model TIMES for electricity demand (bottom-up approach on used devices for households and top-down approach on development of energy intensity and gross-value added for industry, the service sector and agriculture), for public electric power and district heating supply (based on available capacities for all types of power plants in combination with energy prices, subsidies and fees) (AEA 2013),
    - Energy Economics Group of the Technical University Vienna with INVERT/EE-Lab, based on a stochastic, non-recursive, myopic and economic algorithm with the objective function to minimise costs, for domestic heating (including district heating demand) and hot water supply (TU Wien 2013),
    - Technical University of Graz with the models GLOBEMI, which was developed for the calculation of emission inventories for road transport in larger areas, and GEORG, a fleet based model for the calculation of energy consumption and emissions of mobile off-road sources (TU Graz 2013).
- The forecast of emissions from industrial processes and solvents are based on expert judgements of the Environment Agency Austria (EAA).
- The estimations of emissions for fluorinated gases are based on a study published in 2010 (Gschrey 2010).
- The agricultural forecast is based on the PASMA model of the Austrian Institute of Economical Research, a model which maximises sectoral farm welfare and is calibrated on the basis of historical crops, forestry, livestock, and farm tourism activities, using the method of Positive Mathematical Programming (this method assumes a profit-maximising equilibrium (e.g. marginal revenue equals marginal cost) in the base run and derives coefficients of a non-linear objective function on the basis of observed levels of production activities) (Sinabell et al. 2011).
- The waste forecast is based on the Environment Agency Austria forecast of the quantity of waste deposited and wastewater handled.
- For LULUCF, CRF 5.A.1, the model PROGNAUS (PROGNosis for AUStria) was used, a yield and silvicultural science-based model, consisting of several sub-models, including a basal area increment model, a height increment model, a tree recruitment model and a model describing tree mortality.

The models are described in more detail in Umweltbundesamt 2013b.

The data structure of activities, input data, emission factors and emission calculations is based on SNAP categories (Selected Nomenclature for sources of Air Pollution). The structure of output data is presented and aggregated in the Common Reporting Format (CRF) of the UNFCCC. Sectoral definitions align fully with the IPCC. For the purpose of transparency CRF source categories are specified in the headings and tables, respectively.

5.4.2 Key Input Parameters

A summary of key variables used for both scenarios is given in Table 5.12.

Table 5.12: Key input parameter of emission projections.

Year	2010	2015	2020	2025	2030
GDP [bio€ at 2010 price]	286	312	340	372	410
GDP annual growth [%]	3.7	1.5	1.5	1.5	1.5
Population [1 000]	8 382	8 555	8 733	8 889	9 034
Stock of dwellings [1 000]	3 683	3 820	3 957	4 096	4 166
Heating degree days	3 241	3 166	3 100	3 053	3 006
Exchange rate [US$ /€]	1.33	1.30	1.30	1.30	1.30
International coal price [US$/t]	99.2	105	109	113	116
International oil price [US$/bbl]	78.1	106	118	127	135
International gas price [€/GJ]	7.1	9.3	10.4	11.3	11.9
CO_2 certificate price [€/t CO_2]	13	15	20	25	30

The emission projections presented do not include the emission cuts by the number of allowances allocated to installations, but represent real emissions as forecast under the provided assumptions. The European ETS was assumed to continue beyond 2020 and a significant shortfall in emission certificates ensuring a substantial price for certificates was presumed. Furthermore, it has been assumed that the price is not influenced by decisions of Austrian plant operators.

5.4.3 Differences to Previous National Communication

In general, there are three main factors influencing these changes:

- Recalculations in the GHG inventory, which have been triggered by methodological changes. Methodological changes have to be applied consistently for the calculation of historical and forecast emissions.
- Assumptions for activity forecasts have changed. These changes can be triggered by revised economic or technical scenarios, additional policies and measures considered, and revisions of policies or measures due to amendments to legal texts.
- Changes of the models used for activity or emission scenarios.

The national energy balance is one of the most statistics for the calculation of the GHG emission inventory – improvements of the energy balance, including a more detailed breakdown of data, have been incorporated. Individual emission factors in some sectors (e.g. solvents, agriculture, waste) have been updated. An extensive survey of the F-gas sector in Austria has been used to improve the inventory and to

develop new projections. Results of the new forest inventory have been incorporated in the inventory of the LULUCF sector.

The economic crisis in 2009/09 has been taken into account. A lower GDP growth for the coming decades is assumed and in general, input parameters for the projections have been updated according to current knowledge. Of course, measures implemented since the latest national communication have been taken into account as well as new or updated plans of measures.

Regarding model changes, a new macroeconomic model was used, as well as new models for electricity demand and supply and for energy demand of households.

In addition the time horizon for scenarios has been extended to 2030. More details can be found in Umweltbundesamt 2013b.

5.4.4 Sensitivity Analysis

The sensitivity analysis regarding the energy sector was based on the influence of economic growth on GHG emissions from transport, energy industries and manufacturing industries and construction, as well as the influence of changes in fuel prices and subsidies on GHG emissions in the residential and commercial sector. All these assessments are based on model results, obtained by calculating the effects on the Energy sector.

It is necessary to mention that the emission results in general are not linearly dependent on changes of an input factor. This is the reason why the presented sensitivity data cannot be seen as a functional dependency with varied parameters. The emission effect can only be seen for the specific values of the given parameters.

Two complete scenarios with different assumptions on economic growth and energy prices were calculated, based on the "with measures"scenario. The input main variables are summarised in Tables 5.13 and 5.14. Main difference was a higher average economic growth of 2.5 % per year in the "Sensitivity 1" scenario and a lower growth of 0.8 % per year in the "Sensitivity 2" scenario.

Table 5.13: Key input parameter for "Sensitivity 1".

Year	2010	2015	2020	2025	2030
GDP [bio€ at 2010 price]	286	329	379	438	510
GDP annual growth [%]	3.7	2.5	2.5	2.5	2.5
International coal price [US$/t]	99.2	105	112	121	131
International oil price [US$/bbl]	78.1	111	130	153	180
International gas price [€/GJ]	7.1	9.6	11.5	13.6	16.1
CO_2 certificate price [€/t CO_2]	13	17	30	35	40

Table 5.14: Key input parameter for "Sensitivity 2".

Year	2010	2015	2020	2025	2030
GDP [bio€ at 2010 price]	286	302	318	336	356
GDP annual growth [%]	3.7	0.8	0.8	0.8	0.8
International coal price [US$/t]	99.2	104	107	109	110
International oil price [US$/bbl]	78.1	100	108	113	117

International gas price [€/GJ]	7.1	9.0	9.9	10.1	10.2
CO_2 certificate price [€/t CO_2]	13	13	15	17	20

The model calculations show up to 12 % higher emissions for “Sensitivity 1” compared to the “With Measures” scenario and up to 5 % lower emissions for “Sensitivity 2”. The results are illustrated in Figure 5.4 and Table 5.15. More details on the sensitivity analysis can be found in Chapter 3 of Umweltbundesamt 2013b.

Table 5.13: Results of the sensitivity analysis – total GHG emissions in CO_2 equ.

	Inventory data			Scenario			
	1990	**2000**	**2011**	**2015**	**2020**	**2025**	**2030**
With Measures	78.16	80.20	82.84	82.4	81.6	82.8	84.0
Sensitivity 1				83.9	87.1	91.9	94.3
% change to WM				*+1.8*	*+6.7*	*+11.0*	*+12.2*
Sensitivity 2				81.9	79.9	79.8	80.2
% change to WM				*-0.7*	*-2.1*	*-3.6*	*-4.6*

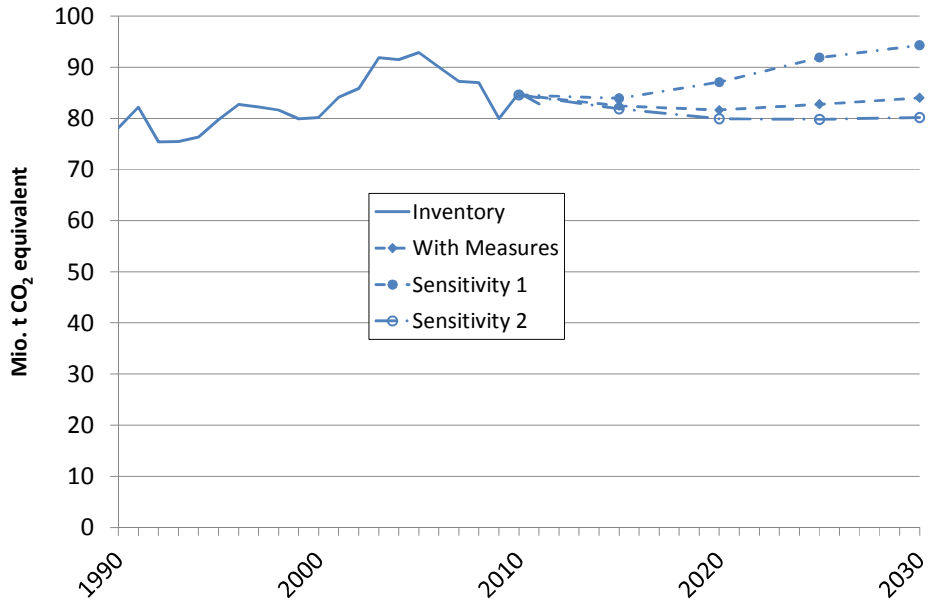

Figure 5.4: Results of the sensitivity analysis.

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Chapter 6

Vulnerability Assessment, Climate Change Impacts and Adaptation Measures

6.1 Expected Impacts of Climate Change

Funded by the Austrian Climate and Energy Fund, several scientific institutions – under the title "Austrian Panel on Climate Change"[1] – have compiled a report on the aspects of climate change relevant for Austria. The "Austrian Assessment Report" is divided into three parts. Part 1 deals with the physical science basis, part 2 with consequences for society and nature and part 3 with mitigation and adaptation. The report is based on peer-reviewed publications and is written by lead authors and contributing authors, co-ordinated by two contributing lead authors for each part. The report has undergone a thorough external review and is expected to be published in 2014. The Austrian Assessment Report will provide an up-to-date and comprehensive as well as detailed description of the results of climate change research in Austria and should be consulted for in-depth information.

A few results of recent research should be highlighted in the next paragraphs:

Temperature has increased by 2°C in total since the mid 19th century in the larger alpine area. There was a slow increase of 1°C from the mid 19th to the mid 20th century; after a period with rather constant temperature a fast increase occurred within the last two decades of the 20th century. Climate scenarios show a continuation of the increasing trend for Austria, with a increase of 0.25°C per decade in the next decades. Increase of mean temperature in the second half of the current century heavily depends on the GHG emission path; for the A1B emissions scenario an increase of 0.36°C is projected.

Sunshine duration has increased by about 20 % with the last 130 years, to a large extent after 1980.

Precipitation trends show considerable regional differences. Since the mid 19th century an increase of about 10 to 15 % has been observed in the north-west of the larger alpine area, whereas a decrease of comparable extent has been observed in the south-east. In Austria the same trends can be observed in the western and south-eastern parts; in northern and central Austria no clear trend can be found. Model results let expect a continuation of the trends, with a seasonal shift of precipitation from summer to winter.

Modelling results for **extreme events** are in general much more uncertain than results for average data. There is evidence that the occurrence of heat waves will increase in parallel to mean temperature. For extreme events of wind and precipitation no reliable projections can be made.

Impacts on hydrological systems include seasonal shifts in runoff and increasing temperature of rivers and lakes, increasing evaporation and decreasing soil moisture in spring and summer. Snow cover will be reduced in regions of low and medium altitude, glaciers will continue to shrink.

Impacts on ecological systems include changes in ecosystem composition, migration of species (with a loss of species adapted to cold conditions), biomass increase in mountain forests on the one hand and intensified disturbance regimes in coniferous forests, and regional shifts of conditions relevant for agriculture and crops.

[1] www.apcc.at

Impacts on society include issues that are directly relevant for human health (heat waves, improved conditions for yet non-endemic infectual diseases and allergen plants) or indirectly (potential increase of extreme events) as well as impacts on economy (changes of weather conditions that are relevant for tourism, but also potential increase of extreme events which may affect infrastructure and buildings).

6.2 Vulnerability Assessment

The Austrian Strategy for Adaption to Climate Change contains a vulnerability analysis, differentiated according to the areas of action. The analysis builds mainly on the expected temperature- and precipitation-induced effects, some examples of the effects and resulting vulnerability assessments are listed below.

A**griculture and forestry** are strongly dependent on meteorological and climatic factors and are assessed as sectors with high vulnerability. There is considerable regional variability of vulnerability. Heat stress, reduced water supply due to changing precipitation patterns, new invasive species and pathogens may affect crop production and grassland as well as animal husbandry. Comparable risks exist for forestry, where changes may be faster than the life-cycle of trees and common tree species may not be fit for changed circumstances. Forest fires due to longer periods with reduced precipitation have to be seen as additional risk in this sector.

Vulnerability with respect to **water resources and water management** exhibits strong regional variability. Increase in precipitation and runoff in winter and decrease in summer is expected for some regions and may have impacts on shipping, quality of water bodies and aquatic biocenoses, the latter also being affected by increasing water temperature. In southern and eastern Austria, a decrease in groundwater recharge is likely. On a small scale, existing bottlenecks in water supply in areas with unfavourable water resources could worsen. Seasonal changes of precipitation patterns and earlier melting of snow may shift the risk of flooding into spring and winter in northern Austria, but there is high uncertainty regarding this topic.

Tourism is assessed to have high to low vulnerability. Depending on the region, winter snow cover may be considerably reduced, resulting in considerable losses in winter tourism. Low vulnerability is assumed for summer tourism as well as city tourism and health and spa tourism, which may benefit from increasing air and water temperatures, less rainfall in summer and an extended summer season on the one hand but which bear risks from worsening water quality of warmer lakes, heat waves in cities and lower diversity in the natural scenery (biodiversity, glacier retreat) on the other hand.

In the **energy** sector vulnerability is expected to be low for space heating because of decreasing energy demand of buildings and decreasing heating degree days. High vulnerability is expected for cooling of buildings, as cooling degree days will increase and periods of high electricity demand for cooling may coincide with unfavourable conditions for electricity production. Electricity production by thermal power plants are assessed as vulnerable, because increasing temperatures of ambient air and cooling water deteriorate efficiency and availability of thermal plants. Run-of-river power plants may be affected by seasonal changes in runoff, but current data does not al-

low for a reliable estimate of vulnerability. Supply of renewable energy sources is heavily influenced by climatic conditions; especially production of forest biomass is expected to be highly vulnerable in some regions.

In **construction and housing**, existing buildings are – regionally different – highly vulnerable to e. g. heat waves in urban areas, to more frequent events of heavy rain, to increased snow loads, to increasing frequency of local-scale floods as well as avalanches and landslides. Some of these risks may be minimised by renovation measures and most risks may be avoided for the construction of new buildings.

Different grades of vulnerability can be found concerning **human health**. Vulnerability to heat stress is high for children, elder people and people with heart diseases and lower for the rest of the population. Vulnerability to increasing levels of ground-level ozone and increasing UV-radiation is high for sensible parts of the population but moderate for the general population. Changed climatic conditions may be favourable for the spread of pathogens, vectors and allergic plants, which poses a risk for population in general.

Ecosystems and biodiversity are assessed to by highly vulnerable to the expected changes, like increasing temperature and changed precipitation patterns. Especially regions with a high share of endemic species like alpine regions must be seen as highly vulnerable. Changes in species composition, spread of alien species and loss of habitats and species must be expected.

Vulnerability is expected to be high for **transportation infrastructure** in some regions. Increase in the amount of snow at elevations above 1800 m, potentially accompanied by a higher risk of avalanches in certain regions, and thawing of permafrost, resulting in rock-fall and land-slides, may affect infrastructure in higher regions. Heavy precipitation on local level can result in drainage system overloads and the flooding of underpasses as well as in increasing risk of landslides and mud flows; erosion and washouts can threaten the stability of railroad embankments and road beds. Increased heat stress can result in damage to materials and structures, as well as the deformation of pavement and rail infrastructure.

For **industry and trade** vulnerability in general is assessed to be moderate. Higher temperatures and heat waves increase the cooling requirements for the storage and transport of various products and affect working conditions. Decrease in the availability of cooling water can affect cooling-intensive production as well as power generation. Potential changes in the availability of raw materials and intermediate products due to changes in temperature and precipitation conditions can have an impact on the entire value chain. Through globalisation, both the supply for production in Austria and the sales of Austrian products will be influenced by climate effects in other regions of the world.

Current climate scenarios do not allow for an assessment of the future trend for extreme events, like storms and hail, floodings and landslides. Most of the sectors mentioned above, however, would exhibit considerable vulnerability to an increase of the frequency and intensity of extreme events.

More details on the vulnerability assessment can be found in Section 5.3 and in the Annex of BMLFUW 2013.

6.3 Adaptation Measures

6.3.1 Status Quo

Austria has already been dealing with the issue of adaptation to climate change for quite a long time. As an alpine country Austria is used to adapt to environmental risks since centuries, and the Forest Engineering Service in Torrent and Avalanche Control – the federal body responsible for natural hazards management – has a history reaching back into the 19th century. The permanent implementation of new measures against natural hazards motivated by socio-economic and land-use changes is beneficial for adapting to climate change. Austrian adaptation measures in the last decade can therefore be distinguished in existing, continuously optimised measures related to environmental risks and measures directly motivated by impacts of an observed climate change. Direct climate change motivated adaptation measures have been initiated by regional administrations as well as by private companies, the latter concerning e.g. artificial snow making to safeguard ski tourism and insurance products for agricultural production.

At the level of the federal states (*Länder*), a variety of initiatives have already been enacted, ranging from research projects to concrete measures in individual sectors. All nine federal states appreciate climate change adaptation as a part of an integrated climate mitigation policy. In some federal states, state-specific strategies for adaptation are in preparation; in Upper Austria the strategy has already been adopted.

Examples for *Länder* measures are touristic concepts and water management measures for an important large lake in eastern Austria, research projects devoted to impacts and adaptation measures in the Alps, projects for flood risk management and spatial planning, protection of forests and habitats, and concepts for safeguards against summertime overheating of buildings in urban areas. A considerable share of projects were carried out at transnational level, funded by EU programmes.

Details on the initiatives at regional level can be found in Chapter 10 of BMLFUW 2013.

6.3.2 Development of the National Strategy

At both the international and European levels, the issue of climate change adaptation has become a major focus of attention. The obligation to develop a national adaptation strategy can be found in the United Nations Framework Convention on Climate Change, as well as in Art. 10 (b) of the Kyoto Protocol, which came into force in 2005. These agreements require the signatory parties to develop, implement, and update national and (where appropriate) regional programmes that facilitate adequate adaptation to climate change. In addition, at the international level, the Nairobi Work Programme (NWP) of the UNFCCC has contributed to a better understanding of the impacts of climate change and adaptation options. Starting in 2007 with the

European Commission's Green Paper on Climate Change, the development of adaptation strategies gathered momentum in the European Union.

The development process of the Austrian adaptation strategy began in September 2007, initiatiated by the Austrian Ministry of Agriculture, Forestry, Environment, and Water Management. It was based on the outcome of the "Current State of Adaptation to Climate Change in Austria" (Gingrich et al. 2008).

Between June 2008 and November 2011 recommendations for adaptation in 14 areas for action were successively developed from a scientific perspective, commissioned by the Lebensministerium and the Austrian Climate and Energy Fund. Conclusions regarding sectoral and regional climate impacts as well as a first qualitative evaluation of vulnerabilities supported the development of draft adaptation measures. On the basis of a literature review and a written survey involving numerous experts, concrete recommendations for 14 areas for action were formulated. In order to specify the recommendations with a view to their implementation, an acompanying participatory process including some 100 organizations was undertaken between the summer of 2008 and July 2011.

Based on the above mentioned studies, the first political position paper (Policy Paper: The Path to a National Adaptation Strategy – First Draft) was published in July 2009. A second draft was published in October 2010. The policy paper has been continuously revised and expanded and developed towards the Austrian adaptation strategy. Informal workshops hosted by the Lebensministerium have accompanied the development process of the national adaptation strategy. Between September 2007 and November 2011, a total of six workshops were organized in which the current state of work was presented and discussed with a wide audience.

The strategy (BMLFUW 2013) was adopted by the Federal Government in October 2012 and by the *Länder* in May 2013.

6.3.3 Recommendations for Action

In total 132 recommendations in 14 areas have been included in the National Strategy for Adaptation. The Action Plan, as the second part of the Strategy, describes the recommendations in detail. The Action Plans lists a. o. the objective, relations to other instruments, status of implementation, further steps, necessary ressources and responsibilities for every recommendation.

The following areas are covered by the recommendations:

- Agriculture
- Forestry
- Water Resources and Water Management
- Tourism
- Energy – Focus on the Electricity Industry
- Construction and Housing
- Protection from Natural Hazards
- Disaster Risk Management
- Health

- Ecosystems/Biodiversity
- Transportation Infrastructure and Selected Aspects of Mobility
- Spatial Planning
- Business/Industry/Trade
- Cities – Urban Green and Open Spaces.

The recommendations are too comprehensive to be described here, an overview can be found in Chapter 15 of BMLFUW 2013.

6.3.4 Implementation of the Strategy

Implementation of the National Adaptation Strategy has to be done in close cooperation with Federation, *Länder* and local authorities. The implementation of the recommendations will have to be achieved within the existing jurisdictions of all governmental authorities. Under the current circumstances implementation of the recommendations has to be covered by the resources available in the applicable financial frameworks of the public sector. Integration of adaptation principles into existing instruments and structures of the policy making and administration will be necessary. Given the short term and long term perspectives of adaptation, prioritization of adaptation measures will be necessary in the implementation process.

Evaluation of the implementation process is essential for the success of adaptation to climate change. Currently criteria for assessing the implementation success of the Austrian adaptation strategy are under development. A pragmatic and easy to apply evaluation tool for the estimation/assessment of the status quo in climate change adaptation in the defined areas for action will be designed on the basis of international experiences. A first implementation report including a clear description of the state of implementation of the Austrian adaptation strategy is planned to be finalised by the end of 2014.

An economic evaluation of the consequences of climate change is currently under preparation. It aims at a quantification of the costs of inaction as well as the costs of adaptation measures.

The current Austrian adaptation strategy is the first political milestone in addressing the consequences of climate change. However, the document must be further developed on a regular basis to reflect the growth in knowledge and factual needs. The Austrian adaptation strategy should therefore be regarded as a kind of “living document”. The further evolution of the adaptation strategy will in any case incorporate new scientific/practical insights, such as regards the vulnerability of each area for action. A first updated version of the Austrian adaptation strategy is envisaged for the end of 2015.

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Chapter 7

Financial Resources and Transfer of Technology

Climate finance is a key element in tackling climate change at the global level. In this context, Austria is fully committed to meeting its climate finance commitments under the Convention. We have provided new and additional financial resources in accordance with Article 4 paragraph 3 of the Convention from the very beginning and are committed to doing so in the future. Details of Austria's performance through bilateral and multilateral channels, including the Global Environment Facility (GEF), are contained in tables 7.1 to 7.6, respectively.[1]

7.1 Provision of "New and Additional" Resources

The definitional scope of "new and additional" resources is regularly discussed in UNFCCC negotiations. Different Parties attach different meanings to the term, offering room for debate. In light of the ongoing discussions, Austria takes a neutral stance in the debate. We count as "new and additional" all climate finance resources that underpin a gradual and substantial scaling-up of climate finance over the years since the Convention and its Kyoto Protocol entered into force. Indeed, as is further elaborated under section 7.3 and in the tables in this chapter, Austria's climate finance contributions have been scaled up significantly over the past years, including in the years following the publication of our fifth National Communication.

Table 7.1: Financial contributions to the Global Environment Facility (GEF)

	Contribution (millions of US dollars)			
	2009	**2010**	**2011**	**2012**
Global Environment Facility		18.54		

7.2 Assistance to Developing Country Parties that are Particularly Vulnerable to Climate Change

We believe that a focus on the poorest and most vulnerable developing countries is a priority in the area of climate finance. We therefore concentrate bilateral financial resources mainly on LDCs and Africa. In order to maximise synergies with non-climate development finance, our focus is largely on the Austrian Development Cooperation's six key regions and priority countries in Africa, Asia, Central America and South-Eastern and Eastern Europe (see tables 7.3 to 7.6 for further details).

7.3 Provision of financial resources

Austria's climate finance has increased continuously from 1992 onwards. Milestones for increasing our climate finance contributions include 1997 (Kyoto Protocol), 2001

[1] All data is based on the use of OECD-DAC "Rio markers" and OECD-DAC exchange rates.

("Marrakech Accords"), 2006 ("Bonn Declaration") and 2009 (Copenhagen Accord), respectively. In the last three years, we have met – and indeed even slightly exceeded – our commitments under Fast-Start Finance in the period of 2010 to 2012.

Table 7.2.: Climate Change relevant financial contributions to multilateral institutions and programmes

Institution or programme	**Contribution (millions of US dollars)**			
	2009	**2010**	**2011**	**2012**
Multilateral institutions:				
1. World Bank	0.41	5.16	2.78	2.57
2. IFC	3.34	14.04	8.06	4.50
3. AfDB				
4. ADB	0.27		4.86	
5. EBRD	8.35	15.89	5.56	6.42
6. IADB	0.41			1.15
7. UNDP **- Specific programmes**				
8. UNEP **- Specific programmes**				
9. UNFCCC **- Supplementary Funds**	0.09			0.06
10. OeEB (Austrian Development Bank)	1.81	1.45	0.14	1.03
11. IPCC	0.03			0.06

Table 7.3: Bilateral and regional financial contributions related to the implementation of the Convention, 2009 (millions of US dollars)

	Mitigation					Adaptation		
Recipient country/region	**Energy**	**Transport**	**Forestry**	**Agri**	**Waste mgmt**	**CB**	**Coastal Zone mgmt**	**Other v'bility assmts**
Bhutan	2.48		0.44					
Bolivia	0.12							
Burkina Faso	0.34	0.10	0.10	2.79	0.50			
Central America &Caribbean (regional)	2.78							
Himalaya/Hindukush (regional)	0.68							
LDCs (unallocated)						0.30		
Macedonia (FYRO)	1.73				0.10			
Nicaragua			0.70					
Senegal			0.30					
Serbia	0.04		0.80	0.08				
Southern Africa (regional)	0.68							
South Eastern Europe Region	0.15		0.15	0.05	0.15			
Sub-Saharan Africa (multi-country)	1.00							
Western Africa (regional)	1.80							

Table 7.4: Bilateral and regional financial contributions related to the implementation of the Convention, 2010 (millions of US dollars)

	Mitigation					Adaptation		
Recipient country/region	**Energy**	**Transport**	**Forestry**	**Agri**	**Waste mgmt**	**CB**	**Coastal Zone mgmt**	**Other v'bility assmts**
Burkina Faso						0.80		
Himalaya/Hindukush (regional)	0.15		0.25	0.25				
Nicaragua	0.30	0.06	1.00	0.15	0.30			
Serbia	0.06	0.02			0.20			
Sub-Saharan Africa (multi-country)						0.30		
Tajikistan	0.07							
Uzbekistan	0.20							

Table 7.5: Bilateral and regional financial contributions related to the implementation of the Convention, 2011 (millions of US dollars)

	Mitigation					Adaptation		
Recipient country/region	**Energy**	**Transport**	**Forestry**	**Agri**	**Waste mgmt**	**CB**	**Coastal Zone mgmt**	**Other v'bility assmts**
Africa (regional)						2.08		
Argentina			0.01					
Asia (regional)	2.00							
Burkina Faso	0.01					2.22		
Bhutan	1.80							
Cape Verde						0.03		
Central Asia (regional)			0.41					
Egypt	0.27							
Ethiopia			4.04					
Georgia			2.08					
Indonesia						3.20		
Latin America (regional)			1.40					
Nepal								0.73
Nicaragua			0.27					
North and Central America (regional)	0.83							
Peru	0.07							
Serbia	0.14							
South Africa	0.27							
South and Central Asia (regional)						0.97		

South East Europe (regional)			0.97					
Sub-Saharan Africa (regional)	0.03					1.40		
Uzbekistan				0.27				

Table 7.6: Bilateral and regional financial contributions related to the implementation of the Convention, 2012 (millions of US dollars)

	Mitigation					Adaptation		
Recipient country/region	**Energy**	**Transport**	**Forestry**	**Agri**	**Waste mgmt**	**CB**	**Coastal Zone mgmt**	**Other v'bility assmts**
Africa (regional)	0.38							
Bangladesh							0.43	
Bhutan			1.41					
Brazil			0.01					
Burkina Faso						5.57		
Caribbean (regional)						0.65		
Central America (regional)	0.77							
DR Congo			0.61					
Ethiopia	0.81		2.19					
Georgia			0.74					
Kyrgyzstan								0.25
Laos						0.64		
Moldova						1.44		
Mozambique				2.05				
South East Europe (regional)	1.73							
Serbia	0.13							
South and Central Asia (regional)						1.22		
Sub-Saharan Africa (regional)	2.55					2.44		
Uganda			0.90			1.93		
Western Africa (regional)	1.67		0.77					

Western Balkans (regional)						1.67		

7.3.1 Adaptation Fund

Austria contributes to the Adaptation Fund through the Share of Proceeds levied on the issuance of Certified Emission Reductions (CERs) under the Kyoto Protocol's Clean Development Mechanism. In the period of 2009 to 2012, our national JI/CDM Programme purchased a total of 11.956,286 (primary) CERs; this amounts to a contribution of 244,006 CERs to the Adaptation Fund.

7.4 Activities Related to Transfer of Technology

7.4.1 General overview and background information

Austria is a pioneer nation in environment topics of the future. Austrian cutting-edge technologies in the fields of solar energy and photovoltaics (for hot water supply and supplementary heating, but also for environmentally sound refrigeration and the production of cold from heat), wind and hydropower for the generation of electricity, biomass (for the generation of electricity, heat and organic fuels), waste treatment, air and water purification as well as ecological construction are meanwhile used world-wide. Austria's vision continues - not only to become a leading supplier of environmental technology and services[2] - but also to achieve domestic energy autarky. The model regions for green mobility and for climate and energy are driving forces on our way towards the self-sufficiency. But it is obvious: Energy autarky cannot be achieved overnight; it requires great efforts and the restructuring of the energy and economic systems for the long term, but Austria could manage to generate sufficient amounts of energy from water, the sun, wind and biomass by the year 2050. More than in other sectors this boom is perceptible in the field of environmental technology. About 210,000 people are currently employed in Austria's environmental sector, representing an increase of 7.9 % in 'green' jobs. According to a new study[3] the turnover generated alone in the producing environmental technology sector has increased more than five times since 1993 and amounted to Euro 8.2 billion in 2011. Euro 6 billion were due to exports. In order to support the trend the Austrian Federal Ministry of Agriculture, Forestry, Environment and water Management (BMLFUW) and the Austrian Federal Economic Chamber (WKÖ) launched the Austrian environmental technologies export initiative.

The joint environmental-technologies export initiative of the Federal Ministry of Agriculture, Forestry, Environment and Water Management and the Federal Economic Chamber is a vital contribution to global environmental protection. The initiative provides support and strengthens the export orientation especially of SME's and hence supports technology transfer. The information events abroad present the offers and problem-solving capacities of Austrian environmental technology and service providers. In addition to the opportunity of participating in various seminars on the target markets, participants present their environmental-technology products and services right on the spot. The goods and services offered by the enterprises

[2] as a percentage of GDP
[3] WIFO 2013 „Austrian environmental technology industry"

selling environmental technologies are presented also in joint catalogues and business guides. Austrian environmental-technology products and services has been presented, so far, in Croatia, Russia, Romania, Bulgaria, South Korea, Ukraine, China , the United Arab Emirates, Jordan, Syria, Hungary, Tunisia, Japan, the United States, Canada, Turkey as well as the United Nation. In 2013 the Austrian environmental technologies export initiative stopped over at the IE Expo in Shanghai. Furthermore in 2013 study trips of experts including meetings and presentations in Chengdu, Chongqing and Shenyang (P.R.China) was organized.

The Federal Ministry for Transport, Innovation and Technology (bmvit) respectively the Staff Group for Technology Transfer and Security Research also supports activities with regard to technology transfer. According to the work programme of the Austrian Government, the mission of bmvit in the area of technology transfer is, to increase the share of Austrian technologies in the overall exports and therefore save and or create jobs in the Austrian infrastructure technology industry.

Background:

- Export offensive of the Austrian Government with the target to support Austrian companies; Effect shall be an increase of the Austrian added value; bmvit supports mainly infrastructure technology projects; financing facilities: export guarantees or Soft Loans;
- 2005: Formation of the Staff Group for Technology Transfer and Security Research in bmvit, directly reporting to the Vice-Minister responsible for all matters of Innovation;
- Close cooperation between Staff Group and all other relevant organizations concerning Technology Transfer like the Federal Chancellery, Federal Ministry for European and International Affairs, Federal Ministry of Economy, Family and Youth, Austrian Chamber of Commerce, etc.

Activities:

- Mobility has become a high priority in today's society and is central to our individual well-being and to our common economic development. Mobility of people and goods makes it possible to share ideas and products with people from around the world and also impacts choices for business locations.
- At the same time, the ever increasing demand for mobility has created or amplified the major transport issues: accidents and casualties, traffic congestion, emissions including greenhouse gases, and energy consumption and dependency, to name but some.
- Today's transport policy challenge is to strike a balance between ensuring mobility for people and goods while avoiding or reducing negative consequences, thus ensuring long-term sustainability in a double sense. In addition, new challenges arise from the rapid pace of urbanisation and ageing populations. Intelligent Transport Systems (ITS) solutions are a key enabler in addressing several of these challenges. By collecting, exchanging and using data and information related to the mobility of persons and goods, ITS can provide appropriate and flexible management and information tools for all actor groups involved (policy, administration, infrastructure operators, transport service providers, industrial and private users) and therefore improve daily mobility for all. The implementation of ITS can also create employment and contribute to economic growth. Thus ITS have to be seen as an effective instrument for policy makers to achieve transport

policy objectives with respect to safety, efficiency and environmental sustainability and in order to save public funds.

- ITS is only part of the bigger scale approach with “Smart City” concepts. Along with the Austrian Institute of Technology, bmvit is highly involved in the elaboration of smart city concepts. Those concepts lead to:
    - Reduction of energy consumption
    - Reduction of emissions– in particular fine dust PM 10
    - Sustainable mobility, e-mobility
    - Involvement of local players, multipliers, Citizens
- Resent activities of bmvit in that matter: Close cooperation with the People’s Republic of China in implementing a smart city concept “Made in Austria” in a pilot region. Bmvit has also started an intensive dialogue concerning smart cities as well as ITS with the Republic of India.
- With several countries bmvit is also very active concerning the construction and operation of hydro power plants. Austrian hydro power technologies are used for energy generation in Bhutan, India, Russia, Serbia and Brasilia, just to name a few.

The Ministry of Economy is also active in the field of technology transfer, in particular in China. In 2005 a partnership related to energy and environmental technology was initiated between the two governments. In implementing this initiative the Ministry of Economy and the National Reform Commission (NDRC) of China signed a Memorandum of Understanding. This Memorandum was extended during the bilateral visit of the President of the People’s Republic of China in October 2011 in Vienna. On the basis of the Memorandum several Austrian companies had first consultations concerning pilot projects. Another initiative is the cooperation with the “Ecopark” in Nantong, where Austrian know how and technology, in particular in the fields of solar energy and energy efficient buildings, should be used.

7.4.2 Engagement in international networks and fora

Austria is member of institutions and initiatives that have the exchange of research results and transfer of technology as a main target, e.g. the International Energy Agency and the Climate Technology Initiative (CTI). Austria is member of the CTI Board of Management and hosted several workshops and conferences in Vienna, some together with the UNIDO. Recent activities are related to the Private Financing Advisory Network (PFAN) which is a multilateral, public-private partnership initiated by the Climate Technology Initiative (CTI) in cooperation with the UNFCCC Expert Group on Technology Transfer. PFAN operates to bridge the gap between investments and clean energy businesses.

Austria is also member of REEEP (Renewable Energy and Energy Efficiency Partnership, located in Vienna) which is a public private partnership for scaling up clean energy business models in developing countries and emerging markets. REEEP collaborates with CTI PFAN on business models for technology transfer.

Since 1999 Austria is playing a key role as initiator and supporter of the Global Forum on Sustainable Energy (GFSE). GFSE is a neutral multi-stakeholder platform which is facilitating international dialogue on energy for sustainable development by taking into accounts the special interests and challenges of developing countries. It

plays a crucial role in facilitating sustainable energy projects, by bringing together donors, investors and project developers.

7.4.3 Technology transfer in the ADC sustainable energy sector

Ten years ago, most of ADC[4]s financial support to the energy sector was dedicated to the construction and maintaining of hydropower plants for the national energy supply of partner countries. In 2007, the first contribution agreement to the regional "Energy and Environment Partnership" (EEP) in Central America was signed, and since 2009 the focus of ADCs energy portfolio is on regional initiatives that support the development and dissemination of decentralised renewable energy solutions. Therewith, the support of applied research and technology transfer gains importance within the energy portfolio.

Although not all renewable energy sources are equally recommended in view of their direct GHG emissions, it has to be taken into account that in Africa, where most of the above mentioned regional initiatives take place, almost all energy currently used is coming either from fossil fuel and gas, or from wooden biomass. In this regard, a switch to energy efficient solutions or any non-wood renewable energy source is a significant contribution to combatting deforestation and therewith indirectly mitigating atmospheric GHG emissions.

Some examples:

Project/programme title: Contribution to the Energy and Environment Programme in Southern and Eastern Africa			
Purpose: Broad range and increased level of renewable energy service solutions adopted in energy related policies and strategies and implemented by public and private stakeholders			
Recipient country	**Sector**	**Total funding**	**Years in operation**
Southern Africa Region	power generation/ renewable sources	EUR 1.000.000.- (from Austria, in total 9,5 Mio EUR, lead donor = Finland)	January 2010 – December 2012
Description: The Southern and East Africa Energy and Environment Partnership Programme (EEP S&EA) is one of the five EEP programmes currently in execution and one of the four which were launched in the last 3 years based on the successful experience of the pioneer EEP programme implemented in Central America since 2002. The programme became operational in March/April 2010. The starting point for the EEP-S&EA was the fact that Africa has abundant untapped renewable energy sources that could become the backbone of a reliable, affordable and low-carbon energy system. However, renewable energy and energy efficiency are facing various barriers, like lack of financing, subsidies and knowledge in these regions. Furthermore, the existing technologies have not been widely tested and adopted in the partner countries and there was a high expectation that an EEP programme could help find the most suitable solutions for local conditions. The overall objective of the EEP-S&EA is increased access to modern, affordable and reliable energy services through an increased usage of renewable energy technologies. The overall objective is expected to be reached by achieving result areas: (i) Market understanding, institutional support and knowledge management; (ii) Opportunities for public and private financing for project and business development; and (iii) Financing implementation of national or regional pilot and demonstration projects.			

[4] Bilateral Austrian Development Cooperation

Indicate factors that led to project's success: Because of the institutional arrangement adopted for the EEP S&EA implementation, the countries have definitively been provided ownership of the activities, with projects following the overall national objectives and using the local systems in place

Technology transferred: all types of renewable energy and energy efficiency solutions

Impact on greenhouse gas emissions: the EEP outcome analysis conducted in November 2012 estimated that the expected installed capacity correlates to an emission saving potential of up to 95 kt CO_2eq per year

Project/programme title: Preparatory and first operational phase of the ECOWAS Regional Center for Renewable Energy and Energy Efficiency (ECREEE)

Purpose: Increase access to modern energy services by promoting the adoption of renewable energy and energy efficient technologies and services in ECOWAS member states thereby supporting the region's economic and social development in an environmentally benign manner.

Recipient country	Sector	Total funding	Years in operation
West Africa Region	energy policy and administrative management	EUR 1.800.000.- (partners = UNIDO, recipient countries)	November 2009-April 2013

Description: This project aimed to establish and operationalize the ECOWAS Center for Renewable Energy and Energy Efficiency (ECREEE). The activities of ECREEE are aimed at increasing access to modern energy services through increased deployment of renewable energy technologies and improve energy security by promoting energy efficiency technologies and services in line with sustainable development needs of the region. This will be achieved by the establishment of functional renewable energy and energy efficiency markets in the region through developing regional policy and regulatory frameworks, enhancing capacities of market players and enablers, knowledge management, and research and technology transfer. ECREEE will play a catalytic function in support of ECOWAS member states' effort to address energy challenges both individually and collectively. The services of ECREEE will be continuously refined in response to changes and emerging challenges in the renewable energy and energy efficiency markets in the region. As such the ECREEE will continuously provide demand driven services.

Indicate factors which led to project's success:

- The strong cooperation with all ECOWAS member state ministries implied strong regional ownership that can be shown by engagement of the member states own budgets
- The mixture of local and international staff in ECREEE ensures good exchange of ideas and know-how transfer (in both directions)
- A region-wide call for proposal which led to a high visibility of the center, and a higher awareness for renewable energy and energy efficiency within the region
- International visibility activities helped to interest a broader range of donors for upcoming years
- A consequent strategic approach led to a long-term business plan, adopted by all member states

Technology transferred: all types of renewable energy and energy efficiency solutions

Impact on greenhouse gas emissions: The ECOWAS region has significant but unevenly distributed energy resources yet inter-state energy trade is minimal. Traditional biomass is the main source of energy for the majority poor and accounts for 80% of total energy consumed for domestic purposes. This is why all types of renewable energy solutions can be regarded as contribution to avoid deforestation and GHG emissions, even if the exact amount of avoided GHG emissions is difficult to estimate.
A total of 23,000 MW of hydroelectric potential is concentrated in five of the 15 Member States, of which only 16% has been exploited.. There are considerable wind energy resources along the coastal region and on specific sites inland and the region has vast solar energy potential with very high radiation averages of 5 to 6 kWh/m2 throughout the year that largely go unexploited.

Project/programme title: Southern African Solar Thermal Training and Demonstration Initiative

(SOLTRAIN)			
Purpose: broad dissemination of technically improved solar thermal systems in the participating SADC countries			
Recipient country	**Sector**	**Total funding**	**Years in operation**
Mozambique, Namibia, South Africa, Zimbabwe	Solar energy	EUR 680.000.- (2009-2012), EUR 1.675.900.- (2012-2016)	March 2009-August 2012, new phase from September 2012 on
Description: The overall goal of this project is to contribute to the switch from a fossil fuel based energy supply to a sustainable energy supply system based on renewable energies. This should be achieved by building up training capacities in the field of solar thermal technology and the improvement of the quality, performance and lifetime of solar thermal systems. Furthermore it is the aim of the project to create new jobs at small and medium enterprises and to initiate and/or to strengthen political support mechanisms for solar thermal systems. Finally 60 demonstration systems for social institutions (hospitals, orphanages, homes for elderly people, HIV/AIDS institutions etc.) have been installed in order to increase the hygienic standard of the social institutions and to reduce significantly the energy cost for water heating. The project was carried out in Mozambique, Namibia, South Africa and Zimbabwe in cooperation with educational institutions as well as institutions and companies working in the field of renewable energies.			
Indicate factors that led to project's success: • Train the trainer approach for engineers and officials/ministry staff ensured enhancement of endogenous capacities • Monitoring and improving the performance of existing solar thermal systems together with local experts • Funding of solar water heater systems for public buildings and social institutions (e.g. hospitals) is expected to create awareness among the overall population • Solar thermal energy is strongly neglected by many donors and countries, although it can directly use the very high solar radiation in African countries for water heating in buildings as well as for food processing industry			
Technology transferred: solar thermal systems			

7.4.4 ADC rural development /rural livelihoods

In the context of rural development projects and programs, which are following a multisector approach, the entry points for climate change mitigation are correspondingly divers: activities to avoid deforestation and degradation of vegetation and soils are matched by the search for alternative energy sources respectively energy efficiency solutions for household, agricultural production and small business activities.

Example:

Project/programme title: Regional Development Programme Boucle de Mouhoun			
Purpose: The inhabitants of the target zone benefit from a better life quality through sustainable improvement of their living and working conditions, in the context of real local ownership			
Recipient country	**Sector**	**Total funding**	**Years in operation**
Burkina Faso	Rural development	EUR 2.000.000.-	Pilot phase since March 2006, fully operational phase September 2009-December 2012

Description: A fund was placed under the authority of the Regional Council, to finance trainings and structural investments in selected communities as well as on regional level. Apart from some funding for income generation measures and institutional strengthening of the newly installed community administrations, a focus laid on dissemination of sustainable agricultural methods, watershed management, sanitation and waste management. As there is no functioning grid in the region, the need for other local energy sources than wood and expensive fossil fuel was constantly addressed by the beneficiaries. From 2010 on, a partnership between this program and the National Biogas Initiative allowed the training of local craftspeople to build biogas digesters, and a modification of the nationally used digester model (by introducing locally available construction materials) did significantly reduce the installation costs per unit. By end 2012, a number of 210 digesters for individual households and small businesses have been functional, hundreds more are planned for the successive phase of the programme.
Indicate factors that led to project's success: Intensive information and awareness activities went hand in hand with respect of local ownership. This allowed real engagement – as the biogas partnership as the elaboration of an integrated action plan for regional watershed management (including reforestation and forest protection) were demanded by the local/regional partners and not proposed by donors. Their propositions for the next phase from 2013 foresee an even bigger share of funding for environmental protection and climate change adaptation. Anyway, the awareness is not always matched yet by an appropriate know-how.
Technology transferred: know how regarding sustainable management, integrated watershed management, sanitation, reforestation and forest protection; renewable non-wood energy solutions (especially biogas digesters).

7.4.5 ADC business partnerships

Furthermore, ADC does support initiatives by Austrian Enterprises in Non-Annex I countries. Most often, the fields of interests do concern renewable energy (especially solar energy systems) and energy efficient buildings. The granted funding by this "business partnerships programme" has to be matched by at least the same amount of the enterprises own funds. This is why business partnership projects, while not giving a full picture of private sector's engagement, can serve as an indicator for existing initiatives:

Project title: High quality Solar thermal systems for the Egyptian market			
Purpose: Adaptation of Solarthermal technology to climatic conditions in Egypt			
Recipient country	**Sector**	**Total funding**	**Years in operation**
Egypt	Solar energy	EUR 200.000.-	April 2011-March 2014
Description: Sunny countries like Egypt could meet a large part of their future energy needs with solar thermal energy. There is, however, still a lack of know-how, trained specialists and general awareness of this environment-friendly energy form. To date, pilot measures with solar collection systems have often failed in the desert nation, as without professional maintenance the sensitive collectors are quickly disabled by sandstorms and the salinated air. As part of a business partnership of Austrian Development Cooperation, European solar systems will be adapted to Egyptian conditions and will be available at affordable prices by 2014. In collaboration with Austrian solar specialists, Sekem Energy GmbH and Pink GmbH from Styria, GREENoneTEC GmbH from Carinthia and Egyptian partners, SEKEM, E-Green und EcoEnergy, experts provide their collective know-how to local educational institutions and companies. Specialists are trained to professionally install and properly maintain solar panels to deliver sufficient clean energy in future. In cooperation with local companies, facilities will also be built up for the production and sale of components for high-quality solar collection systems in Egypt.			
Indicate factors that led to project's success:			

Adaptation of solar thermal technology to local situations has to take into account various factors on very different levels. Concerning this specific project, it meant, among others:

- Switch in methods, e.g. to use welding instead of soldering technics, as local craftspeople are more use to welding
- Technical innovation, e.g. development of special gaskets to avoid sand entrance
- Switch in material, e.g. using black steel instead of copper to reduce cost

Technology transferred: locally adapted solar thermic systems

Project/programme title: Fruit and Vegetable processing by combined solarthermal and biomass desiccation

Purpose: Promotion of cultivation and processing of fruit, vegetables and nuts in Biological rsp. Fair Trade-Quality

Recipient country	Sector	Total funding	Years in operation
Uzbekistan	agricultural development	EUR 200.000.-	January 2011 – June 2013

Description: Desiccated sweet and sour cherries produced by Marap Handels GmbH mainly come from organic cultivation in Uzbekistan. For years, with its subsidiary DP Silk Road Organic Foods and more than 150 smallholders, Marap has been actively promoting the cultivation of organic fruit in the fertile but poor region at the Silk Road. With support from the business partnership programme of Austrian Development Cooperation, a carbon-neutral solar and biomass driven drying unit has been set up near the town of Samarkand. In a recycling system, it uses processed waste, such as cherry peel or stones, as biomass. This new processing technology makes farming less dependent on the unstable power supply. By qualifying two installation enterprises, Marap has also prepared the way for marketing the unit in the whole of Central Asia.

Indicate factors that led to project's success: while the technology came from Austria, a strong accent has been laid on local ownership and capacity development. The effectiveness was proved as the activities did continue even when the Austrian partner enterprise had to face insolvency problems

Technology transferred: Solar thermic and biomass technology for food processing

Project/programme title: Promotion of energy efficient building with a focus on facade engineering

Purpose: The offer on advanced trainings, orientated on practical needs and focused on facades as crucial building element, is extended and a national "passive house" competence center in Skopje established

Recipient country	Sector	Total funding	Years in operation
Macedonia (FYROM)	engineering	EUR 77.527,79	November 2007-June 2011

Description: A handbook on thermal insulation composite systems was published by the national chamber of architects and Engineers, which guarantees its status as mandatory regulation framework as well as the dissemination among the target group. It is complemented by various brochures concerning specific solutions in this field. Software for optimizing insulation layers offers a simple tool to calculate and visualize the benefit of modern insulation materials.

The trainings offered for Project planners and processors did reveal a big interest, but also a huge need for further trainings. The lack of a national heath insulation ordinance was identified as another obstacle for the national implementation of the technology.

Indicate factors that led to project's success: collaboration with national universities as well as the chamber of architects and engineers guaranteed dissemination of the relevant information among the target groups as well as a certain lobbying for standardizing the technology

Technology transferred: thermal insulation composite systems

Project title: Novi Sad eco Profit			
Purpose: Enhance the sustainability of SME in Novi Sad by fostering ecological management practices relevant capacities of public institutions			
Recipient country	**Sector**	**Total funding**	**Years in operation**
Serbia	environment policy and administration	EUR 100.000.-	March 2011-September 2013
Description: The quality of the environment of Serbian cities as Belgrade or Novi Sad has been decreasing in recent years due to the explosive economic development. There are many industrial sites within or in close proximity to the city boundaries. The pressure on all components of the environment - air, water, soil, wildlife - has caused problems and created pollution hot spots. There are negative effects on the public health as well. This goal will be achieved according to the ecoProfit-approach (synonymous to Cleaner Production), aiming at the prevention and reduction of waste and emissions. With ecoProfit the companies learn systematically how to identify, plan and realize measures for reducing costs and environmental impact. In order to disseminate and foster the idea of ecoProfit in the long run, the Municipality of Novi Sad will learn to apply the "EcoBusinessPlan", a grant-program developed by the City of Vienna aiming at stimulating ecoProfit activities among local corporations. Ultimately, the Municipality of Novi Sad will be put in a position to set up and run an ECOBusinessPlan and to develop it in a proper direction, meaning the capacity to identify the right modules (methods) for the companies to cover the most important impacts of trade and industry in the Municipality.			
Indicate factors that led to project's success: • The ecoProfit approach to build teams responsible for implementing measures, instead of individual persons, allows an integrated view of systems, to intergrate as well the technical specialist's as the economist's and the environmental perspective • Training is done "on the job", to ensure practical feasibility of the trainings content			
Technology transferred: Environmental Management (including emission reduction) systems for public and private sector			

7.4.6 Technology transfer via international financial institutions

In the context of co-financing technical support in International Financial Institutions capacity building in developing countries also technology transfer is facilitated and supported. In the period 2009 to 2012 the Austrian Ministry of Finance has supported 33 projects (including replenishments) with a total amount of approx.. EUR 70 million in the framework of Fast Start Finance.

Some examples:

Project/programme title: EBRD Ukraine Energy Efficiency Program			
Purpose: Improve the capacity of local banks to assess energy efficiency proposals and build local capacity for energy audits			
Recipient country	Sector	Total funding	Years in operation
Ukraine	Energy	€ 7 million	Since 2009
Description: There exists a significant potential for improvement for energy efficiency in Ukraine. Her energy intensity is over three times higher that EU average coupled with outdated and inefficient equipment. The project helps increase the financial capacity for local banks for credit analysis and risk management and provides technical support to investors for carrying our energy audits and business plans.			
Indicate factors that led to project's success: Incentive payments to local bank to promote energy efficiency investment with clients.			
Technology transferred: know-how on risk management for energy efficiency projects, know-how on preparing energy audits and business plans			

Project/programme title: IFC Renewable Energy Program			
Purpose: Improved energy supply			
Recipient country	Sector	Total funding	Years in operation
Western Balkan	Energy	> US$ 8 million	Since 2009
Description: Electricity production in the Western Balkan countries is predominantly based on coal fired thermal power plants and conventional hydro power. The region has significant renewable energy potential. The project aims to catalyze renewable energy in the Western Balkans through a focus on small hydro power plants (SHPP): a) improve existing regulatory framework to enable SHPP sponsors to develop and construct feasible SHPP, b) Work with SHPP sponsors to improve their SHPP designs and business plans, c) Work with selected financial institutions in the Western Balkan countries to improve their internal capacities and knowledge on SHPP and project financing, and eventually provide IFC financing to financial institutions for lending targeted for small hydro projects.			
Indicate factors which led to project's success: working with local regulators and governments in setting regulation and tariff structure including feed in tariffs			
Technology transferred: know-how regarding design, development and structure SHPP			

Project/programme title: IFC Cleaner Production Program			
Purpose: Stimulate uptake of CP improvements and investment at the company level and raise awareness of CP among firms, policy makers and financial institutions			
Recipient country	Sector	Total funding	Years in operation
Eastern Europe	Energy	US 2.7 Mio.	Since 2009
Description: Overall, the ECA region has nearly four-fold the energy intensity of the EU. In some countries, the energy intensity is eight times greater than the EU benchmark Cleaner Production improves economic and environmental performance by reducing and preventing pollution and waste at the source, while simultaneously improving competitiveness and industrial efficiency by reducing costs. However, few companies at present actively invest in CP technologies and techniques. The Program will concentrate on those CP technologies and techniques that have proven to reduce pollution and associated treatment costs. Industry throughout the ECA region will receive information on the benefits of cleaner production through information materials and awareness workshops. The Program will produce at least 10 case studies and conduct at least 8 awareness workshops. The Program will also disseminate results of benchmarking surveys and case studies *developed* by the Ukraine and Russia Cleaner Production Programs, as well as by other IFC Global CP initiatives. **Indicate factors which led to project's success:** focus on early winners where the saving potential is biggest as demonstration and peer for others, promote best practices of companies and expertise,			
Technology transferred: know-how regarding the potential of CP			

Project/programme title: IFC Armenia Sustainable Energy Finance Program			
Purpose: Improve sustainable local energy supply			
Recipient country	**Sector**	**Total funding**	**Years in operation**
Armenia	Energy	> US$ 1 million	Since 2010
Description: Armenia currently imports around two-thirds of its energy resources from foreign sources and suffers from obsolete domestic generation equipment. The Project seeks establish a sustainable market for energy efficiency (EE) and renewable energy (RE) investments in Armenia, together referred to as sustainable energy finance (SEF). The Project will achieve this goal by a) Supporting the development of renewable energy financing through local financial institutions, b) Creating a platform to support financial institutions in the development and marketing of energy efficiency lending, c) Improving the regulatory framework for the development of renewable energy, d) Increasing the awareness of RE project developers and the expertise of local design companies on the application of modern design solutions and new technologies to ensure the long-term sustainability of RE projects and e) building awareness and market demand for sustainable energy finance through a broad public awareness campaign.			
Indicate factors which led to project's success: Emphasis on awareness raising and capacity building in public and public sector, supporting local banks in developing lending tools			
Technology transferred: know-how regarding renewable energy and energy efficiency, supply of energy efficient equipment, hydropower technology			

7.4.7 Activities of the Austrian Development Bank (OeB)

OeEB acts as the official Development Bank of Austria. As a private sector financial institution it has been mandated by the Republic of Austria to promote economically,

environmentally and socially sustainable development through financing and investing in profitable private sector projects in developing and transition countries and through the provision of advisory services.

Renewable energy, energy and resource efficiency are areas of special focus. By end-2012, OeEB had directly co-financed renewable energy projects in the amount of EUR 31.4 million. In addition, OeEB supports renewable energy and energy efficiency projects through local financial intermediaries. By end-2012, local financial institutions had used EUR 65.9 million of OeEB's funds to finance renewable energy projects with a total credit volume of EUR 525.6 million (including equity and credit volume of co-financing partners). This enable the construction of 255.5 MW newly installed capacity from renewable resources. Furthermore, by end-2012, EUR 36.8 million of OeEB's funds were used by financial intermediaries for energy efficiency measures.

OeEB's total committed loan portfolio for projects contributing to the mitigation of climate change amounted to EUR 159 million by end-2012. This included financing for the construction of hydro, solar, wind and geothermal power plants employing adequate technology as well as projects for the refurbishment of existing hydro plants and transmission lines and measures to enhance energy efficiency. In addition, advisory services were provided, inter alia, for training local financial institution staff to build up a green finance business line and in support of the national energy sector regulator of a non-Annex I country. Finally, OeEB also provided funding to technical assistance facilities of the Green for Growth Fund and the Global Climate Partnership Fund.

Some examples:

Project/programme title: Mongolia: Wind Farm Salkhit			
Purpose: Supply of energy from wind power; reduce share of electricity generation using non-renewable sources			
Recipient country	**Sector**	**Total funding**	**Years in operation**
Mongolia	Renewable Energy	US$ 856,000	Since 2012
Description: Wind farm (first in Mongolia) with a capacity of 50 MW and transmission line is constructed in Salkhit, Mongolia. OeEB provides funding jointly with other bilateral and multilateral development banks.			
Indicate factors which led to project's success: use of adequate technology; suitable project structure; strong financing partners.			
Technology transferred: wind farm. **Impact on greenhouse gas emissions/sinks:** 115,000 persons can be supplied with clean energy, 180,000 tons CO2 p.a. saved.			

Project/programme title: Nicaragua: San Jacinto Geothermal Power Plant			
Purpose: Supply of energy from geothermal sources; reduce share of electricity generation using non-renewable sources			
Recipient country	**Sector**	**Total funding**	**Years in operation**
Nicaragua	Renewable Energy	US$ 15.1 million	Since 2013 (Phase 2)
Description: Geothermal power plant (expansion of a pilot plant) with a capacity of up to 72 MW is planned and installed in San Jacinto, Nicaragua. OeEB provides funding jointly with other bilateral and multilateral development banks.			
Indicate factors which led to project's success: use of adequate technology.			
Technology transferred: geothermal power plant. **Impact on greenhouse gas emissions/sinks:** Ca. 400,000 tons CO2 p.a. saved.			

7.4.8 Capacity Building in the Forestry Sector

The Austrian Federal Research Centre for Forests (BFW), as an Austrian federal, multidisciplinary research and education centre in fields like forest management and natural hazards, does not only provide training on national level, but is increasingly involved in capacity building projects for developing countries. BFW has already implemented projects with a focus on Western Africa in the last decade. Current projects deal with sustainable forest management practices and forest inventory:

Project/programme title: Threats to priority food tree species in Burkina Faso: Drivers of resource losses and mitigation measure – BFW Institute of Forest Genetics / Dr T Geburek			
Purpose: Scientific			
Recipient country	**Sector**	**Total funding**	**Years in operation**
Burkina Faso	Forest Science	60.000 EUR	Since 2012
Description: This project addresses the vulnerability of key food tree species to current and future threats (e.g., changes in land use and tenure, fragmentation of habitat, global environmental change, overexploitation) in order to propose sustainable management practices including conservation methods that are practical, comprehensive, aligned with traditional uses, and can be expected to improve human well-being in the short term as well as securing long-term sustainability of food tree resources.			
Indicate factors which led to project's success: Collaboration with research institutions in Burkina Faso. Emphasis on capacity enhancement and training. The research results will be translated into practical guidelines with the participation of local people and relevant local institution			
Technology transferred: Knowledge transfer in genetic techniques.			

Project/programme title: National Forest Inventory Suriname – BFW Institute of Forest Inventory / Dr K Schadauer			
Purpose: Scientific			
Recipient country	**Sector**	**Total funding**	**Years in operation**
Suriname	Forest Science	145.000 EUR	Since 2011
Description: A national forest inventory is the basis for the sustainable utilization and the protection of forest resources. In a collaborative project a tailored forest inventory concept based on remote sensing techniques and terrestrial forest resource assessment is elaborated. The obtained inventory data are the basis for the implementation of forest policy concepts, most importantly the protection of tropical forests.			
Indicate factors which led to project's success: Collaboration with research institutions in Suriname. Emphasis on method development, knowledge transfer and practical training.			
Technology transferred: Knowledge transfer in forest inventory techniques.			

Chapter 8

Research and Systematic Observation

8.1 General policy on and funding of research and systematic observation

The Federal Government directly finances the basic infrastructure of universities and extra university research institutions. Public funds provide support for basic research as well as for applied research and technology development. With respect to environmental research, commissioned research for the leading ministries within several key areas such as flood risks and for other public authorities plays an important role.

In addition private sectors, such as the energy sector, or tourism industry, finance research activities to better understand and address climate change risks.

Areas of competence and legal basis

The federal ministries and provincial governments bear responsibility for research issues within their own specialised areas of responsibility. The Federal Ministry of Science and Research and the Federal Ministry of Transport, Innovation and Technology hold a central position in co-ordination, administration and financing of research. The former is responsible for matters relating to universities and for non-university research institutions in the area of basic research and general scientific research; the latter is responsible for industry-related research, technology development and innovation funding and issues relating to the creation of priority areas of research in national research programmes by the Council for Research and Technology Development.

Essential questions concerning science, research and technology funding are governed mainly by the Research and Technology Funding Act (Forschungs- und Technologieförderungsgesetz), Research Organisation Act (Forschungsorganisationsgesetz) and the Universities Act 2002 (Universitätsgesetz 2002). The Research and Technology Funding Act sets up different, publicly financed research funds, which, in a subsidiary manner, support basic research projects and projects in the field of industry-related applied research and development. The Research Organisation Act determines principles and targets in publicly funded research and sets out legal and organisational rules for research activities by universities and federal scientific institutions. The Universities Act defines the set-up and structures of Austrian universities and their status as legal entities which may independently avail of their budgets.

General Strategy

Research expenditure has continuously increased from below 2 % of GDP in 2000 to 2.81 % in 2012. The private sector (including multinational companies) contributes about 60% and the public sector around 40%. In order to achieve the objective of a 3% share, the “Council for Research and Technology Development” has prepared the “National Research and Innovation Plan” in order to establish a long-term strategy for Austrian research and innovation policy. The Council has been established in 2000 and provides advice on all research and technology policy questions and implementation measures at the federal level.

Main objectives of the Austrian R&D policy are a. o. promoting international mobility and networking, stimulating the cooperation between enterprises and research organisations and strengthening evaluation as the basis for political governance on R&D.

General Funding

Publicly endowed independent funds (FWF and FFG) finance basic and application-oriented research and technology developments. Support is rendered in the form of financing of individual and of complementary projects, grants and scholarships, and loans. Applied research and technology developments are promoted by intensified support of co-operation between science and industry (centres of competence, Fachhochschule stimulation actions, post-doctoral actions) and by financing the necessary infrastructure. Science and industry define their own common research programmes with reference to the framework of the new technology and research funding programmes. The day-to-day operation of the federal research institutions (predominantly the universities) and of independent institutions, such as the Academy of Sciences, and of umbrella organisations, is financed directly by public funding.

The Austrian Science Fund (FWF) was set up as a bottom-up oriented instrument for basic research funding in 1967. About 85% of the subsidies go to university researchers, mainly for basic research. Funding is provided for individual research projects, programmes, publications, grants, and awards. Applications for subsidies are subjected to stringent international peer-review. The total budget granted in 2011 was EUR 195 million.

The Austrian Research Promotion Agency (FFG) has been established in 2004 for financing of innovative projects in applied business-oriented research carried out by enterprises and co-operating scientific institutions. Support is given in the form of loans, interest rate subsidies and the assumption of liability. In 2012 about EUR 425 million were granted for projects; about 80 % go to enterprises.

Environmental Issues

Research on topics of environmental relevance is covered by a wide spectrum of activities and stimuli, ranging from the basic support of relevant university and extra-university institutes and specific, well-funded research programs to single projects, which are commissioned by individual public authorities for ad-hoc expert analyses as well as for studies in the longer term.

Environmental issues are part of the key areas of research commissioned by the Federal Ministry of Science and Research and the Federal Ministry of Transport, Innovation and Technology, the Federal Ministry of Agriculture and Forestry, Environment and Water Management, and the Länder. Funding focuses on well-defined, interdisciplinary fields of research of great interest to the public, e. g. the efficient use of energy and cleaner production or impacts of environmental change.

Some environment related mid-term research programmes are administered by the Austrian Academy of Sciences, e. g. on alpine research, on hydrology, as well as the UNESCO Man and Biosphere programme. The Austrian Academy of Sciences also hosts the Austrian National Committee on the Global Change Programmes, which is dedicated to establishing contacts with, and to funding Austrian contributions to the Global Research Programmes IGBP (International Geosphere-Biosphere Programme), WCRP (World Climate Research Programme) and IHDP (International Human Dimensions Programme on Global Environmental Change).

In 2007 the Federal Government established a specific fund (climate and energy fund - KLIEN) in order to support the reduction of GHGs in Austria in the short, medium and long-term. From 2007 to 2012 the fund had available 730 Mio € that supported 57000 projects structured along 111 programs, ranging from basic and applied research to subsidies for the implementation of climate friendly technology.

In 2011 the **C**limate**C**hange**C**enter**A**ustria (CCCA) has been established as a coordinating facility to promote and support climate research in Austria with particular focus on: strengthening the climate research landscape in Austria, facilitating the education of a new generation of researchers and supporting knowledge transfer and advising politics and society. In this context, the term “climate research” encompasses the scientific examination of climate change, the causes of climate change (physical, political, economic, cultural, social), the consequences of climate change for society, economy, environment, climate mitigation / adaptation strategies and identification of vulnerabilities / capacities. AustroCLIM terminated its agenda with February 2013 as it will be addressed also by the CCCA, comprising meanwhile 20 organisations.

Several extra-university institutions, which are part of, controlled by, or (partly) funded by public authorities, perform tasks in environmental research and monitoring, among these the Central Institute for Meteorology and Geodynamics, the Federal Environment Agency, the Hydrographical Central Bureau, institutes of the Federal Ministry of Agriculture and Forestry, Environment and Water Management such as the Federal Research and Training Centre for Forests, Natural Hazards and Landscape (BFW), the Austrian Agency for Health and Food Safety (AGES), the Austrian Research Centers Seibersdorf, and Joanneum Research, as well as the environmental departments of the provincial governments.

A special focus on climate change is given within the research programme “StartClim”, which is financed by private-public-partnership and which celebrated its 10th anniversary in 2013. Its goal is to meet the challenges that climate change poses to science and to support the necessary decisions in the political and economic sectors. It is based on an initiative of the Federal Minister of Agriculture, Forestry, Environment and Water Management with the main focus on extreme events and climate change and its impacts on health, tourism and energy. Adaptation to climate change was the main topic for 2008 to 2013 with a specific focus on forests in 2011.

8.2 Research

Research on the climate system and climate change issues is heavily influenced by the geographical situation of Austria, especially by the Alps. Alpine regions experience rather heterogeneous meteorological patterns on a small scale and are a serious challenge for climate modelling; they are also very sensitive to any climatic changes. Research on socio-economic aspects of climate change and on adaptation measures is increasing. Research on mitigation technologies with its traditional focus on biomass and solar energy is expanding to give solutions for the complex problems of future lifestyle.

APCC, a specific project funded under the KLIEN, is a regional assessment modeled after the IPCC assessment reports started in 2011. Basically, the focus is on alpine regions of Austria and neighboring countries. The assessment is divided into 3 volumes like the IPCC assessment reports with 6 chapters each. These volumes of the APCC address "science" of climate change, impacts and adaptation and mitigation, respectively and a specific review process, including also stakeholders, has been established and will be published in spring 2014.

For examples of interdisciplinary research projects and activities, which have been funded confer Appendix C, Table C.1.

8.2.1 Climate Process and Climate System Studies

Climate process and climate system studies in Austria relate to a wide spectrum of topics, but a certain emphasis appears continues to be on processes influenced by topography, especially the Alps. All aspects of the hydrological cycle, including the interaction with the biosphere have attracted a number of research groups.

8.2.2 Modelling and Prediction, Including Global Circulation Models

In view of the limited resources available to a small country, the Austrian climatological research community has refrained from entering into global circulation model (GCM) research as such. There are, however, modelling activities in special areas, e.g. diagnostic analyses of subsynoptic flows, or remote sensing applications to improve global climate models and climate forcing inputs via global observational constraints, in which Austrian researchers are particularly active and, if conditional for a research project, GCM outputs are obtained from appropriate international groups. This is, e.g., true for prediction activities based on statistical analyses linking regions or scenarios. Special emphases is but on the development of limited area models (LAM) in climate mode for Austria. Within the project reclip:more and the follow up project reclip:century, a research group including scientists from three universities and two research institutions, worked on a systematic evaluation of the potential of different LAMs for Austria and the development of dynamical downscaled climate change scenarios. The members of this group also participated in the relevant EC-founded European research projects (e.g. ACQWA, CECILIA, CLAVIER).

8.2.3 Research on the Impacts of Climate Change

With regard to the impacts of climatic change, Austrian research focuses on topics that are of vital interest to the country: floods, forests, agriculture, lakes, glaciers, etc. As climate change impacts are an interdisciplinary problem, the research programs ACRP, StartClim, Floodrisk and ProVision have been launched within the last decade, to meet this challenge. Within these programs not only the physical impacts are investigated, but also the socio-economic impacts and potential adaptation options are addressed.

Most of these studies look into the effects of climatic change in the Alpine region, since its climate is very specific due to the elevated and complex topography and also very sensitive to minor shifts in the general circulation including the paths of cyclones. This is one of the reasons why regionalization is discussed intensively in Austria as a priority in climate research. Some studies are looking at the flat eastern part of Austria, which is climatologically more related to Central and Eastern Europe (CEE) than the Alps. In this region water shortage could lead to difficulties for agriculture in the future. The impacts of the hot and dry summer 2003 have demonstrated the need for research in this area. Several national and international projects are dedicated to this problem.

8.2.4 Socio-economic analysis, including analysis of both, the impacts of climate change and response options

Austrian research in this field continues growing. The traditionally important topics, which are the estimation of costs and economical as well as social benefits of increased renewable energy supply technologies at the one hand and the development of regional response options aiming at reducing greenhouse gas emissions from energy generation at the other hand, are still carried on and are supported by several research lines of the Climate and Energy Fund and by ProVision.

Regional response options particularly aiming at reducing greenhouse gas emissions are currently integral part of most regional and local development plans. There is a definite demand-side pressure for research in this field, as 950 municipalities in Austria representing more than 60 % of the Austrian inhabitants have joined the *Klimabündnis* dedicating themselves to halve their CO_2 emissions until 2030.

Apart from research on regional response strategies, Austria's research is also investigating socio-economic impacts related to the introduction of renewable energy systems. Within this context, social as well as economical factors for innovation and adoption of these technologies in Austria have been identified.

In addition to these energy related research topics other important socio-economic sectors (e.g agriculture, tourism) have been investigated too. In several interdiscipli-

nary projects comprehensive analyses of all relevant socio-economic effects in case study regions have applied.

8.2.5 Research and development on mitigation and adaptation technologies

Research on mitigation technologies addresses a broad range of topics in Austria. The research topics reach from process optimization in agriculture (e.g. diary production) to sustainable cooling. Austria has a long research tradition concerning energy technologies based on renewable sources and holds competitive positions in the fields of biomass utilization and solar energy technologies. Concerning biomass, research is mainly directed towards biomass utilization in small and medium (up to 50 MW) heating facilities.

In 2012 the programme e!MISSION.at - Energy Mission Austria (http://www.ffg.at/e-mission) has been launched as follow-up activity of "New Energies 2020" ("Neue Energien 2020"). „Building of Tomorrow plus", ("Haus der Zukunft plus": http://www.hausderzukunft.at/) a systematic research line, focusing on all aspects of new energy and the mitigation options in building, has been installed within the last years. By 2010 more than 35 Mio Euro had been granted to three hundred interdisciplinary projects.

A wide range of research projects, reports on pilot projects and demonstration projects (overall more than 1800), supported by the Ministry of Transport, Innovation and Technology in the research programs on Technologies for Sustainable Development ("Building of Tomorrow plus", "Factory of Tomorrow", "New Energies 2020" and their previous programs) is listed on the website: http://www.nachhaltigwirtschaften.at/.

In 2008 the Austrian government initiated the development of a "national adaptation strategy". Part of this process are a series of workshops to start the communication between experts and stakeholders, a study to summarize the current information on the status of adaptation to climate change in Austria, and a data base gathering all relevant information on Austrian adaptation activities.
(http://www.klimawandelanpassung.at/ms/klimawandelanpassung/de/kwadatenbank/

8.2.6 Research – focus support of developing countries

The Commission for Development Studies (KEF; Kommission für Entwicklungsforschung) OeAD-GmbH was founded already in 1981 as the Austrian follow-up measure to the UN conference on 'Science and Technology for Development'. Research partnerships are chosen by KEF members after an external scientific preliminary assessment, according to the KEF criteria of scientific quality, development political relevance, sustainability, and context with the Millennium Development Goals (MDGs). The partner countries of KEF include development countries according to the DAC list (Development Assistance Committee) of the OECD. These are countries in Sub-Saharan Africa, in Central and South America, and Asia.

KEF spent around 100.000 € per year in the period 2009-2011 for projects with developing countries.

For examples of research projects and activities, which have been funded confer Appendix C, Table C.2.

8.3 Systematic Observation

Climate observations have a long tradition in Austria, going back to the 18th century. A dense network of observing stations for meteorological and hydrographical parameters is in operation; observations relating to mass balance of glaciers and species composition of ecosystems are reported to international data centres as well. Measurements of atmospheric composition and solar radiation became of importance in the late 20th century. During recent years, Austria has increasingly engaged in space-based observation programs.

The Austrian GCOS coordination unit has been established at the Central Institute for Meteorology and Geodynamics (ZAMG), which is the national meteorological service. A comprehensive GCOS report has been compiled in 2013 and has been presented at the Group on Earth Observation (GEO) Ministerial Summit in January 2014 in Geneva. Detailed information on climate change observing systems in Austria can be found in that report (GCOS 2014). The collection of metadata is an on-going process; a database with preliminary results will be available in the course of 2014. The national GCOS report will be updated in regular intervals.

8.3.1 Atmospheric climate observing systems

It is important to note that monitoring climate in the Alps, where the general model-based findings on climate change have limited applicability because of the complex topography, is a particular responsibility that Austria is undertaking, in cooperation with its neighbours. Austria also provides locations for monitoring where there is little influence by human activities, which is rare in Europe. With regard to climate observations, it can be stated that the longest of Austria's instrumental time series go back as far as to the 18th century and are among the longest that exist. Due to this long experience with meteorological measurements, quality- and homogeneity control of the data are highly developed and long-time homogeneous datasets are available, like HISTALP, a historical instrumental climatological surface time series of the greater alpine region.

To meet the demands of the complex topography of Austria, a dense network for observing atmospheric climate parameters is established. More than 1000 stations are measuring at least temperature and precipitation, the majority of these stations is managed by the Hydrographic Service (Dept. VII/3 of the Federal Ministry of Agriculture, Forestry, Environment and Water Management in co-operation with the

Länder)[2]. The network of the Central Institute for Meteorology and Geodynamics (ZAMG) comprises more than 250 stations, which gather a comprehensive set of meteorological data (air temperature, air pressure, wind speed and direction, water vapour, precipitation). 150 of these stations are exchanged internationally within the WWW. 3 stations are part of GSN. The Austrian regional GAW station is located at "Hoher Sonnblick" at 3106 maSl. This high altitude meteorological observatory is operating continuously since 1886, which is the longest continuous and homogeneous meteorological time series for high altitudes worldwide. Starting in the 1990ies, additional measurements (e.g. atmosphere composition, radiation, cryosphere) are increasingly using the infrastructure of the observatory. Information of all activities at the Sonnblick observatory can be found under http://www.sonnblick.net/portal/index.php. Radiosonde data from the station at the ZAMG headquarter in Vienna is provided to GUAN.

Routine radiation measurement is performed at the 250 stations of ZAMG. In 2010 the Austrian Radiation Network ARAD started to collect detailed and precise radiation data at four monitoring stations. The ARAD station at Hoher Sonnblick is part of BSRN; Hoher Sonnblick and 6 other stations report data to the World Radiation Data Center. Measurements of stratospheric ozone and spectral UV-radiation are performed at Hoher Sonnblick and delivered to the NDACC. Several broadband UV monitoring stations are distributed over Austria and provide the population with UV index information; their data are reported to WOUDC.

The measurements of atmospheric constituents are in the responsibility of the *Länder* and the Federal Environment Agency and are focusing on air quality aspects; for that purpose data from more than 120 stations are collected and published by the Federal Environment Agency. At Hoher Sonnblick, measurements of the atmospheric concentration of surface ozone started in 1989, of CO_2 in 1999 and of CH_4 in 2012; besides that, concentrations of CO and oxidised nitrogen compounds are measured. Time series from Hoher Sonnblick are available at the WDCGG.

8.3.2 Terrestrial climate observing systems

Austria has a long tradition in glacier monitoring. Since the end of the 19th century length fluctuations of approximately 100 glaciers are observed continuously. But not only length measurements are performed as a matter of routine – on several glaciers mass balance measurements using the direct glaciological method are established since decades. All these data are reported internationally to the World Glacier Monitoring Service. Measurements of permafrost have started in recent years.

To describe the water runoff within the complex terrain of Austria more than 1300 stations with precipitation measurements, 550 stations for the river discharge measurements and 3360 stations for the ground water storage are established, but also more than 900 stations with snow depth measurements (Hydrographic Service, ZAMG). River runoff data for about 70 stations have been delivered to GRDC.

In Austria the LTER network (as part of the ILTER network on "International Long Term Ecological Research") rapidly expanded within the last years and today 27

[2] http://www.lebensministerium.at/wasser/wasser-oesterreich/wasserkreislauf/hydrographie_oesterreich/Organisation_HZB.html

ILTER sites are established in Austria. Within the UNESCO's Programme on "Man and the Biosphere" 6 sites are Biosphere Reserves. (Additional information on ILTER networks and Biosphere Reserves can be found at:
http://www.ilternet.edu/ and http://cvl.univie.ac.at/biosphaerenparks/index_engl.cfm)

Further observations and measurements with relevance for climate change are, for example, phenological observations (with time series back to the early 20th century) or measurements of the exchange of carbon dioxide and water between atmosphere and ecosystems (with data provided to FLUXNET).

8.3.3 Space-based observing programs

Austrians space based activities are coordinated by the Austrian Space Agency (ASA) which was founded in the year 1972. On January 1987 Austria became a full member of the European Space Agency (ESA). Since January 1994 Austria is also a member of the European Meteorological Organisation EUMETSAT. Since 2005 the agenda of ASA are hosted in the Aeronautics and Space Agency (ALR) of the FFG (Austrian Promotion Agency).

The ALR acts as the central contact point for the coordination of all aeronautical and space-related activities in Austria and is the docking station to the international aeronautical and space scene. The agency supports the participation of Austrian researchers in international and bilateral aerospace collaborations and fosters the creation and development of international networks. It implements Austrian aeronautical space policy and represents Austria's interests in international aeronautical and space organisations. The agency's main focus is on managing the contributions of the Republic of Austria to the programmes of the European Space Agency (ESA) and is responsible for the management of the Austrian Space Programme ASAP. Several ASAP projects have dealt with earth observation and climate change issues. Information can be found on the ASAP web-page (https://www.ffg.at/austrian-space-applications-programme).

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GCOS, 2014: *Global Climate Observing System Bericht Österreich*. GCOS Sekretariat Österreich, Zentralanstalt für Meteorologie und Geodynamik (ZAMG), Vienna, Austria.
(http://www.gcos.at)

Chapter 9

Education, Training and Public Awareness

9.1 Education

9.1.1 Framework

Since 1979, Environmental Education (EE) has been a *principle of instruction* and has been integrated into the curricula of general education and – since the beginning of the 1990s – also into those of the vocational school system. The *Constitutional Decree "Environmental Education in Schools"* (edited 1985, re-published 1994) defines main aims of EE: Action competence; experiencing of democratic attitudes and behaviour in order to enable the learners to be active in political life. This decree was the first national document to support EE-oriented project teaching and was the stimulus and the basis for the development of EE in Austria. In a new edition of this decree the implications with respect to school development and Education for Sustainable Development (ESD) will be considered.

In the *"Austrian National Strategy for Sustainable Development (2002)"* (http://www.nachhaltigkeit.at) which has been approved by the government and the parliament, the chapter "Quality of Life in Austria" focuses on education in two key objectives: "A Sustainable Life Style" (objective 1) and "Solutions through Education and Research" (objective 4).

The *Austrian Strategy for Education for Sustainable Development* was tabled by the Federal Ministry for Education, Arts and Culture, the Federal Ministry for Agriculture, Forestry, Environment and Water Management and the Federal Ministry of Science and Research and passed the Austrian Council of Ministers on November 12, 2008.

The openness of the term "Education for Sustainable Development" provides space for innovations like interdisciplinary projects, community co-operation of schools in Local Agenda 21 processes, participatory programmes and developments, as well as research-based learning and impulses for local curriculum development.

The Austrian efforts of stabilizing the earth's climate are also assisted by the *agricultural education, training and extension institutions*. This is based on the long established guiding principle of socio-ecological agricultural policy, which also founds the combined competences of the Federal Ministry of Agriculture and Forestry, Environment and Water Management. Soil protecting and organic farming are deep seated objects of agricultural education and training programmes. These programmes also include biomass and biogas production. Furthermore the Austrian agricultural education, training and extension institutions create public awareness on ecological topics.

9.1.2 Initiatives and Networks

There are several specific institutions, initiatives and networks, which promote sustainable education and topics relevant for climate change. They are in general supported by federal ministries and/or *Länder*. Some important examples are listed below:

- *FORUM Umweltbildung (FORUM Environmental Education)*

  Since 1983, this organisation has been operating on behalf of both the Ministry of Education and the Ministry of Environment, developing and promoting educational programmes. FORUM Umweltbildung organises specific programmes, provides schools with teaching materials and tools and offers workshops on relevant topics. (http://www.umweltbildung.at)

- *ÖKOLOG – Österreichs größtes Netzwerk für Schule und Umwelt (Network for Schools and Environment)*

  ÖKOLOG is the first and main Austrian programme for schools at the interface of Environmental Education and School development. It is based on the approach of the International decentralised Network "Environment and School Initiatives/ENSI" to EE and ESD. Schools define ecological, technical and social conditions of their environment and, on the basis of these results, define objectives, targets and/or concrete activities and quality criteria, to be implemented and evaluated. The ÖKOLOG-programme is supported and supplemented at the Länder level with regional support teams in all provinces. More than 400 schools and 4 universities for teacher education participate in the network. Specific topics are supported by information material, in-service training and partly by local advising.
  (http://www.oekolog.at)

- *Umweltzeichen für Schulen und Bildungseinrichtungen (National Environmental Performance Award for Schools and Educational Institutions)*

  This is a national and government based award, its criteria were set in force by January 2002. About half of the 120 criteria relate to EE, school curriculum and school development. The other half refers to technical aspects like energy saving. The award is valid for four years after the obligatory external evaluation and has to be renewed afterwards.
  (http://www.umweltzeichen.at/schulen)

- *BINE – Bildung für Nachhaltige Entwicklung (Education for Sustainable Developement)*

  ESD is a nation wide University study course for in-service training for teacher educators for ESD. The aim is to promote ESD in teacher education, to foster innovative didactics, to encourage exchanging experiences and methods and to help teacher educators develop research competencies. One of the strengths of the project is the cooperation of Universities and an NGO (FORUM Umweltbildung) and a big emphasis on networking both nationally and internationally.
  (http://www.umweltbildung.at/veranstaltungen/bine-lehrgang/bine-lehrgang.html)

- *Hochschule für Agrar- und Umweltpädagogik Wien (University-level training institute for educational professions in agricultural and ecological affairs)*

  The University-level training institute for educational professions in agricultural and ecological affairs started operation in 2007. This institute is essentially supporting the development and dissemination of appropriate methods and practices of teaching, training and creation of awareness in ecological matters.

(http://www.agrarhochschule.at/)

- *Climate protection issues in the Agricultural and Forestry Schools*

  These secondary schools, which offer a professional education regarding agriculture and forestry, are engaged in different projects related to climate change with indirect or direct involvement of students. Projects concern changes in the physical school environment (energy contracting for school buildings, ecological ways of construction for buildings, installation of photovoltaic systems), awareness changes (ranging from acquisition of organic products for the school kitchens to integrated improvement processes in order to join the ÖKOLOG school network or to get awarded the Austrian eco-label for schools) as well as hands-on training (organic farming in school farms, eco-driving for tractors).

Austria also participates in international networks like the international decentralised Network "Environment and School Initiatives" (ENSI, (http://www.ensi.org) and relevant COMENIUS network projects of the EU.

Valuable work is done by several NGOs such as the Climate Alliance Austria, WWF, Naturschutzbund, Umweltberatung, etc. Some of these NGOs, interest groups and communication agencies have organised project competitions, provided teaching materials, organised workshops for teachers or have acted as consultants. Expert lessons in schools or outdoors have been provided. For example, some hundred schools and kindergartens have joined Climate Alliance Austria and take part in local and nationwide activities.

9.2 Training and Advising

Special training programmes on energy saving have been established by the Länder governments themselves, by regional energy agencies and by the national government as well, partly in co-operation with other institutions. Advice, support and partial grants for measures related to environmental protection and energy efficiency are offered to small and medium enterprises as well as to consumers. For several branches of commerce and industry, energy efficiency strategies were developed at Länder level and are now being implemented together with the professional associations.

Besides initiatives from Federation and *Länder*, several stakeholders have taken their own initiatives, like the Austrian Federal Economic Chamber, which founded the Business Energy Institute as a platform for facilitating implementation of energy efficiency measures for businesses (http://www.energieinstitut.net), or the Austrian Biomass Association, which has established a certification-system for plumbers specialized in installing biomass-heating systems (http://www.biowaermepartner.at).

The central initiative of the Federal Ministry of Agriculture and Forestry, Environment and Water Management is klima:aktiv, which was launched in 2004. In four thematic clusters (Renewable Energy, Building, Energy Efficiency and Mobility) specific programmes are carried out by various programme managers of different elected institutions. These programmes follow a comprehensive and systematic approach in supporting the market introduction of climate-friendly technologies, services and activities by training and advising measures and subsidies.

The overall objective of klima:aktiv is to reduce energy consumption and to enforce CO_2-neutral usage of energy. The initiative is aiming to enhance quality and accelerate the introduction of climate friendly technologies and services, which shall become the self-evident alternatives for companies, communities and for private end-users as soon as possible. klima:aktiv programs develop technological and organisational solutions able to compete on the market, take care of innovative quality standards and promote training of all relevant groups. This is achieved by appropriate information of those investing in climate-relevant areas (i.e. promoters of residential housing projects, companies, home builders), by developing expert know-how of the providers of the respective services (master builders, architects) and by improvement of the offer on the market. Next to investment subsidy programs and legal and fiscal instruments, klima:aktiv provides targeted support for e.g. further education and vocational training of key players, for standard setting and quality management or for target-group specific information, motivation and marketing as well as building and activating of networks.
(http://www.klimaaktiv.at)

The klima:aktiv mobil programmes motivate and support transport producing stakeholders and actors to develop and implement measures to reduce GHG in their transport and mobility activities promoting alternative clean fuels and vehicles as well as environmentally friendly transport modes and mobility management while at the same time increase transport efficiency and stimulating energy saving and renewables. The concept consists of consulting, financial supporting, motivating and awarding of partners – with a clear target to reduce CO_2 emissions.
(http://www.klimaaktivmobil.at)

With respect to climate change issues in agriculture, the chambers of agriculture (LKÖ), the Rural Adult Education Institutes (LFI), Bio Austria and the Austrian Council for Agricultural Engineering and Rural Development (ÖKL) are important institutions for extension related to climate protection issues. Agricultural extension and further training for adult farmers comprise the series of topics with regard to climate protection, ranging from the Austrian agri-environmental programme ÖPUL (e.g. reduced utilisation of nitrogen and nutrient balance) and organic farming to energy efficiency and renewable energy sources.

9.3 Public Awareness

According to surveys of the last decade, climate change is one of the most important environmental problems for the Austrian population. Awareness programmes at federal, *Länder* and municipal level take account of these concerns and inform about everyone's possibilities to take part in the fight against climate change.

Climate protection requires more than a contribution towards sustainable development from political, economic and administrative players. Every individual can support climate protection objectives, although many people are unaware of how much individual behaviour can contribute towards climate change.

Programmes like klima:aktiv cover aspects of training and advising as well as aspects of public awareness. Championships for fuel-saving driving, for example,

raise the public awareness on the potential of reduced fuel consumption of vehicles; klima:aktiv mobil organises these championships and provides information and advise on eco-driving (http://www.spritspar.at/). Klima:aktiv mobil supports the Austrian national cycling strategy by awareness campaigns and awards in parallel to support for infrastructure improvements and consulting and advice for stakeholders (http://www.klimaaktiv.at/mobilitaet/radfahren/masterplanradfahren.html).

With respect to products from organic farming, public information plays an important role for the Federal Ministry of Agriculture, Forestry, Environment and Water Management. Well-informed consumers will appreciate the advantages of organic farming and its products. Information is published by the Ministry as well as by Agrarmarkt Austria GmbH and by the joint platform of the associations for organic farmers, "BIO AUSTRIA".

Many Austrian communities and individuals participate in initiatives like the European Carfree Day and the European Mobility Week, which foster awareness for pollution free mobility (http://www.mobilityweek.eu), or the Energy Globe Award, which is a competition for initiatives in the fields of (a. o.) energy efficiency and renewable energy sources from all over the world, organized by the Energy Globe Foundation based in Austria (http://www.energyglobe.info).

Environmental NGOs, organised in the umbrella organisations *Ökobüro* and *Umweltdachverband*, contribute to public awareness on climate change issues by various activities, covering articles in their members' magazines and specific public campaigns, information brochures and scientific studies, practical tools and GHG mitigation tips and many more activities that are too numerous to be mentioned here.

The *Climate Alliance* is a NGO with climate change and climate justice as its main topics. It was founded in 1990 in Frankfurth am Main and is a global partnership for climate protection, set up by more than 1600 European municipalities and the Indigenous Peoples of the rainforest in the Amazon Basin. In Austria more than 950 municipalities and all *Länder*, about 800 private companies and more than 380 educational institutions have joined the Alliance. As a very successful non-profit organisation – with respect to raising public awareness for climate change issues as well as stimulating counter measures at the local level – it is supported by the members as well as by the Federal Ministry for Agriculture and Forestry, Environment and Water Management.

Members have committed themselves to:

- half their greenhouse gas emissions by 2030 (baseline 1990)
- support the indigenous partners in Amazonia in preserving their culture, their way of life and the rainforest

In almost all member municipalities, working groups dealing with the implementation of measures in different areas (energy, transport, procurement, etc.) have been established. The success of these working groups is usually based on the involvement of committed citizens and local NGOs.

Many and diverse activities were undertaken by Climate Alliance Austria in the last years. These range from nation-wide competitions to regional seminars:

- A yearly nation-wide Climate Alliance meeting allows intensive discussion and exchange of opinions among the member municipalities. The meetings consist of presentations and excursions; several hundred municipalities have taken part in recent years.
- From 16 to 22 September thousands of European towns and cities participate in the European Mobility Week (EMW) and invite their citizens to a wide range of activities promoting sustainable mobility. In Austria Climate Alliance Austria coordinates this initiative.
- Information on different subjects of climate protection was offered at about 250 local seminars and regional meetings.
- A periodical, issued four times a year, informs the members and public about current activities and serves as project exchange for the members.
- Since 2002 the “Kids in the Move Campaign” invites children all over Europe to make their daily journeys independently and in a climate-friendly way. By collecting so-called Green Footprints all over Europe, the children show the "big ones", what the "small ones" do to protect the global climate. In 2013 more than 160.000 children and young people from 13 European countries took part and collected more than 2 million Green Footprints. In Austria Climate Alliance Austria coordinates this campaign (“Klimameilen-Kampagne”).
- Information campaigns have been realised on special topics such as the advantages of organic farming, the ban of HCFCs and HFCs in municipal procurement and on fair trade.
- The campaign for climate protection includes the business sector, too. After initial analysis and advice by the Climate Alliance, companies commit themselves to energy saving measures and to a CO_2-reduction target. The performance with respect to the targets is evaluated regularly. Currently about 800 companies have joined Climate Alliance Austria.

An important part of the activities of the Climate Alliance is the *partnership with indigenous rainforest peoples* and raising awareness for these issues in Austria. Representatives of indigenous peoples have visited Austrian municipalities and vice versa. Austria has contributed to the protection of the global climate system with a programme for sustainable development in the “Alto Rio Negro” region since 1993. The Alto Rio Negro is a tributary of the Amazon in the North-West of Brazil. In this region 23 indigenous peoples have joined together into the umbrella organisation FOIRN. Climate Alliance Austria supports the FOIRN in their efforts for economic and cultural autonomy and in preserving the tropical rainforests, these being the very basis of their existence, by granting them title of ownership and ensuring the sustainable use of their territories. The main principle is the integration of native people in measures for the protection of their environment. Thanks to the support on communal, regional and federal level an area of 10 million hectare of rain forest has been declared as indigenous territory. This prepares the ground for many initiatives and projects of the indigenous peoples in the Rio Negro region.

Appendix A

Indicators

This Annex presents the indicators pursuant to Article 3 (1) j of the former EU Greenhouse Gas Monitoring Decision (280/2004/EC), a detailed description of the indicators can be found in Annex II of Commission Decision of 10 February 2005 laying down rules implementing Decision No 280/2004/EC of the European Parliament and of the Council concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol (2005/166/EC). [1]

Table A.1: CO_2 emissions indicators (Source: *Austria's annual greenhouse gas inventory 1990–2011, Submission under Decision 280/2004/EC*; Report REP-0407, Umweltbundesamt 2013, Vienna, Austria)

No	Indicator	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011
	Priority										
1	Total CO2 intensity of GDP [t CO2/Mio Euro]	358.5	330.9	292.3	325.1	303.0	281.7	276.4	261.9	276.4	260.9
2	Energy related CO_2 intensity of GDP [t CO_2/Mio Euro]	312.3	291.0	256.2	287.8	265.2	243.7	237.6	229.0	240.5	224.7
3	Specific CO_2 emissions of passenger cars [g CO_2/ km]	212.3	205.8	192.5	176.9	171.2	168.1	164.5	159.7	155.9	152.4
4	Energy related CO_2 intensity of industry [t/Mio Euro]	290.1	284.6	255.4	278.9	261.2	240.6	243.1	253.3	256.3	232.8
5	Specific CO_2 emissions of households [t CO_2/dwelling]	3.40	3.17	2.76	2.53	2.31	2.03	2.06	1.97	2.16	1.88
6	CO_2 intensity of the commercial and institutional sector [t CO_2/Mio Euro]	25.12	28.55	22.62	23.52	24.11	17.80	20.37	14.87	17.48	15.76
7	Specific CO_2 emissions of public and autoproducer power plants [t CO_2/TJ]	166.8	150.9	128.6	123.0	121.5	117.7	106.7	97.3	101.8	107.0
	Additional Priority										
1	Freight transport on road [g CO_2/ ton-km]	140.6	120.5	94.6	87.7	87.2	85.3	84.4	84.4	81.1	81.6
2	Total CO_2 intensity – iron and steel industry [t CO_2/Mio Euro]	2 651	3 193	2 525	3 490	3 657	3 468	3 659	3 565	4 604	3 977
3	Energy related CO_2 intensity – chemical industry [t CO_2/Mio Euro]	575.2	532.8	492.4	516.8	414.0	328.3	385.9	317.4	324.2	308.4
4	Energy related CO_2 intensity – glass, pottery and building materials industry [t CO_2/Mio Euro]	672.6	651.1	609.6	641.1	656.8	693.0	748.0	782.2	745.1	731.0
5	Specific CO_2 emissions of iron and steel industry [t CO_2/t production]	2.17	1.92	1.82	1.79	1.78	1.71	1.75	1.91	1.72	1.70

[1] The units of the transport indicators (No. 3 Priority Indicator, No. 1 Additional Priority Indicator, and No.1-3 Supplementary Indicator) were changed to the common unit g CO_2/km

No	Indicator	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011
6	Specific energy related CO_2 emissions of cement industry [t CO_2/t production]	0.225	0.226	0.214	0.194	0.207	0.213	0.205	0.200	0.193	0.181
	Supplementary										
1	Specific diesel related CO_2 emissions of passenger cars [g CO_2/ km]	193.7	189.1	179.1	166.7	159.8	158.4	157.6	153.5	152.2	149.5
2	Specific petrol related CO_2 emissions of passenger cars [g CO_2/ km]	216.2	212.1	202.7	190.6	187.3	182.5	175.1	169.0	161.2	156.5
3	Passenger transport on road [g CO_2/passenger-km]	155.7	159.1	157.1	148.7	144.3	142.2	139.7	136.1	133.3	130.7
4	Passenger transport by air [kg CO_2/passenger]	234.0	226.1	125.8	110.8	110.7	108.8	98.8	96.0	81.6	93.3
5	Energy related CO_2 intensity – food, drink and tobacco industry [t CO_2/Mio Euro]	234.2	181.4	169.5	176.2	167.3	136.3	142.4	179.7	161.9	131.1
6	Energy related CO_2 intensity – paper and printing industry [t CO_2/Mio Euro]	864.7	803.4	653.9	618.6	550.4	512.9	533.7	532.2	554.5	522.4
7	Specific CO_2 emissions of households for space heating [t CO_2/m^2]	33.84	30.32	25.42	22.71	20.49	17.87	18.13	17.19	18.72	16.23
8	Specific CO_2 emissions of commercial and institutional sector for space heating [kg CO_2/m^2]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Specific CO_2 emissions of public power plants [t CO_2/TJ]	166.4	143.5	133.3	112.2	110.2	103.1	93.9	84.2	84.7	87.1
10	Specific CO_2 emissions of autoproducer plants [t CO_2/TJ]	168.2	168.2	117.6	161.5	157.2	158.2	145.7	138.6	156.5	166.8
11	Carbon intensity of total power generation [t CO_2/TJ]	68.37	59.04	48.19	59.28	57.43	53.87	49.09	42.72	49.60	53.37
12	Carbon intensity of transport [t CO_2/TJ]	65.94	64.06	63.61	65.06	62.51	61.71	60.36	60.12	60.25	59.99
13	Specific energy related CO_2 emissions of paper industry [t CO_2/t production]	0.755	0.643	0.536	0.465	0.424	0.421	0.427	0.448	0.433	0.415
14	Carbon intensity in Industry [kt CO_2 /PJ]	58.58	61.76	54.65	54.67	52.04	50.57	49.68	45.36	48.11	47.51
15	Carbon intensity Households [kt CO_2 /PJ]	40.92	37.51	34.86	31.56	30.10	28.01	27.93	26.87	27.24	26.31

[1)] Please note that for the road transport indicators activity data has been adjusted to reflect also the transport activity abroad, driven by fuel sold in Austria but consumed abroad. Activity data used for the calculation is therefore higher than those shown in Chapter 2.

Appendix B

Greenhouse Gas Inventory Information – Tables

Table B.1 Summary report for CO_2 equivalent emissions 2011 (CRF Summary2)

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]	**66,913.30**	**5,364.11**	**5,344.57**	**1,349.01**	**60.07**	**321.53**	**79,352.60**
1. Energy	**60,830.19**	**465.49**	**691.63**				**61,987.31**
A. Fuel Combustion (Sectoral Approach)	60,597.01	224.86	691.63				61,513.50
1. Energy Industries	13,861.09	9.00	118.35				13,988.43
2. Manufacturing Industries and Construction	14,827.78	14.97	154.83				14,997.58
3. Transport	21,523.38	13.37	213.32				21,750.07
4. Other Sectors	10,337.93	187.49	204.15				10,729.58
5. Other	46.83	0.03	0.98				47.84
B. Fugitive Emissions from Fuels	233.17	240.63	IE,NA				473.81
1. Solid Fuels	IE,NA,NO	0.74	NA				0.74
2. Oil and Natural Gas	233.17	239.90	IE,NA				473.07
2. Industrial Processes	**9,450.09**	**18.45**	**47.80**	**1,349.01**	**60.07**	**321.53**	**11,246.95**
A. Mineral Products	3,029.59	NA	NA				3,029.59
B. Chemical Industry	631.56	18.36	47.80	NO	NO	NO	697.72
C. Metal Production	5,788.94	0.09	NA	NO	NO	0.16	5,789.19
D. Other Production	NA						NA
E. Production of Halocarbons and SF_6				NA	NA	NA	NA
F. Consumption of Halocarbons and SF_6 [2]				1,349.01	60.07	321.37	1,730.45
G. Other	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	**173.19**		**151.02**				**324.20**
4. Agriculture		**3,549.85**	**4,027.25**				**7,577.10**
A. Enteric Fermentation		3,214.66					3,214.66
B. Manure Management		325.31	924.62				1,249.93
C. Rice Cultivation		NO					NO
D. Agricultural Soils[3]		9.23	3,102.49				3,111.72
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		0.65	0.14				0.79
G. Other		NA	NA				NA
5. Land Use, Land-Use Change and Forestry[1]	**-3,542.18**	**0.13**	**50.78**				**-3,491.28**
A. Forest Land	-5,362.94	0.13	0.03				-5,362.78
B. Cropland	513.30	NA,NO	50.75				564.05
C. Grassland	362.92	NO	NO				362.92
D. Wetlands	353.61	NO	NO				353.61
E. Settlements	257.76	NA,NO	NA,NO				257.76
F. Other Land	333.16	NA,NO	NA,NO				333.16
G. Other	NE	NA	NA				NA,NE
6. Waste	**2.03**	**1,330.18**	**376.09**				**1,708.31**
A. Solid Waste Disposal on Land	NA,NO	1,252.83					1,252.83
B. Waste-water Handling		23.30	265.97				289.27
C. Waste Incineration	2.03	0.00	0.01				2.04
D. Other	NA	54.05	110.12				164.18
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	2,212.86	1.02	27.43				2,241.31
Aviation	2,168.44	0.98	22.57				2,191.99
Marine	44.43	0.04	4.86				49.32
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**23,302.33**						**23,302.33**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	82,843.87
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	79,352.60

Table B.2 Summary report for national emissions in 2011 (CRF Summary1.A)

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		**66,913.30**	**255.43**	**17.24**	**2,397.90**	**1,349.01**	**328.36**	**60.07**	**0.01**	**0.01**	**181.14**	**607.02**	**127.74**	**18.40**
1. Energy		**60,830.19**	**22.17**	**2.23**							**173.95**	**578.36**	**48.29**	**17.18**
A. Fuel Combustion	Reference Approach [2]	64,338.11												
	Sectoral Approach [2]	60,597.01	10.71	2.23							173.95	578.36	46.36	16.94
1. Energy Industries		13,861.09	0.43	0.38							13.58	5.74	0.95	2.96
2. Manufacturing Industries and Construction		14,827.78	0.71	0.50							32.28	153.23	2.44	11.32
3. Transport		21,523.38	0.64	0.69							106.56	145.46	13.03	0.21
4. Other Sectors		10,337.93	8.93	0.66							21.46	273.65	29.92	2.44
5. Other		46.83	0.00	0.00							0.08	0.28	0.02	0.01
B. Fugitive Emissions from Fuels		233.17	11.46	IE,NA							IE,NA	IE,NA	1.93	0.23
1. Solid Fuels		IE,NA,NO	0.04	NA							NA	NA	NA,NO	NA
2. Oil and Natural Gas		233.17	11.42	IE,NA							IE,NA	IE,NA	1.93	0.23
2. Industrial Processes		**9,450.09**	**0.88**	**0.15**	**2,397.90**	**1,349.01**	**328.36**	**60.07**	**0.01**	**0.01**	**1.50**	**23.95**	**4.91**	**1.22**
A. Mineral Products		3,029.59	NA	NA							NA	9.78	IE,NA	NA
B. Chemical Industry		631.56	0.87	0.15	NO	NO	NO	NO	NO	NO	0.38	11.12	1.32	0.77
C. Metal Production		5,788.94	0.00	NA				NO		0.00	0.11	2.31	0.45	0.45
D. Other Production [3]		NA									1.01	0.74	3.13	NA
E. Production of Halocarbons and SF_6						NA		NA		NA				
F. Consumption of Halocarbons and SF_6					2,397.90	1,349.01	328.36	60.07	0.01	0.01				
G. Other		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table B.2 continued

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	**173.19**		**0.49**							**NA**	**NA**	**72.53**	**NA**
4. Agriculture		**169.04**	**12.99**							**5.66**	**0.50**	**1.95**	**0.00**
A. Enteric Fermentation		153.08											
B. Manure Management		15.49	2.98									NA,NO	
C. Rice Cultivation		NO										NO	
D. Agricultural Soils[4]		0.44	10.01									1.88	
E. Prescribed Burning of Savannas		NO	NO							NO	NO	NO	
F. Field Burning of Agricultural Residues		0.03	0.00							0.01	0.50	0.08	
G. Other		NA	NA							5.65	NA	NA	0.00
5. Land Use, Land-Use Change and Forestry	[5] **-3,542.18**	**0.01**	**0.16**							**IE,NA,NE**	**IE,NA,NE**	**NA,NE**	**NA**
A. Forest Land	[5] -5,362.94	0.01	0.00							NE	NE	NE	
B. Cropland	[5] 513.30	NA,NO	0.16							IE	IE	NE	
C. Grassland	[5] 362.92	NO	NO							IE	IE	NE	
D. Wetlands	[5] 353.61	NO	NO							NA	NA	NA	
E. Settlements	[5] 257.76	NA,NO	NA,NO							NA	NA	NA	
F. Other Land	[5] 333.16	NA,NO	NA,NO							NA	NA	NA	
G. Other	[5] NE	NA	NA							NA	NA	NA	NA
6. Waste	**2.03**	**63.34**	**1.21**							**0.01**	**4.21**	**0.06**	**0.01**
A. Solid Waste Disposal on Land	[6] NA,NO	59.66								NA,NO	4.20	0.06	
B. Waste-water Handling		1.11	0.86							NA	NA	NA	
C. Waste Incineration	[6] 2.03	0.00	0.00							0.01	0.01	0.00	0.01
D. Other	NA	2.57	0.36							NA	NA	NA	NA
7. Other *(please specify)* [7]	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

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	**2,212.86**	**0.05**	**0.09**							**9.55**	**2.61**	**0.94**	**0.70**
Aviation	2,168.44	0.05	0.07							9.05	2.53	0.94	0.69
Marine	44.43	0.00	0.02							0.51	0.08	NA	0.01
Multilateral Operations	**NO**	**NO**	**NO**							**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass	**23,302.33**												

Table B.3 Short summary report for national emissions in 2011 (CRF Summary1.B)

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		**66,913.30**	**255.43**	**17.24**	**2,397.90**	**1,349.01**	**328.36**	**60.07**	**0.01**	**0.01**	**181.14**	**607.02**	**127.74**	**18.40**
1. Energy		**60,830.19**	**22.17**	**2.23**							**173.95**	**578.36**	**48.29**	**17.18**
A. Fuel Combustion	Reference Approach[2]	64,338.11												
	Sectoral Approach[2]	60,597.01	10.71	2.23							173.95	578.36	46.36	16.94
B. Fugitive Emissions from Fuels		233.17	11.46	IE,NA							IE,NA	IE,NA	1.93	0.23
2. Industrial Processes		**9,450.09**	**0.88**	**0.15**	**2,397.90**	**1,349.01**	**328.36**	**60.07**	**0.01**	**0.01**	**1.50**	**23.95**	**4.91**	**1.22**
3. Solvent and Other Product Use		**173.19**		**0.49**							**NA**	**NA**	**72.53**	**NA**
4. Agriculture [3]			**169.04**	**12.99**							**5.66**	**0.50**	**1.95**	**0.00**
5. Land Use, Land-Use Change and Forestry		[4] **-3,542.18**	**0.01**	**0.16**							**IE,NA,NE**	**IE,NA,NE**	**NA,NE**	**NA**
6. Waste		**2.03**	**63.34**	**1.21**							**0.01**	**4.21**	**0.06**	**0.01**
7. Other		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Memo Items: [5]														
International Bunkers		**2,212.86**	**0.05**	**0.09**							**9.55**	**2.61**	**0.94**	**0.70**
Aviation		2,168.44	0.05	0.07							9.05	2.53	0.94	0.69
Marine		44.43	0.00	0.02							0.51	0.08	NA	0.01
Multilateral Operations		**NO**	**NO**	**NO**							**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass		**23,302.33**												

Table B.4 CO_2 emissions 1990–2011 (CRF Table10s1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	**54,171.69**	**57,963.28**	**53,065.21**	**53,465.97**	**53,537.97**	**56,355.12**	**60,112.28**	**59,299.50**	**59,256.20**	**58,027.14**
A. Fuel Combustion (Sectoral Approach)	54,069.60	57,852.19	52,945.09	53,353.84	53,410.33	56,227.97	60,041.14	59,178.87	59,114.26	57,856.50
1. Energy Industries	13,792.28	14,622.47	11,314.87	11,466.07	11,761.35	12,918.64	13,804.55	13,874.68	13,002.69	12,526.98
2. Manufacturing Industries and Construction	12,685.38	13,074.34	11,948.10	12,247.75	13,237.18	13,489.03	13,704.06	15,241.14	13,991.70	13,205.72
3. Transport	13,771.40	15,234.53	15,208.62	15,341.65	15,391.00	15,675.07	17,232.78	16,251.57	18,351.92	17,825.01
4. Other Sectors	13,785.55	14,883.76	14,439.82	14,258.97	12,979.24	14,112.67	15,260.85	13,774.39	13,725.54	14,257.21
5. Other	35.00	37.09	33.67	39.41	41.56	32.55	38.89	37.08	42.39	41.57
B. Fugitive Emissions from Fuels	102.09	111.09	120.13	112.13	127.64	127.15	71.14	120.63	141.94	170.65
1. Solid Fuels	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO
2. Oil and Natural Gas	102.09	111.09	120.13	112.13	127.64	127.15	71.14	120.63	141.94	170.65
2. Industrial Processes	**7,581.71**	**7,423.68**	**6,877.10**	**6,853.58**	**7,180.38**	**7,387.93**	**7,086.99**	**7,677.03**	**7,321.04**	**7,145.69**
A. Mineral Products	3,274.18	3,131.72	3,152.67	3,087.49	3,201.88	2,862.55	2,775.17	2,975.07	2,821.92	2,807.37
B. Chemical Industry	582.56	603.24	565.70	600.61	546.56	583.54	590.17	582.72	579.50	585.61
C. Metal Production	3,724.96	3,688.72	3,158.74	3,165.48	3,431.94	3,941.84	3,721.65	4,119.24	3,919.62	3,752.71
D. Other Production	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	279.30	233.48	185.15	185.98	170.76	189.95	173.16	191.87	173.82	159.76
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[2]	**-9,968.16**	**-15,685.06**	**-10,886.83**	**-11,322.73**	**-10,189.25**	**-11,539.09**	**-8,432.56**	**-17,095.69**	**-15,199.62**	**-18,073.56**
A. Forest Land	-11,862.92	-17,612.32	-12,869.02	-13,355.05	-12,196.39	-13,143.37	-10,012.15	-18,651.87	-16,725.50	-19,592.47
B. Cropland	198.19	197.54	219.22	236.17	238.51	249.23	261.41	274.86	281.37	282.34
C. Grassland	353.68	348.22	342.85	337.43	347.77	149.32	162.21	175.14	188.10	193.55
D. Wetlands	191.08	205.66	220.24	234.82	242.09	241.34	248.79	256.24	263.70	274.63
E. Settlements	286.26	293.58	300.90	308.22	293.03	217.76	197.91	178.07	158.23	149.10
F. Other Land	865.55	882.26	898.97	915.68	885.74	746.64	709.25	671.87	634.48	619.30
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	**26.89**	**23.40**	**10.86**	**10.60**	**10.65**	**10.97**	**11.30**	**11.62**	**11.94**	**12.26**
A. Solid Waste Disposal on Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
B. Waste-water Handling										
C. Waste Incineration	26.89	23.40	10.86	10.60	10.65	10.97	11.30	11.62	11.94	12.26
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7. Other ***(as specified in Summary 1.A)***	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total CO_2 emissions including net CO_2 from LULUCF	**52,091.43**	**49,958.78**	**49,251.49**	**49,193.40**	**50,710.50**	**52,404.88**	**58,951.17**	**50,084.33**	**51,563.39**	**47,271.30**
Total CO_2 emissions excluding net CO_2 from LULUCF	**62,059.59**	**65,643.84**	**60,138.33**	**60,516.13**	**60,899.75**	**63,943.97**	**67,383.73**	**67,180.02**	**66,763.01**	**65,344.86**
Memo Items:										
International Bunkers	**924.70**	**1,027.57**	**1,110.20**	**1,173.64**	**1,228.45**	**1,375.60**	**1,515.79**	**1,573.72**	**1,630.79**	**1,593.64**
Aviation	885.97	993.88	1,077.44	1,139.98	1,185.65	1,327.42	1,466.42	1,525.57	1,578.21	1,541.67
Marine	38.72	33.70	32.77	33.66	42.80	48.17	49.37	48.15	52.58	51.98
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass	9,927.77	10,814.86	10,576.17	11,145.84	10,753.83	11,454.01	12,189.91	11,755.98	11,514.85	13,213.80

Table B.4 continued

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	**57,988.69**	**62,080.09**	**63,210.27**	**69,306.04**	**69,781.67**	**70,790.94**	**67,658.51**	**64,492.35**	**63,752.74**	**59,187.77**
A. Fuel Combustion (Sectoral Approach)	57,824.04	61,897.24	63,043.12	69,072.89	69,571.52	70,585.79	67,426.35	64,255.19	63,540.58	58,922.61
1. Energy Industries	12,221.05	13,825.71	13,473.50	16,287.24	16,324.94	16,274.39	15,159.57	13,885.09	13,672.64	12,740.11
2. Manufacturing Industries and Construction	13,861.46	13,715.72	14,044.13	14,678.86	15,094.98	16,363.64	16,097.25	15,841.54	15,932.21	14,340.21
3. Transport	18,620.84	20,109.47	22,008.29	23,858.14	24,379.03	24,679.12	23,402.81	23,576.88	22,322.82	21,516.93
4. Other Sectors	13,079.89	14,204.98	13,475.28	14,206.19	13,729.55	13,225.07	12,722.66	10,907.06	11,567.74	10,279.66
5. Other	40.80	41.36	41.91	42.47	43.03	43.57	44.06	44.61	45.17	45.70
B. Fugitive Emissions from Fuels	164.65	182.85	167.15	233.15	210.15	205.15	232.16	237.16	212.16	265.16
1. Solid Fuels	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO
2. Oil and Natural Gas	164.65	182.85	167.15	233.15	210.15	205.15	232.16	237.16	212.16	265.16
2. Industrial Processes	**7,776.11**	**7,702.91**	**8,273.32**	**8,218.67**	**8,233.11**	**8,707.48**	**9,113.12**	**9,546.07**	**9,952.23**	**8,051.65**
A. Mineral Products	2,965.71	2,983.49	3,093.10	3,081.21	3,178.18	3,132.87	3,306.72	3,517.56	3,531.12	2,915.82
B. Chemical Industry	589.70	541.95	553.66	595.00	589.62	559.25	593.00	525.08	593.32	539.08
C. Metal Production	4,220.70	4,177.48	4,626.55	4,542.46	4,465.32	5,015.35	5,213.40	5,503.43	5,827.79	4,596.75
D. Other Production	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	192.62	204.10	218.14	221.26	188.85	212.99	250.73	228.07	210.69	153.46
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[(2)]	**-14,972.68**	**-16,860.72**	**-10,916.88**	**-870.42**	**-5,927.75**	**-7,333.52**	**-1,523.82**	**-464.24**	**433.57**	**-3,589.07**
A. Forest Land	-16,452.00	-18,352.99	-12,651.32	-2,613.20	-7,695.76	-9,148.49	-3,333.89	-2,305.75	-1,410.95	-5,459.25
B. Cropland	288.61	294.49	370.74	380.88	402.68	398.40	408.41	439.75	461.38	519.66
C. Grassland	198.99	204.56	396.82	398.14	399.09	400.67	399.63	401.25	399.96	375.73
D. Wetlands	285.56	296.49	313.96	324.24	335.06	329.47	332.01	346.88	345.94	347.46
E. Settlements	100.61	104.92	174.07	181.02	189.63	261.80	262.33	262.87	263.40	266.04
F. Other Land	605.55	591.81	478.84	458.48	441.55	424.62	407.69	390.76	373.83	361.28
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	**12.26**	**12.26**	**12.26**	**12.26**	**12.26**	**12.26**	**10.15**	**8.12**	**6.09**	**4.06**
A. Solid Waste Disposal on Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
B. Waste-water Handling										
C. Waste Incineration	12.26	12.26	12.26	12.26	12.26	12.26	10.15	8.12	6.09	4.06
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7. Other ***(as specified in Summary 1.A)***	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total CO_2 emissions including net CO_2 from LULUCF	**50,997.00**	**53,138.65**	**60,797.11**	**76,887.82**	**72,288.15**	**72,390.15**	**75,508.68**	**73,810.38**	**74,355.31**	**63,807.87**
Total CO_2 emissions excluding net CO_2 from LULUCF	**65,969.68**	**69,999.37**	**71,713.99**	**77,758.25**	**78,215.90**	**79,723.67**	**77,032.51**	**74,274.62**	**73,921.74**	**67,396.95**
Memo Items:										
International Bunkers	**1,752.24**	**1,711.16**	**1,608.21**	**1,506.68**	**1,789.05**	**2,021.80**	**2,100.87**	**2,231.18**	**2,232.59**	**1,935.67**
Aviation	1,695.58	1,651.28	1,540.85	1,452.97	1,724.93	1,959.83	2,048.88	2,175.79	2,181.97	1,893.40
Marine	56.66	59.88	67.36	53.71	64.12	61.97	51.99	55.38	50.62	42.27
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass	12,477.53	13,552.81	12,508.81	12,985.42	13,152.82	16,553.92	17,540.02	19,358.17	20,828.33	21,260.95

Table B.4 continued

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	(Gg)	(Gg)	%
1. Energy	**63,387.55**	**60,830.19**	**12.29**
A. Fuel Combustion (Sectoral Approach)	63,150.38	60,597.01	12.07
1. Energy Industries	14,105.13	13,861.09	0.50
2. Manufacturing Industries and Construction	15,291.93	14,827.78	16.89
3. Transport	22,204.20	21,523.38	56.29
4. Other Sectors	11,502.84	10,337.93	-25.01
5. Other	46.27	46.83	33.79
B. Fugitive Emissions from Fuels	237.17	233.17	128.40
1. Solid Fuels	IE,NA,NO	IE,NA,NO	0.00
2. Oil and Natural Gas	237.17	233.17	128.40
2. Industrial Processes	**9,024.34**	**9,450.09**	**24.64**
A. Mineral Products	2,935.73	3,029.59	-7.47
B. Chemical Industry	607.80	631.56	8.41
C. Metal Production	5,480.81	5,788.94	55.41
D. Other Production	NA	NA	0.00
E. Production of Halocarbons and SF_6			
F. Consumption of Halocarbons and SF_6			
G. Other	NA	NA	0.00
3. Solvent and Other Product Use	176.89	173.19	-37.99
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[(2)]	**-3,567.72**	**-3,542.18**	**-64.46**
A. Forest Land	-5,411.09	-5,362.94	-54.79
B. Cropland	509.72	513.30	158.99
C. Grassland	368.75	362.92	2.61
D. Wetlands	355.78	353.61	85.06
E. Settlements	261.90	257.76	-9.96
F. Other Land	347.22	333.16	-61.51
G. Other	NE	NE	0.00
6. Waste	**2.03**	**2.03**	**-92.45**
A. Solid Waste Disposal on Land	NA,NO	NA,NO	0.00
B. Waste-water Handling			
C. Waste Incineration	2.03	2.03	-92.45
D. Other	NA	NA	0.00
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**0.00**
Total CO_2 emissions including net CO_2 from LULUCF	**69,023.08**	**66,913.30**	**28.45**
Total CO_2 emissions excluding net CO_2 from LULUCF	**72,590.80**	**70,455.49**	**13.53**
Memo Items:			
International Bunkers	**2,100.06**	**2,212.86**	**139.31**
Aviation	2,049.55	2,168.44	144.75
Marine	50.51	44.43	14.73
Multilateral Operations	NO	NO	0.00
CO_2 Emissions from Biomass	23,978.12	23,302.33	134.72

Table B.5 CH_4 emissions 1990–2011 (CRF Table10s2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	31.97	33.78	32.80	32.56	30.43	31.22	31.91	27.39	26.61	26.11
A. Fuel Combustion (Sectoral Approach)	22.01	23.91	22.07	21.74	19.99	20.45	21.18	16.60	16.01	16.06
1. Energy Industries	0.16	0.18	0.15	0.16	0.15	0.16	0.18	0.19	0.18	0.17
2. Manufacturing Industries and Construction	0.34	0.37	0.37	0.36	0.39	0.40	0.42	0.43	0.42	0.42
3. Transport	3.07	3.40	3.38	3.38	3.31	3.08	2.77	2.48	2.42	2.11
4. Other Sectors	18.44	19.95	18.17	17.84	16.15	16.81	17.81	13.50	12.98	13.35
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	9.96	9.87	10.73	10.83	10.44	10.78	10.73	10.79	10.61	10.05
1. Solid Fuels	0.55	0.48	0.40	0.39	0.32	0.31	0.27	0.27	0.28	0.27
2. Oil and Natural Gas	9.41	9.39	10.32	10.43	10.11	10.47	10.46	10.52	10.33	9.78
2. Industrial Processes	**0.71**	**0.70**	**0.67**	**0.70**	**0.71**	**0.69**	**0.70**	**0.71**	**0.74**	**0.70**
A. Mineral Products	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Chemical Industry	0.70	0.70	0.66	0.70	0.71	0.68	0.69	0.70	0.73	0.69
C. Metal Production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Other Production										
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use										
4. Agriculture	**199.63**	**196.68**	**188.75**	**188.92**	**188.81**	**192.07**	**188.83**	**185.58**	**184.20**	**182.06**
A. Enteric Fermentation	178.73	176.11	168.77	168.70	168.90	172.08	169.32	166.32	165.07	163.65
B. Manure Management	20.52	20.18	19.61	19.70	19.46	19.50	19.02	18.76	18.63	17.90
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	0.33	0.33	0.31	0.47	0.40	0.44	0.45	0.45	0.45	0.45
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**0.03**	**0.01**	**0.02**	**0.02**	**0.01**	**0.00**	**0.00**	**0.00**	**0.01**	**0.00**
A. Forest Land	0.03	0.01	0.02	0.02	0.01	0.00	0.00	0.00	0.01	0.00
B. Cropland	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,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	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
F. Other Land	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
6. Waste	**163.20**	**162.62**	**158.13**	**155.73**	**147.17**	**138.86**	**130.94**	**124.20**	**119.16**	**113.79**
A. Solid Waste Disposal on Land	157.82	157.23	152.77	150.35	141.80	133.61	125.98	119.60	114.85	109.68
B. Waste-water Handling	4.85	4.84	4.70	4.56	4.39	4.21	3.87	3.53	3.19	2.93
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	0.52	0.55	0.65	0.82	0.98	1.04	1.09	1.08	1.12	1.18
7. Other ***(as specified in Summary 1.A)***	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total CH_4 emissions including CH_4 from LULUCF	**395.54**	**393.78**	**380.36**	**377.92**	**367.13**	**362.84**	**352.38**	**337.88**	**330.72**	**322.66**
Total CH_4 emissions excluding CH_4 from LULUCF	**395.51**	**393.78**	**380.35**	**377.90**	**367.13**	**362.84**	**352.38**	**337.88**	**330.71**	**322.65**
Memo Items:										
International Bunkers	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03
Aviation	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03
Marine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass										

Table B.5 continued

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	25.17	25.09	23.78	23.41	23.55	23.79	22.91	22.41	22.39	22.16
A. Fuel Combustion (Sectoral Approach)	15.11	15.22	14.05	13.77	13.14	13.31	12.16	11.52	11.65	10.99
1. Energy Industries	0.16	0.19	0.20	0.24	0.27	0.26	0.29	0.30	0.32	0.36
2. Manufacturing Industries and Construction	0.44	0.46	0.46	0.53	0.58	0.61	0.62	0.62	0.66	0.64
3. Transport	1.92	1.80	1.76	1.67	1.50	1.33	1.16	1.02	0.86	0.77
4. Other Sectors	12.59	12.77	11.62	11.33	10.79	11.11	10.08	9.58	9.82	9.22
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	10.06	9.87	9.74	9.64	10.41	10.48	10.75	10.89	10.74	11.17
1. Solid Fuels	0.30	0.29	0.33	0.28	0.08	0.04	0.04	0.04	0.04	0.04
2. Oil and Natural Gas	9.76	9.58	9.40	9.36	10.33	10.44	10.71	10.85	10.70	11.13
2. Industrial Processes	**0.70**	**0.67**	**0.71**	**0.70**	**0.70**	**0.75**	**0.92**	**0.91**	**0.89**	**0.85**
A. Mineral Products	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Chemical Industry	0.70	0.67	0.70	0.69	0.70	0.75	0.92	0.90	0.88	0.84
C. Metal Production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Other Production										
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use										
4. Agriculture	**180.63**	**178.29**	**174.45**	**172.68**	**172.33**	**170.27**	**169.63**	**170.34**	**169.67**	**171.78**
A. Enteric Fermentation	162.71	160.48	157.20	155.71	155.69	153.74	153.23	153.84	153.52	155.49
B. Manure Management	17.42	17.33	16.83	16.52	16.20	16.12	15.94	16.03	15.70	15.83
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	0.45	0.43	0.38	0.41	0.37	0.37	0.41	0.42	0.41	0.42
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	0.05	0.05	0.05	0.05	0.07	0.05	0.04	0.04	0.04	0.04
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**0.01**	**0.00**	**0.03**	**0.03**	**0.00**	**0.00**	**0.01**	**0.01**	**0.01**	**0.01**
A. Forest Land	0.01	0.00	0.03	0.03	0.00	0.00	0.01	0.01	0.01	0.01
B. Cropland	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,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	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
F. Other Land	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
6. Waste	**108.97**	**104.93**	**105.40**	**107.30**	**100.80**	**94.98**	**90.55**	**85.08**	**78.86**	**73.17**
A. Solid Waste Disposal on Land	105.05	101.08	101.64	103.62	96.84	91.00	86.63	81.16	75.05	69.43
B. Waste-water Handling	2.68	2.43	2.18	1.95	1.79	1.64	1.48	1.39	1.30	1.20
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	1.24	1.41	1.58	1.74	2.16	2.33	2.44	2.52	2.51	2.53
7. Other ***(as specified in Summary 1.A)***	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total CH_4 emissions including CH_4 from LULUCF	**315.47**	**308.98**	**304.37**	**304.12**	**297.38**	**289.80**	**284.02**	**278.74**	**271.82**	**267.96**
Total CH_4 emissions excluding CH_4 from LULUCF	**315.47**	**308.98**	**304.34**	**304.09**	**297.38**	**289.79**	**284.01**	**278.74**	**271.81**	**267.95**
Memo Items:										
International Bunkers	0.03	0.03	0.04	0.04	0.05	0.04	0.04	0.05	0.05	0.04
Aviation	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Marine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass										

Table B.5 continued

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	(Gg)	(Gg)	%
1. Energy	23.55	22.17	-30.67
A. Fuel Combustion (Sectoral Approach)	11.99	10.71	-51.36
1. Energy Industries	0.40	0.43	165.93
2. Manufacturing Industries and Construction	0.68	0.71	110.10
3. Transport	0.71	0.64	-79.27
4. Other Sectors	10.21	8.93	-51.58
5. Other	0.00	0.00	28.50
B. Fugitive Emissions from Fuels	11.56	11.46	15.05
1. Solid Fuels	0.04	0.04	-93.67
2. Oil and Natural Gas	11.52	11.42	21.46
2. Industrial Processes	**0.87**	**0.88**	**24.37**
A. Mineral Products	NA	NA	0.00
B. Chemical Industry	0.87	0.87	24.18
C. Metal Production	0.00	0.00	83.83
D. Other Production			
E. Production of Halocarbons and SF_6			
F. Consumption of Halocarbons and SF_6			
G. Other	NA	NA	0.00
3. Solvent and Other Product Use			
4. Agriculture	**171.33**	**169.04**	**-15.32**
A. Enteric Fermentation	155.06	153.08	-14.35
B. Manure Management	15.78	15.49	-24.50
C. Rice Cultivation	NO	NO	0.00
D. Agricultural Soils	0.46	0.44	33.83
E. Prescribed Burning of Savannas	NO	NO	0.00
F. Field Burning of Agricultural Residues	0.04	0.03	-45.06
G. Other	NA	NA	0.00
5. Land Use, Land-Use Change and Forestry	**0.01**	**0.01**	**-78.00**
A. Forest Land	0.01	0.01	-78.00
B. Cropland	NA,NO	NA,NO	0.00
C. Grassland	NO	NO	0.00
D. Wetlands	NO	NO	0.00
E. Settlements	NA,NO	NA,NO	0.00
F. Other Land	NA,NO	NA,NO	0.00
G. Other	NA	NA	0.00
6. Waste	**67.96**	**63.34**	**-61.19**
A. Solid Waste Disposal on Land	64.29	59.66	-62.20
B. Waste-water Handling	1.11	1.11	-77.12
C. Waste Incineration	0.00	0.00	-98.41
D. Other	2.57	2.57	394.67
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**0.00**
Total CH_4 emissions including CH_4 from LULUCF	**263.72**	**255.43**	**-35.42**
Total CH_4 emissions excluding CH_4 from LULUCF	**263.72**	**255.43**	**-35.42**
Memo Items:			
International Bunkers	0.04	0.05	194.23
Aviation	0.04	0.05	220.45
Marine	0.00	0.00	-3.85
Multilateral Operations	NO	NO	0.00
CO_2 Emissions from Biomass			

Table B.6 N_2O emissions 1990–2011 (CRF Table 10s3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	**1.79**	**2.00**	**1.97**	**2.04**	**2.06**	**2.13**	**2.24**	**2.20**	**2.32**	**2.35**
A. Fuel Combustion (Sectoral Approach)	1.79	2.00	1.97	2.04	2.06	2.13	2.24	2.20	2.32	2.35
1. Energy Industries	0.15	0.17	0.14	0.14	0.14	0.16	0.15	0.15	0.17	0.16
2. Manufacturing Industries and Construction	0.26	0.28	0.28	0.30	0.31	0.32	0.35	0.36	0.37	0.41
3. Transport	0.62	0.73	0.77	0.81	0.86	0.87	0.90	0.88	0.98	0.95
4. Other Sectors	0.76	0.81	0.79	0.79	0.75	0.78	0.83	0.81	0.80	0.82
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	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA
1. Solid Fuels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2. Oil and Natural Gas	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA
2. Industrial Processes	**2.94**	**2.99**	**2.70**	**2.83**	**2.66**	**2.77**	**2.82**	**2.78**	**2.89**	**2.98**
A. Mineral Products	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Chemical Industry	2.94	2.99	2.70	2.83	2.66	2.77	2.82	2.78	2.89	2.98
C. Metal Production	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. Other Production										
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
4. Agriculture	**14.08**	**14.89**	**13.94**	**13.17**	**14.81**	**15.12**	**13.81**	**13.95**	**14.06**	**13.81**
A. Enteric Fermentation										
B. Manure Management	3.01	3.01	2.93	2.96	2.98	3.08	3.04	3.04	3.04	3.03
C. Rice Cultivation										
D. Agricultural Soils	11.06	11.88	11.00	10.21	11.82	12.04	10.76	10.91	11.01	10.78
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**0.13**	**0.13**	**0.13**	**0.13**	**0.13**	**0.13**	**0.12**	**0.12**	**0.12**	**0.12**
A. Forest Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Cropland	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.12
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	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
F. Other Land	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
6. Waste	**0.43**	**0.43**	**0.43**	**0.43**	**0.49**	**0.55**	**0.61**	**0.63**	**0.68**	**0.74**
A. Solid Waste Disposal on Land										
B. Waste-water Handling	0.35	0.35	0.33	0.32	0.36	0.40	0.45	0.49	0.53	0.58
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	0.08	0.08	0.09	0.12	0.14	0.14	0.15	0.15	0.15	0.16
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total N_2O emissions including N_2O from LULUCF	**20.13**	**21.19**	**19.92**	**19.36**	**20.91**	**21.44**	**20.34**	**20.44**	**20.82**	**20.74**
Total N_2O emissions excluding N_2O from LULUCF	**19.99**	**21.06**	**19.79**	**19.23**	**20.78**	**21.31**	**20.22**	**20.32**	**20.70**	**20.62**
Memo Items:										
International Bunkers	**0.04**	**0.05**	**0.05**	**0.05**	**0.06**	**0.06**	**0.07**	**0.07**	**0.07**	**0.07**
Aviation	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.06	0.05
Marine	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass										

Table B.6 continued

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	**2.36**	**2.45**	**2.48**	**2.56**	**2.55**	**2.66**	**2.56**	**2.50**	**2.43**	**2.28**
A. Fuel Combustion (Sectoral Approach)	2.36	2.45	2.48	2.56	2.55	2.66	2.56	2.50	2.43	2.28
1. Energy Industries	0.16	0.19	0.19	0.22	0.24	0.27	0.29	0.31	0.33	0.32
2. Manufacturing Industries and Construction	0.43	0.43	0.40	0.42	0.43	0.50	0.51	0.52	0.52	0.48
3. Transport	0.98	1.01	1.09	1.13	1.10	1.08	1.00	0.95	0.85	0.79
4. Other Sectors	0.78	0.82	0.79	0.79	0.78	0.81	0.76	0.72	0.73	0.68
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	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA
1. Solid Fuels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2. Oil and Natural Gas	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA
2. Industrial Processes	**3.07**	**2.54**	**2.60**	**2.85**	**0.91**	**0.88**	**0.90**	**0.87**	**1.05**	**0.53**
A. Mineral Products	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Chemical Industry	3.07	2.54	2.60	2.85	0.91	0.88	0.90	0.87	1.05	0.53
C. Metal Production	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. Other Production										
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	0.75	0.71	0.67	0.64	0.60	0.56	0.53	0.52	0.51	0.47
4. Agriculture	**13.28**	**13.29**	**13.22**	**12.67**	**12.36**	**12.38**	**12.54**	**12.71**	**13.20**	**12.99**
A. Enteric Fermentation										
B. Manure Management	2.98	2.98	2.93	2.94	2.95	2.93	2.93	2.96	2.97	3.00
C. Rice Cultivation										
D. Agricultural Soils	10.30	10.31	10.28	9.73	9.41	9.45	9.61	9.75	10.23	9.99
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**0.12**	**0.12**	**0.12**	**0.12**	**0.11**	**0.12**	**0.12**	**0.14**	**0.15**	**0.16**
A. Forest Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Cropland	0.12	0.12	0.12	0.12	0.11	0.12	0.12	0.14	0.15	0.16
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	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
F. Other Land	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
6. Waste	**0.83**	**0.93**	**0.95**	**0.97**	**1.03**	**1.09**	**1.15**	**1.18**	**1.19**	**1.20**
A. Solid Waste Disposal on Land										
B. Waste-water Handling	0.66	0.74	0.74	0.73	0.73	0.77	0.81	0.83	0.84	0.85
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	0.17	0.19	0.22	0.24	0.30	0.32	0.34	0.35	0.35	0.35
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total N_2O emissions including N_2O from LULUCF	**20.41**	**20.04**	**20.04**	**19.81**	**17.56**	**17.69**	**17.81**	**17.91**	**18.53**	**17.62**
Total N_2O emissions excluding N_2O from LULUCF	**20.29**	**19.92**	**19.93**	**19.69**	**17.45**	**17.57**	**17.68**	**17.77**	**18.37**	**17.46**
Memo Items:										
International Bunkers	**0.08**	**0.08**	**0.08**	**0.07**	**0.08**	**0.09**	**0.09**	**0.09**	**0.09**	**0.08**
Aviation	0.06	0.06	0.05	0.05	0.06	0.07	0.07	0.07	0.07	0.06
Marine	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass										

Table B.6 continued

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	(Gg)	(Gg)	%
1. Energy	**2.35**	**2.23**	**24.46**
A. Fuel Combustion (Sectoral Approach)	2.35	2.23	24.46
1. Energy Industries	0.39	0.38	156.73
2. Manufacturing Industries and Construction	0.50	0.50	90.83
3. Transport	0.75	0.69	10.39
4. Other Sectors	0.71	0.66	-12.89
5. Other	0.00	0.00	12.22
B. Fugitive Emissions from Fuels	IE,NA	IE,NA	0.00
1. Solid Fuels	NA	NA	0.00
2. Oil and Natural Gas	IE,NA	IE,NA	0.00
2. Industrial Processes	**0.20**	**0.15**	**-94.76**
A. Mineral Products	NA	NA	0.00
B. Chemical Industry	0.20	0.15	-94.76
C. Metal Production	NA	NA	0.00
D. Other Production			
E. Production of Halocarbons and SF_6			
F. Consumption of Halocarbons and SF_6			
G. Other	NA	NA	0.00
3. Solvent and Other Product Use	0.48	0.49	-35.05
4. Agriculture	**12.48**	**12.99**	**-7.72**
A. Enteric Fermentation			
B. Manure Management	3.02	2.98	-1.00
C. Rice Cultivation			
D. Agricultural Soils	9.46	10.01	-9.55
E. Prescribed Burning of Savannas	NO	NO	0.00
F. Field Burning of Agricultural Residues	0.00	0.00	-50.48
G. Other	NA	NA	0.00
5. Land Use, Land-Use Change and Forestry	**0.16**	**0.16**	**23.75**
A. Forest Land	0.00	0.00	-78.00
B. Cropland	0.16	0.16	24.09
C. Grassland	NO	NO	0.00
D. Wetlands	NO	NO	0.00
E. Settlements	NA,NO	NA,NO	0.00
F. Other Land	NA,NO	NA,NO	0.00
G. Other	NA	NA	0.00
6. Waste	**1.21**	**1.21**	**182.19**
A. Solid Waste Disposal on Land			
B. Waste-water Handling	0.85	0.86	142.89
C. Waste Incineration	0.00	0.00	-95.78
D. Other	0.35	0.36	365.69
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**0.00**
Total N_2O emissions including N_2O from LULUCF	**16.88**	**17.24**	**-14.34**
Total N_2O emissions excluding N_2O from LULUCF	**16.72**	**17.08**	**-14.59**
Memo Items:			
International Bunkers	**0.09**	**0.09**	**99.31**
Aviation	0.07	0.07	135.72
Marine	0.02	0.02	16.01
Multilateral Operations	NO	NO	0.00
CO_2 Emissions from Biomass			

Table B.7 HFC, PFC and SF_6 emissions 1990–2011 (CRF Table10s4)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
Emissions of HFCs[3] - (Gg CO_2 equivalent)	**22.55**	**24.73**	**26.51**	**237.01**	**260.33**	**339.64**	**392.57**	**460.99**	**555.40**	**632.48**
HFC-23	NA,NO	NA,NO	NA,NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-32	NA,NO	NA,NO	NA,NO	NA,NO	0.00	0.00	0.00	0.00	0.00	0.00
HFC-41	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-43-10mee	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-125	NA,NO	NA,NO	NA,NO	0.00	0.00	0.00	0.00	0.01	0.01	0.02
HFC-134	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-134a	0.02	0.02	0.02	0.17	0.18	0.23	0.26	0.30	0.35	0.38
HFC-152a	NA,NO	NA,NO	NA,NO	0.07	0.08	0.08	0.09	0.10	0.10	0.10
HFC-143	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-143a	NA,NO	NA,NO	NA,NO	0.00	0.00	0.00	0.00	0.01	0.01	0.02
HFC-227ea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-236fa	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-245ca	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Unspecified mix of listed HFCs[4] - (Gg CO_2 equivalent)	1.93	3.07	4.44	5.81	7.18	8.53	9.74	9.43	2.96	3.23
Emissions of PFCs[3] - (Gg CO_2 equivalent)	**1,079.24**	**1,087.08**	**462.32**	**52.57**	**58.30**	**68.39**	**65.92**	**96.48**	**44.40**	**64.19**
CF_4	0.14	0.14	0.05	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO
C_2F_6	0.02	0.02	0.01	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO
C_3F_8	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO
C_4F_{10}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
c-C_4F_8	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO
C_5F_{12}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
C_6F_{14}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Unspecified mix of listed PFCs[4] - (Gg CO_2 equivalent)	29.05	36.89	44.73	52.57	58.30	68.39	65.92	96.48	44.40	64.19
Emissions of SF6[3] - (Gg CO_2 equivalent)	**493.37**	**643.82**	**687.97**	**779.93**	**970.88**	**1,153.20**	**1,233.69**	**1,138.81**	**911.84**	**708.98**
SF_6	0.02	0.03	0.03	0.03	0.04	0.05	0.05	0.05	0.04	0.03

Table B.7 continued

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000 (Gg)	2001 (Gg)	2002 (Gg)	2003 (Gg)	2004 (Gg)	2005 (Gg)	2006 (Gg)	2007 (Gg)	2008 (Gg)	2009 (Gg)
Emissions of HFCs[3] - (Gg CO_2 equivalent)	**646.82**	**773.86**	**874.78**	**952.51**	**1,020.17**	**997.37**	**1,004.15**	**1,042.65**	**1,082.02**	**1,134.26**
HFC-23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-32	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.03	0.03
HFC-41	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-43-10mee	0.00	0.00	0.00	0.00	0.00	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-125	0.03	0.04	0.04	0.06	0.06	0.07	0.08	0.08	0.09	0.10
HFC-134	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-134a	0.30	0.34	0.35	0.39	0.43	0.41	0.38	0.39	0.40	0.39
HFC-152a	0.60	0.61	0.95	0.64	0.43	0.20	0.25	0.25	0.09	0.13
HFC-143	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-143a	0.02	0.03	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.08
HFC-227ea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-236fa	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-245ca	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Unspecified mix of listed HFCs[4] - (Gg CO_2 equivalent)	3.85	4.14	4.05	3.88	4.06	3.98	5.03	7.07	7.39	1.71
Emissions of PFCs[3] - (Gg CO_2 equivalent)	**67.46**	**90.03**	**83.46**	**102.20**	**125.49**	**125.04**	**136.94**	**183.72**	**167.13**	**28.64**
CF_4	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO
C_2F_6	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO
C_3F_8	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	0.00	0.00	0.00	IE,NA,NO
C_4F_{10}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
$c\text{-}C_4F_8$	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO
C_5F_{12}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
C_6F_{14}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Unspecified mix of listed PFCs[4] - (Gg CO_2 equivalent)	67.46	90.03	83.46	102.20	125.49	125.04	135.50	182.55	166.39	28.64
Emissions of SF6[3] - (Gg CO_2 equivalent)	**602.25**	**659.69**	**642.89**	**575.58**	**507.07**	**517.12**	**474.88**	**384.22**	**390.87**	**357.54**
SF_6	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.01

Table B.7 continued

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	(Gg)	(Gg)	%
Emissions of HFCs[3] - (Gg CO_2 equivalent)	**1,285.65**	**1,349.01**	**5,882.27**
HFC-23	0.00	0.00	100.00
HFC-32	0.04	0.05	100.00
HFC-41	NA,NO	NA,NO	0.00
HFC-43-10mee	NA,NO	NA,NO	-100.00
HFC-125	0.12	0.13	100.00
HFC-134	NA,NO	NA,NO	0.00
HFC-134a	0.43	0.45	2,823.34
HFC-152a	0.13	NA,NO	0.00
HFC-143	NA,NO	NA,NO	0.00
HFC-143a	0.09	0.09	100.00
HFC-227ea	0.00	0.00	4,471,455.33
HFC-236fa	NA,NO	NA,NO	0.00
HFC-245ca	NA,NO	NA,NO	0.00
Unspecified mix of listed HFCs[4] - (Gg CO_2 equivalent)	1.62	1.63	-15.42
Emissions of PFCs[3] - (Gg CO_2 equivalent)	**63.93**	**60.07**	**-94.43**
CF_4	IE,NA,NO	IE,NA,NO	-100.00
C_2F_6	IE,NA,NO	IE,NA,NO	-100.00
C_3F_8	IE,NA,NO	IE,NA,NO	0.00
C_4F_{10}	NA,NO	NA,NO	0.00
c-C_4F_8	IE,NA,NO	IE,NA,NO	0.00
C_5F_{12}	NA,NO	NA,NO	0.00
C_6F_{14}	NA,NO	NA,NO	0.00
Unspecified mix of listed PFCs[4] - (Gg CO_2 equivalent)	63.93	60.07	106.78
Emissions of SF6[3] - (Gg CO_2 equivalent)	**351.50**	**321.53**	**-34.83**
SF_6	0.01	0.01	-34.83

Table B.8 Emission trends summary (CRF Table10s5)

GREENHOUSE GAS EMISSIONS	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
CO_2 emissions including net CO_2 from LULUCF	52,091.43	49,958.78	49,251.49	49,193.40	50,710.50	52,404.88	58,951.17	50,084.33	51,563.39	47,271.30
CO_2 emissions excluding net CO_2 from LULUCF	62,059.59	65,643.84	60,138.33	60,516.13	60,899.75	63,943.97	67,383.73	67,180.02	66,763.01	65,344.86
CH_4 emissions including CH_4 from LULUCF	8,306.26	8,269.48	7,987.63	7,936.28	7,709.81	7,619.69	7,400.07	7,095.50	6,945.19	6,775.76
CH_4 emissions excluding CH_4 from LULUCF	8,305.68	8,269.33	7,987.25	7,935.96	7,709.65	7,619.60	7,399.99	7,095.44	6,944.92	6,775.74
N_2O emissions including N_2O from LULUCF	6,238.95	6,570.08	6,174.70	6,000.53	6,480.59	6,645.27	6,306.06	6,337.43	6,455.11	6,429.75
N_2O emissions excluding N_2O from LULUCF	6,197.91	6,529.36	6,134.12	5,960.16	6,440.81	6,606.11	6,267.54	6,299.44	6,417.59	6,392.66
HFCs	22.55	24.73	26.51	237.01	260.33	339.64	392.57	460.99	555.40	632.48
PFCs	1,079.24	1,087.08	462.32	52.57	58.30	68.39	65.92	96.48	44.40	64.19
SF_6	493.37	643.82	687.97	779.93	970.88	1,153.20	1,233.69	1,138.81	911.84	708.98
Total (including LULUCF)	**68,231.79**	**66,553.97**	**64,590.62**	**64,199.71**	**66,190.41**	**68,231.07**	**74,349.48**	**65,213.54**	**66,475.32**	**61,882.46**
Total (excluding LULUCF)	**78,158.34**	**82,198.15**	**75,436.50**	**75,481.75**	**76,339.72**	**79,730.90**	**82,743.44**	**82,271.19**	**81,637.15**	**79,918.91**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
1. Energy	55,398.83	59,292.69	54,365.98	54,782.07	54,816.56	57,671.63	61,475.78	60,556.55	60,533.80	59,302.64
2. Industrial Processes	10,103.72	10,121.21	8,905.38	8,816.49	9,310.08	9,820.76	9,668.02	10,250.75	9,744.86	9,489.40
3. Solvent and Other Product Use	511.80	465.98	417.65	418.48	403.26	422.45	405.66	424.37	406.32	392.26
4. Agriculture	8,556.70	8,746.33	8,283.56	8,049.78	8,555.58	8,719.60	8,245.32	8,222.85	8,226.11	8,103.13
5. Land Use, Land-Use Change and Forestry[5]	-9,926.54	-15,644.18	-10,845.87	-11,282.05	-10,149.30	-11,499.84	-8,393.96	-17,057.64	-15,161.83	-18,036.44
6. Waste	3,587.28	3,571.93	3,463.94	3,414.94	3,254.24	3,096.47	2,948.66	2,816.67	2,726.05	2,631.47
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)[5]	**68,231.79**	**66,553.97**	**64,590.62**	**64,199.71**	**66,190.41**	**68,231.07**	**74,349.48**	**65,213.54**	**66,475.32**	**61,882.46**

Table B.8 continued

GREENHOUSE GAS EMISSIONS	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
CO_2 emissions including net CO_2 from LULUCF	50,997.00	53,138.65	60,797.11	76,887.82	72,288.15	72,390.15	75,508.68	73,810.38	74,355.31	63,807.87
CO_2 emissions excluding net CO_2 from LULUCF	65,969.68	69,999.37	71,713.99	77,758.25	78,215.90	79,723.67	77,032.51	74,274.62	73,921.74	67,396.95
CH_4 emissions including CH_4 from LULUCF	6,624.97	6,488.65	6,391.72	6,386.50	6,244.99	6,085.75	5,964.47	5,853.64	5,708.17	5,627.18
CH_4 emissions excluding CH_4 from LULUCF	6,624.85	6,488.58	6,391.16	6,385.96	6,244.94	6,085.66	5,964.26	5,853.53	5,708.02	5,627.01
N_2O emissions including N_2O from LULUCF	6,325.90	6,211.28	6,213.71	6,139.68	5,444.14	5,484.00	5,520.66	5,552.70	5,742.87	5,462.91
N_2O emissions excluding N_2O from LULUCF	6,289.10	6,174.83	6,177.36	6,103.50	5,408.59	5,448.03	5,482.08	5,509.89	5,695.25	5,414.02
HFCs	646.82	773.86	874.78	952.51	1,020.17	997.37	1,004.15	1,042.65	1,082.02	1,134.26
PFCs	67.46	90.03	83.46	102.20	125.49	125.04	136.94	183.72	167.13	28.64
SF_6	602.25	659.69	642.89	575.58	507.07	517.12	474.88	384.22	390.87	357.54
Total (including LULUCF)	**65,264.38**	**67,362.15**	**75,003.66**	**91,044.29**	**85,630.01**	**85,599.43**	**88,609.78**	**86,827.30**	**87,446.36**	**76,418.40**
Total (excluding LULUCF)	**80,200.15**	**84,186.35**	**85,883.64**	**91,878.00**	**91,522.15**	**92,896.90**	**90,094.80**	**87,248.62**	**86,965.03**	**79,958.42**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
1. Energy	59,248.09	63,367.24	64,477.33	70,591.68	71,067.66	72,114.60	68,932.38	65,738.72	64,977.24	60,358.65
2. Industrial Processes	10,058.92	10,027.08	10,696.47	10,746.99	10,181.44	10,636.97	11,028.53	11,445.72	11,936.68	9,755.23
3. Solvent and Other Product Use	425.12	424.82	427.08	418.42	374.23	386.59	415.03	388.34	367.24	299.16
4. Agriculture	7,909.85	7,863.10	7,761.05	7,554.89	7,451.63	7,414.05	7,450.06	7,516.53	7,653.97	7,634.11
5. Land Use, Land-Use Change and Forestry[5]	-14,935.76	-16,824.20	-10,879.97	-833.72	-5,892.14	-7,297.47	-1,485.03	-421.32	481.34	-3,540.02
6. Waste	2,558.17	2,504.11	2,521.70	2,566.02	2,447.19	2,344.70	2,268.81	2,159.30	2,029.90	1,911.26
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)[5]	**65,264.38**	**67,362.15**	**75,003.66**	**91,044.29**	**85,630.01**	**85,599.43**	**88,609.78**	**86,827.30**	**87,446.36**	**76,418.40**

Table B.8 continued

GREENHOUSE GAS EMISSIONS	2010	2011	Change from base to latest reported year
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(%)
CO_2 emissions including net CO_2 from LULUCF	69,023.08	66,913.30	28.45
CO_2 emissions excluding net CO_2 from LULUCF	72,590.80	70,455.49	13.53
CH_4 emissions including CH_4 from LULUCF	5,538.16	5,364.11	-35.42
CH_4 emissions excluding CH_4 from LULUCF	5,538.02	5,363.98	-35.42
N_2O emissions including N_2O from LULUCF	5,234.23	5,344.57	-14.34
N_2O emissions excluding N_2O from LULUCF	5,184.34	5,293.79	-14.59
HFCs	1,285.65	1,349.01	5,882.27
PFCs	63.93	60.07	-94.43
SF_6	351.50	321.53	-34.83
Total (including LULUCF)	**81,496.56**	**79,352.60**	**16.30**
Total (excluding LULUCF)	**85,014.25**	**82,843.87**	**5.99**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(%)
1. Energy	64,609.22	61,987.31	11.89
2. Industrial Processes	10,807.16	11,246.95	11.31
3. Solvent and Other Product Use	327.12	324.20	-36.65
4. Agriculture	7,466.75	7,577.10	-11.45
5. Land Use, Land-Use Change and Forestry[5]	-3,517.69	-3,491.28	-64.83
6. Waste	1,804.00	1,708.31	-52.38
7. Other	NA	NA	0.00
Total (including LULUCF)[5]	**81,496.56**	**79,352.60**	**16.30**

Appendix C

Examples of Research Projects

Table C.1 Interdisciplinary programmes

ACCENT - Atmospheric composition change: A European Network Helga Kromp-Kolb helga.kromp-kolb@boku.ac.at http://www.accent-network.org/	ACCENT's goals are to promote a common European strategy for research on atmospheric composition change, to develop and maintain durable means of communication and collaboration within the European scientific community, to facilitate this research and to optimise two-way interaction with policy-makers and the general public.
CIRCLE Markus Leitner Markus.leitner@umweltbundesamt.at http://www.umweltbundesamt.at/umwelt/circle/ or www.circle-era.net	Umweltbundesamt coordinates the EU network-project ERA-Net CIRCLE, which aims at networking and collaborating with more than 20 national research programmes in the field of climate change impacts, adaptation and vulnerability in more than 20 European countries (including Israel and Turkey). The core tasks of CIRCLE are to align research agendas of its participating national and regional research programmes and to design and execute transnational activities like joint initiatives and calls for research.
FloodRisk Jochen Bürgel Jochen.buergel@umweltbundesamt.at http://www.umweltbundesamt.at/umweltschutz/klima/projekte/floodrisk2/	The project FloodRisk II Intensification and integration of future oriented implementation strategies for the integrated flood management" coordinated from the Umweltbundesamt, consists of 45 sub projects, which are summarized in 8 workpackages. The project FloodRisk II contains essential suggestions in all areas of the integrated flood management.
Climate and Energy Fund (Klima und Energiefonds) office@klimafonds.gv.at http://www.klimafonds.gv.at/	The Klima- und Energiefonds (Climate and EnergyFund) is an important instrument of the Austrian Federal government for setting incentives in climate policy. The Climate and EnergyFund was founded in the year 2007 to contribute to a realization of a sustainable energy supply, a reduction of greenhouse gas emissions and to foster the Austrian climate strategy. Within the Climate and Energy Fund framework, several programme lines have been established. One example is the Austrian Climate Research programme (ACRP). This is a climate research programme that provides a conceptual and institutional framework for supporting climate research in Austria.
proVISION	proVISION is a research programme introduced by the Federal Ministry of Science and Research. It is aimed at implementing Austria's FORNE strategy (on research for sustainable

Karolina Begusch-Pfefferkorn karolina.begusch-pfefferkorn@bmwf.gv.at http://www.provision-research.at	development). Together with complementary research programmes, proVISION provides the scientific basis for the country's sustainability strategy.

Table C.2 Examples of research projects with focus on the support of developing countries.

ERAfrica www.erafrica.eu	It offers a new opportunity for joint African – European ownership in Science&Technology investment. By joining ERAfrica KEF is part of an international ERA-NET within the Seventh Framework Programme (FP7) of the European Union; it was represented in 2011 at network events.
EADI/DSA General Conference 2011	Rethinking Development in an Age of Scarcity and Uncertainty: New Values, Voices and Alliances for Increased Resilience
Holy Water – Floods – Low Water – Contaminated Water / An afternoon dedicated to the topic of water in a changing world	Water regarded in an interdisciplinary way: Conference in Vienna
Design and implementation of community-based breeding strategies for llamas in the Peruvian Andes	Based on findings from different scenarios activities to improve the already existing breeding strategies will be discussed with livestock keepers and simulation models will be used to support the decision-making process.
Effects of Strategic Dietary Supplementation on Local Fogera and Crossbred Dairy Cows in Northwestern Ethiopia	This project will be conducted to address the huge feed deficiency in Ethiopia where the livestock resources are highly constrained by a critical feed shortage especially during the dry period.
A User-focused Knowledge-base for Goal-oriented Municipal Solid Waste Management in Uganda (UGoS)	This research project poses the question which knowledge is required for a sound, well-functioning municipal solid waste management system in low income countries' urban regions. The objective of the project is the development of a knowledge base for goal-oriented solid waste management, driven by the demand of relevant actors ("users") and respecting the goals of waste management (protection of human health and the environment; conservation of resources).
Biocultural Diversity in Costa Rica´s Pacific Coast (BDCR)	The BDCR-project considers that, first, co-management of natural resources should take into account the specific indigenous and local forms of co-existence with the natural environment; and second, that indigenous communities need to be supported in their efforts to participate in strategies for conservation and the sustainable use of natural resources.
Natural Resources Management from a different point of view (NAREM)	In this project scientists at BOKU (Vienna), Makerere University (Kampala, Uganda) and the Amhara Region Agricultural Research Institute (ARARI), Ethiopia, work in collaboration to know farmer-scientist interactions, their epistemologies and implications for future research interventions. The case study was an exclosure project where a former communal grazing area was excluded from grazing and other land

	use by the local people. The grazing land was transformed into an exclosure through reforestation by natural regeneration and soil protection.
The role of enclosures on the diversity of rural landscapes in North Gondar, Ethiopia	The choice of woody plant species forms the key factor to diversify agroecosystems to make them more stable and more productive as there is generally a positive relationship between diversity of ecosystem and its productivity and stability. Studies show that the restoration of indigenous forests and fodder trees has been the best recommended intervention option to achieve the desired outcome in agroforestry practices. Enclosures (keeping land away from human and livestock contact) have been proved and recommended for effective soil restoration, re-colonization, natural regeneration and increasing diversity of native flora even without sowing or planting provided that increased competition of tree seedlings with grasses as well as altered disturbance regimes with higher risks for fire are managed. In this project, three methods are proposed for establishment of enclosures.
Genetic and phenotypic characterization and design of a breeding strategy for an indigenous cattle breed in North Western Ethiopia. A contribution for sustainable genetic resources utilization.	The objectives of the project are characterisation of the population, design of a breeding programme under the concept of conserving the genotype through establishing a scheme of distribution of breeding animals to farmers in the surrounding area or other parts of Ethiopia.
Development of low input systems such as organic farming by optimising the use of legumes in a dry region of Nicaragua to improve soil fertility, crop yield, human nutrition and farm income	The targets of the project as defined in the project document are as follows: (a) On-station trials and (b) On-farm trials.
Effects of Strategic Dietary Supplementation on Local Fogera and Crossbred Dairy Cows in Northwestern Ethiopia	This project will be conducted to address the huge feed deficiency in Ethiopia, where the livestock resources are highly constrained by a critical feed shortage especially during the dry period. As a result, the productivity of the animals, particularly the dairy cows, are below the expected level. This constitutes a serious obstacle to an increase in the per capita consumption of milk which is already 49% below the African average, although the Ethiopian livestock population stands first on the continent.
Building Research and Diagnostic Capacities at Bandarban Sadar Hospital in Southeastern Bangladesh	Limited medical diagnostic capacities in resource-poor environments are one of the main factors determining mortality in the poorest countries of the world. The main goal of this project was to improve the sustainable diagnostic capacities at a district hospital in one of the most remote areas of one of the poorest countries of the world. All objectives as proposed for this project have been achieved. Routine diagnostic and research laboratories have been established and the diagnostic capacity has been expanded not just to improve access to routine medical care but also to allow for a variety of studies and training activities.
Plants for civil engineering structures: Analyses of selected criteria for sustainable soil protection in Southern Brazil	In the centre of the federal state of Rio Grande do Sul (Brazil), in a region called ‘QuartaColônia’, the agricultural system is based on family-run farms. Many farmers have problems with eroded river banks, which cause erosion of agriculturally useful land. Consequently the farmers are interested in sustainable stabilized river banks to protect their farmland, which provides a more stable economic foundation. There is a growing interest on the part of institutions and degree-holding professionals in the use and study of soil bioengineering techniques. The work of scientific dissemination through the publication of articles in

	scientific journals will be completed, and certainly the work of technical dissemination through lectures and course will continue.
Food security in local markets of Kathmandu valley / Nepal – Validation and quality control of methods for pesticide analysis -	The participants from Nepal received theoretical and practical training in food sample preparation, clean up and gas chromatography (GC) analyses of food. Samples taken from the markets of Kathmandu were analysed during this workshop. The analyses were accomplished simultaneously at the LVA laboratory and the BOKU laboratory. The LVA laboratory acts as a reference laboratory.
Cambiodiversity - Promoting biodiversity conservation in Cambodia	In view of this problematic and in line with the UN Millennium Goals Cambiodiversity's main aim is to explore and help paving the way towards a further diversification of the Cambodian agricultural sector, as this seems indeed fundamental for ensuring the population's balanced nutrition and well-being, the country's sustainable development and economic progress as well as global biodiversity.
IRESA- Initiative of River Ecology in Sri Lanka: from science to application	The project IRESA, funded by KEF, was planned as cooperation between the University of Innsbruck (Austria), the University of Kelaniya (Sri Lanka), and the Institute for Limnology of the Austrian Academy of Sciences (Mondsee). The main objectives of IRESA were fourfold: it was a) to help to install river ecology at scientific level, b) to develop a nucleus for follow-up research and education in river ecology, c) to build a network between scientists and end-users involved in freshwater affairs, and d) to raise awareness of endangerment and conservation of natural resources in freshwater policies.
Identification of criteria and indicators for a sustainable management of community forests - Nepal	Community Forestry (CF) has already passed its infant stage of development and now has entered in to its young stage of development in Nepal. Although, the programme has been able to restore the degraded landscapes of Nepal since the handing over of the forests to local communities, it is unable to provide a significant contribution to the livelihood of poor and marginalized people and allow an equitable use of forests products within the community. In this context an approach which increases the voice of the local people in order to promote sustainable forest management (SFM) and improve the livelihoods of local user groups of CF is needed. The University of Natural Resources and Applied Life Sciences,Vienna (BOKU, Institute of Siliviculture) in collaboration with Rural Reconstruction Nepal (RRN), Natural and Organizational Resource Management Services (NORMS), Federation of community forestry users, Nepal (FECOFUN), and Ministry of Forest and Soil Conservation (MoFSC), Nepal is undertaking the participatory action research on "Identification of Criteria and Indicators for sustainable CF management in Nepal". The overall goal of this research project is to facilitate process of identifying criteria and indicators (C&I) for evaluating SFM by involving diverse groups of stakeholders at regional and forest management unit level and to promote SFM.

Appendix D

Summary of Reporting according to the Kyoto Protocol

Table D.1 Summary of reporting of the supplementary information under Article 7, paragraph 2, of the Kyoto Protocol in the NC6

Information reported under Article 7, paragraph 2	NC6 section
National systems in accordance with Article 5, paragraph 1	3.3
National registries	3.4
Supplementarity relating to the Mechanisms pursuant to Articles 6, 12, 17	5.3
Policies and measures in accordance with Article 2	4.3
Domestic and regional programmes and/or legislative arrangements and enforcement and administrative procedures	4.2
Information under Article 10:	
Article 10a	3.3
Article 10b	4.2, 6.3
Article 10c	7.4
Article 10d	8
Article 10e	9
Financial resources	7.1-7.3

Appendix E

Abbreviations, Terms and Units of Measurement

Abbreviations and Terms

ACEA	Association des Constructeurs Européens d'Automobiles; European automobile manufacturers association
AEA	Österreichische Energieagentur (Austrian Energy Agency)
BGBl.	Bundesgesetzblatt (Federal Law Gazette)
BSRN	Baseline Surface Radiation Network
CAP	European Common Agriculture Policy
CDM	Clean Development Mechanism
CFCs	chlorofluorocarbons
CH_4	methane
CHP	combined heat and power
CO	carbon monoxide
CO_2	carbon dioxide
COP	Conference of the Parties
CORINAIR	Coordination d'information environmentale projet partiel air
CRF	Common Reporting Format
ECE (UN)	Economic Commission for Europe
EEG	Energy Economics Group, Technical University Vienna
ETS	Emissions Trading Scheme
EU	European Union
EUR	Euro
EZG	Emissionszertifikategesetz (Emissions Allowance Trading Act)
FCCC (UN)	Framework Convention on Climate Change
GAW	Global Atmosphere Watch
GCM	global circulation model
GDP	gross domestic product
GEF	Global Environment Facility
GET	Global Environment Trust Fund
GHG	greenhouse gas
GRDC	Global Runoff Data Centre
GSN	GCOS Surface Network
GUAN	GCOS Upper-air Network
HFCs	hydrogenated fluorocarbons
ICAO	International Civil Aviation Organisation
IEA	International Energy Agency
IIASA	International Institute for Applied Systems Analyses
IPCC	Intergovernmental Panel on Climate Change
JAMA	Japanese automobile manufacturers association
JI	Joint Implementation

KAMA	Korean automobile manufacturers association
KLI.EN	Klima- und Energiefonds (Austrian Climate and Energy Fund)
KPC	Kommunalkredit Public Consulting
Land	Federal Province of Austria
Länder	Federal Provinces of Austria
LDCF	Least Developed Countries Fund
LTER	Long-term ecological research
NAP	National Allocation Plan
NDACC	Network for Detection of Atmospheric Composition Change
NGO	non-governmental organisation
NMVOC	non-methane volatile organic compound
NO_x	oxides of nitrogen
N_2O	nitrous oxide
ODA	Official Development Assistance
OECD	Organisation for Economic Cooperation and Development
PFCs	perflourocarbons
pkm	passenger kilometres
PSRP	poverty reduction strategy paper
tkm	tonne kilometres
UFI	Umweltförderung im Inland (Environmental support scheme)
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
US$	United States Dollar
VOC	volatile organic compounds
WDCGG	World Data Centre for Greenhouse Gases
WIFO	Österreichisches Institut für Wirtschaftsforschung (Austrian Institute of Economic Research)
WMO	World Meteorological Organisation
WWW	World Weather Watch / World Wide Web
WOUDC	World Ozone and Ultraviolet Radiation Data Centre
ZAMG	Zentralanstalt für Meteorologie und Geodynamik (Central Institute for Meteorology and Geodynamics)

Units of Measurement

k…	kilo (10^3)
M…	Mega (10^6)
G...	Giga (10^9)
T…	Tera (10^{12})
P...	Peta (10^{15})
g	gramme
t	(metrical) ton
J	joule
ha	hectares
.../a	per year
.../d	per day