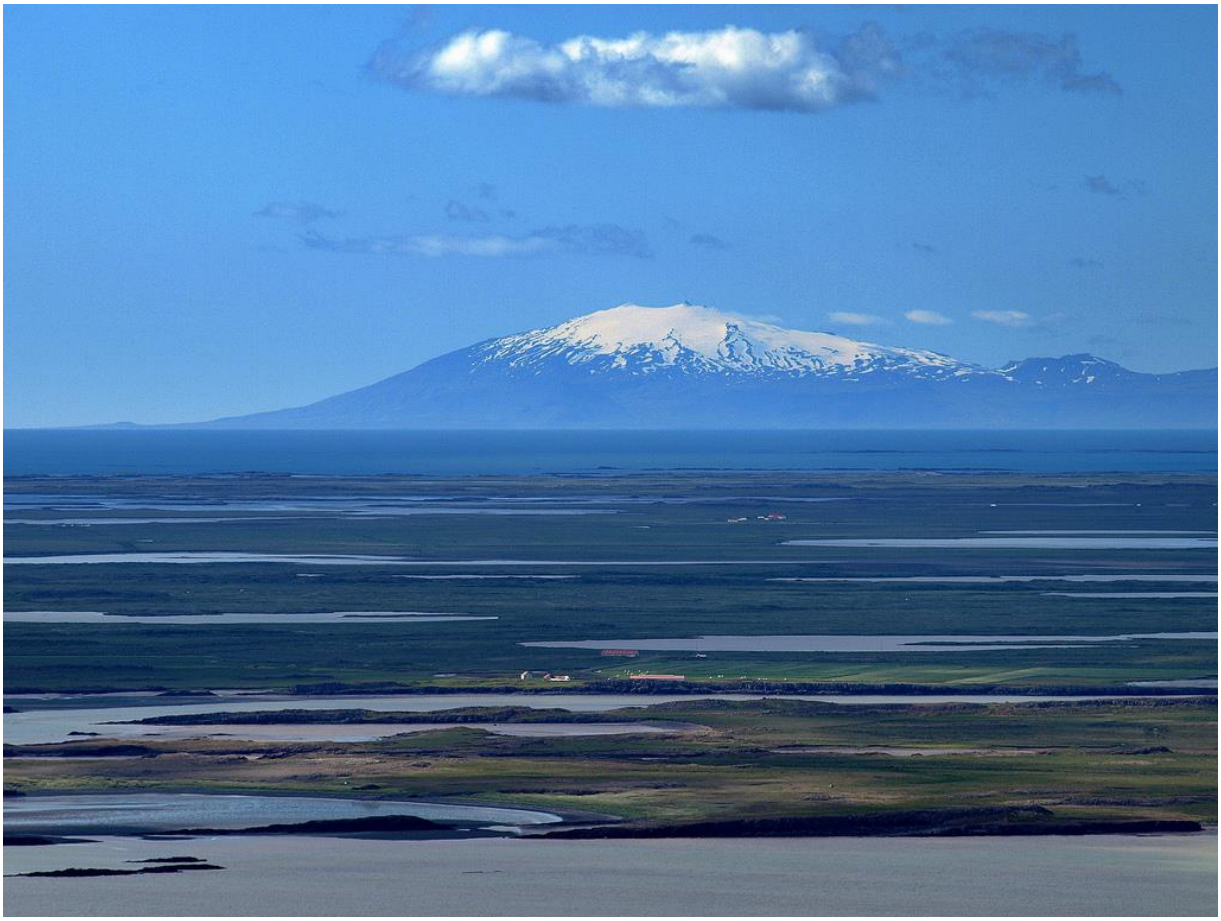
Iceland‘s Second Biennial Report to the UNFCCC



Contents

1. Information on GHG emissions and trends

In 2013, total emissions of greenhouse gases (excl. LULUCF) amounted to 4,536 Gg CO_2-equivalents. The emissions in 2013 were 24.8% above the emissions in 1990 (3,633 Gg CO_2-eq). Total greenhouse gas emissions decreased by 0.26% between 2012 (4,547 Gg CO_2-eq) and 2013 (4,536 Gg CO_2-eq) and have decreased by 11.7% since 2008 when they peaked (5,137 Gg CO_2-eq). Total greenhouse gas emissions in the period 1990 - 2013 are shown in Figure 1.1.

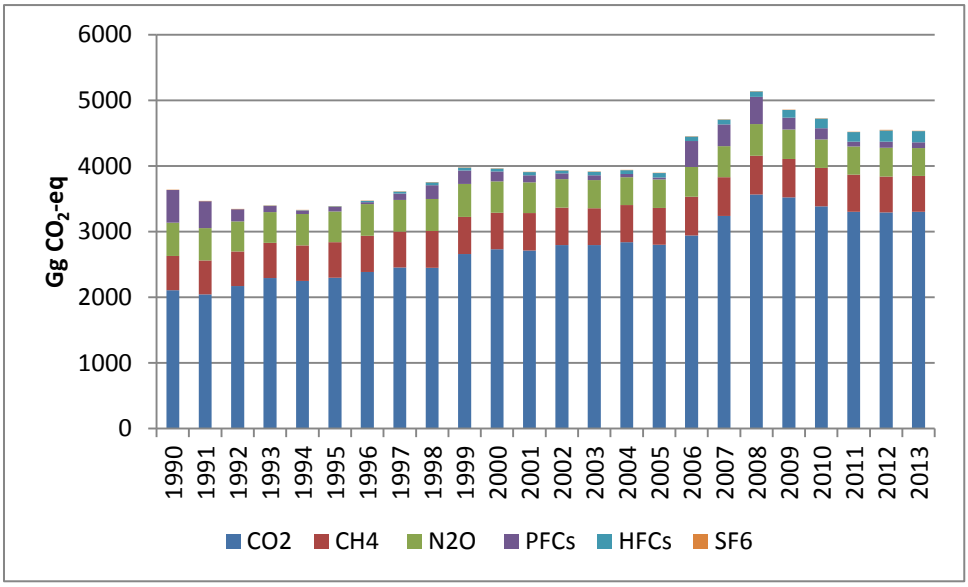


Figure 1.1 Emissions of greenhouse gases by gas, 1990-2013

Carbon dioxide dominates greenhouse gas emissions in Iceland (72%), followed by methane (11.7%), nitrous oxide (10.6%) and fluorinated gases (PFCs, HFCs, and SF_6; 5.7%). The most significant changes in the composition since 1990 are relatively lower emissions of PFCs and a higher proportion of CO_2.

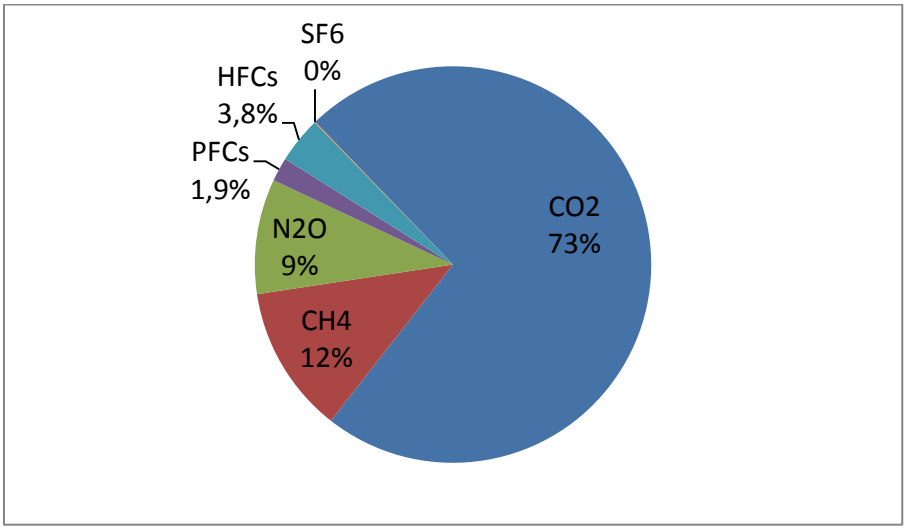


Figure 1.2 Greenhouse gas emissions in 2013 by gas

Greenhouse gas emissions by sector

Industrial processes accounted for 43% of greenhouse gas emissions in 2013. The main source of the emissions was production of non-ferrous metals with 90% of the industrial process emissions; 70% coming from primary production of aluminium and 20% from ferrosilicon production.

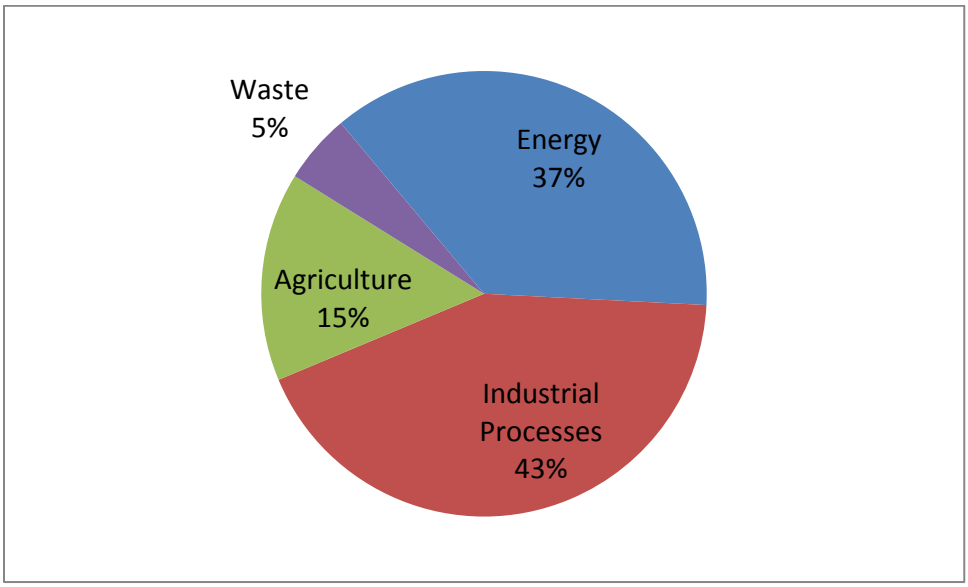


Figure 1.3 Greenhouse gases in 2013 by UNFCCC sector

The energy sector was second largest source of greenhouse gas emissions in 2013 with 37% of total emissions. The largest part of energy sector emissions originate from road vehicles (49%) and fishing (29%). Geothermal energy utilization accounts for 11% of energy sector emissions.

Agriculture accounted for 15% of total greenhouse gas emissions, 86% of total nitrous oxide emissions and 59% of total methane emissions. The methane emissions, 47% of agriculture emissions, orginated mainly from enteric fermentation (86%) and also from manure management. Nitrous oxide, accounting for 53% of agriculture emissions, originated primarily from direct and indirect soil emissions (89%) and manure (11%).

The Waste sector accounted for 5% of total greenhouse gas emissions in 2013 and 39% of total methane emissions. Methane from solid waste disposal on land was the main source emissions from the sector (91%). Other sources were wastewater treatment, waste incineration and composting.

Trends in greenhouse gas emissions

Trends in emissions of greenhouse gases by sector are shown in Figure 1.4. The figure shows deviations, every five years and in 2013, from the emissions in 1990, obtained by subtracting the 1990 emissions from emissions in the relevant year.

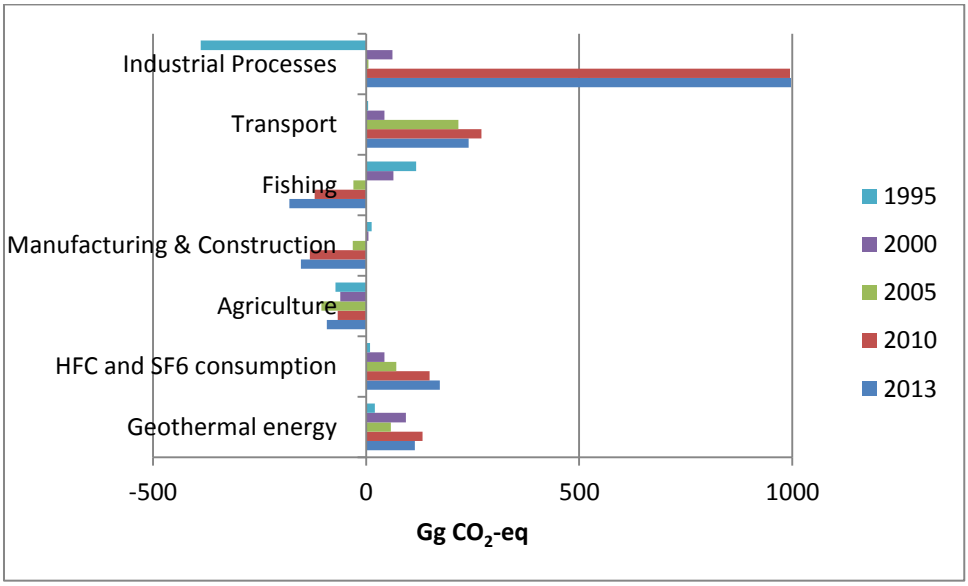


Figure 1.4 Changes in greenhouse gas emissions by sector since 1990

Industrial processes emissions more than doubled between 1990 and 2013 and have contributed most to the increase in total emissions in Iceland since 1990. The emissions fell after 1990 owing to improved technology and process control in the aluminium industry that lead to radical reduction in emissions of PFCs. The closedown of a fertilizer plant in 2001 and a cement plant in 2011 have also contributed to decreased emissions. The reasons for increased emissions in the sector are increased production capacity at the existing aluminium and ferrosilicon plants and the inauguration of two new aluminium plants.

Iceland relies heavily on geothermal energy for space heating and electricity production (27% of electricity produced). Electricity production using geothermal power has increased by more than 16-fold since 1990, from 283 to 5,238 GWh/year. This has led to increased emissions from geothermal utilization by 184%. The emissions are site and time-specific, and can vary greatly between areas and the wells within an area as well as by the time of extraction.

Greenhouse gas emissions from the transport sector increased by 39% between 1990 and 2013. Emissions from road transport increased by 56%, mainly due to a larger vehicle fleet and more

milage diven. The population grew by 26% in the period and the number of vehicles per capita increased. Emissions from road vehicles peaked in 2007 and have decreased by 12% since then. Emissions from both domestic flights and navigation have declined since 1990 and this decrease has compensated in part for rising emissions in the transport sector.

Emissions from fisheries rose from 1990 to 1996 because a substantial portion of the fishing fleet was operating in unusually distant fishing grounds. From 1996 the emissions started to decrease, reaching 1990 levels in 2001. After a 10% increase between 2001 and 2002 the emissions reached the 1990 level again in 2003. In 2013 the emissions had decreased to 27% below the 1990 level and 2% below the 2012 level.

Emissions from agriculture are closely coupled with livestock population sizes, especially cattle and sheep. The amount of nitrogen in fertilizer applied to agricultural soils is another factor that has considerable impact on emission estimates. Emissions from agriculture decreased between 1990 and 1992, but have since fluctuated in the range 670 – 745 Gg CO_2-eq.

Imports of HFCs started in 1993 for use as substitutes for ozone depleting substances (ODS), which are being phased out in accordance with the Montreal Protocol. HFCs are predominantly used for refrigeration and air conditioning. The amount of HFCs stored in refrigeration systems has increased with ongoing retrofitting of refrigeration systems to replace ODS. Increased use and volumes of HFCs have led to increased emissions of HFCs due to leakages. SF_6 is used in electrical equipment and emissions occur because of leaking equipment and accidents. Emissions of SF_6 are small (3 Gg CO_2-eq in 2013) so single accidents become clearly visible in the emission profile.

National inventory arrangements

Act No. 70/2012, on Climate, establishes a national system for the estimation of greenhouse gas emissions by sources and removals by sinks and a national registry. The Envionment Agency of Iceland (EA) is designated as the responsible authority for the national accounting and the inventory of emissions and removals of greenhouse gases in accordance with Iceland's international obligations. The main data suppliers are listed and the type of information they are responsible for collecting and reporting on to the Environment Agency (Figure 1.5).

The contact person at the Environment Agency of Iceland is:
Vanda Úlfrún L. Hellsing
Environment Agency of Iceland
Suðurlandsbraut 24
IS-108 Reykjavík, Iceland

The EA collects most of the data used for the general emission modes, activity data and emission factors. The activity data is obtained from various institutions and companies and collected directly by the EA. Information on fuel sales are collected by the National Energy Authority in accordance with Act No. 48/2007. The Food and Veterniary Authority provides livestock statistics. Information on population, GDP, production of asphalt, food and

beverages, imports of solvents, fertilizers and other products and the import and export of fuels is provided by Statistics Iceland. The EA collects relevant production data from industries in accordance with Act No. 70/2012 and Regulation No. 70/2013. Green Accounts submitted by industries in accordance with Regulation 851/2002 and reports on imports of HFCs submitted to the EA in accordance with Regulation 834/2010 are also used for the inventory. Information on the indentity of importers of cell foam is provided to the EA by the Icelandic Directorate of Customs. The emission factors used are mainly obtained from the 2006 IPCC Guidelines, the revised 1996 IPCC Guidelines, the IPCC Good Practice Guidance and the IPCC Good Practice Guidance for LULUCF.

The Agricultural University of Iceland (AUI) calculates emissions and removals for the LULUCF sector and reports to the EA. The AUI obtains information on revegetated areas from the Soil Conservation Service of Iceland and information on forests, afforestation/deforestation and forest management, from the Icelandic Forest Service. The AUI uses its own geographical database and other land use information for assessment of other land use categories.

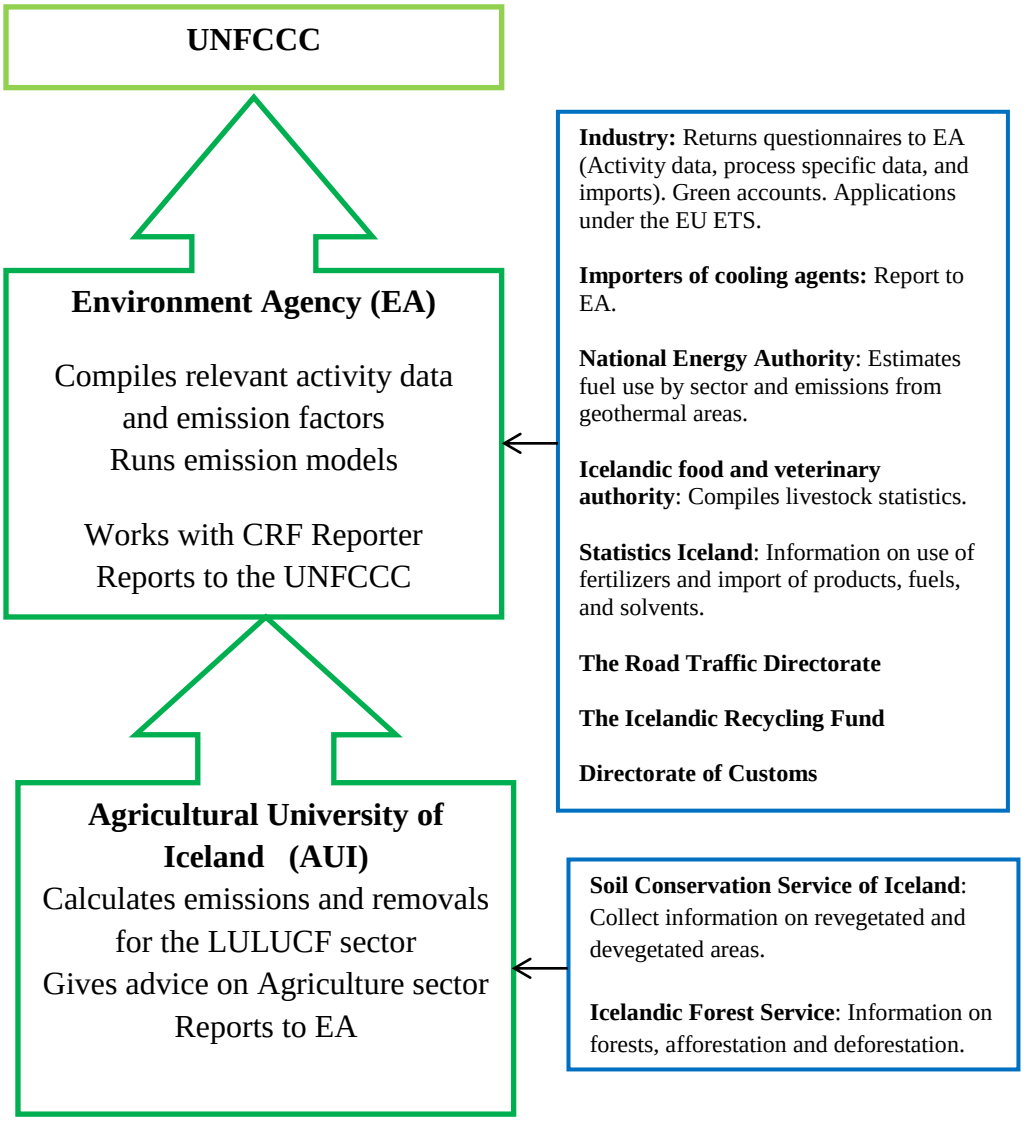


Figure 1.5. National system for the greenhouse gas inventory

The annual national inventory cycle begins with planning of activities by the inventory team and major data providers, taking into account outcomes of internal and external reviews and recommentations from the UNFCCC review. After a period of inventory preparation, including data compilation, emission estimates and QC checks, the inventory is evaluated and then prepared for submission (Figure 1.6). The inventory is submitted to the UNFCCC by the EA after being approved by the inventory team and the director of EA.

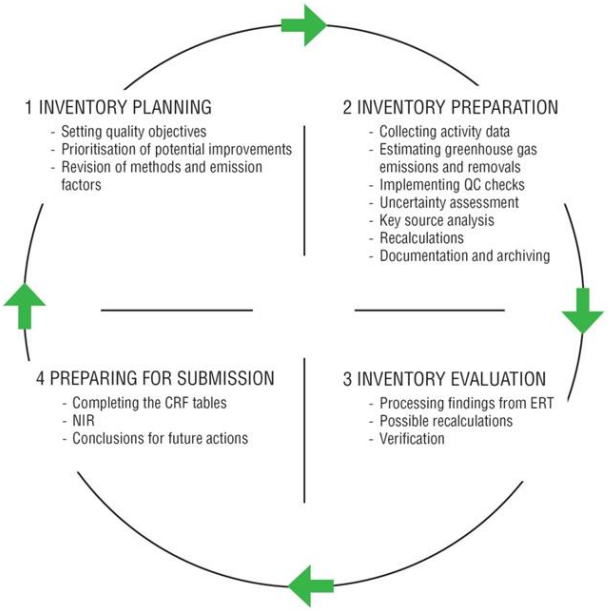


Figure 1.6 The annual inventory cycle.

A QA/QC plan and a quality manual for the annual greenhouse gas inventory of Iceland have been prepared. These documents have been published online:
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http://ust.is/library/Skrar/Atvinnulif/Loftslagsbreytingar/Iceland_QAQC_manual.pdf
The QA/QC plan describes the quality assurance and quality control programme. It includes quality objectives and an inventory quality assurance and quality control plan. It also describes the responsibilities and the time schedule for the performance of QA/QC procedures.

Uncertainty analysis made in preparation of the National Inventory Report is in accordance with the Tier 1 method of the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories where different gases are reviewed separately as CO2-equivalents. Uncertainties were estimated for all greenhouse gas source and sink categories

(i.e. including LULUCF) according to the IPCC Good Practice Guidance. Estimates for activity data uncertainties are mainly based on expert judgement whereas emission factor uncertainties are mainly based on IPCC source category defaults. Errors in the determination of EF uncertainty factors for the Agriculture and Waste sectors were corrected. All source category uncertainties were first weighted with 2012 emission estimates and then summarized using error propagation. This calculation yielded an overall uncertainty of the 2012 emission estimate of 33.5%. Uncertainty estimates introduced on the trend of greenhouse gas emission estimates by uncertainties in activity data and emission factors are combined and then summarized by error propagation to obtain the total uncertainty of the trend. This calculation yielded a total trend uncertainty of 16%. The decrease from the value of the submission in 2014 (16.7%) is caused by the above mentioned correction of errors.

2. Quantified economy-wide emission reduction (QEWER) target

Iceland has committed to a quantified economy-wide emission reduction target of 20% below 1990 levels by 2020 to be fulfilled jointly with the EU and its 28 Member States. Information on Iceland‘s target, assumptions and conditions (e.g. base year, sectors, and coverage of gases), has been communicated to the UNFCCC and can be found in document FCCC/AWGLCA/2012/MISC.1/Add.2[1] and CTF Tables 2(a−f).

The LULUCF sector is of major importance in Iceland’s mitigation efforts, and increase in afforestation and revegetation efforts is seen to increase carbon uptake from the atmosphere. Iceland elected to account for revegetation during the first commitment period of the Kyoto Protocol and will continue to apply activity based accounting for revegetation in the second commitment period.

Iceland anticipates zero carry-over of credits from the first commitment period of the Kyoto Protocol. Iceland will retain the option to engage in carbon markets in addition to its participation in the EU-ETS, even if it intends to reach its 2020 target mainly through domestic action in curbing emissions and increasing carbon sequestration.

[1] http://unfccc.int/resource/docs/2012/awglca15/eng/misc01a02.pdf

3. Progress in achievement of quantified economy-wide emission reduction targets and relevant information

Cross cutting measures

A Climate Change Strategy was adopted by the Icelandic government in 2007. The Strategy sets forth a long-term vision for the reduction of net emissions of greenhouse gases by 50-75% until the year 2050, using 1990 emissions figures as a baseline. Emphasis is placed on reducing net emissions by the most economical means possible and in a way that provides additional benefits, by actions such as including the introduction of new low- and zero-carbon technology, economic instruments, carbon sequestration in vegetation and soil, and financing of climate-friendly measures in other countries.

A Climate Change Action Plan was endorsed by the government in 2010. The Action Plan is a main instrument for defining and implementing actions to reduce emissions of greenhouse gases and enhance carbon sequestration. A committee appointed in 2011 oversees the implementation of the action plan, makes proposals for new projects, and provides information and advice.

Ten key action and 22 additional actions are specified in the Climate Change Action Plan. The ten key actions are:

- Implementation of the EU-ETS
- Tax on carbon
- Change the system for taxes and levies on vehicles and fuel
- Procurement of low-emission and environmentally friendly vehicles for government and local authorities uses
- Increased walking, cycling and use of public transportation
- Use of biofuels for the fishing fleet
- Electrification of the fishmeal industry
- Afforestation and revegetation
- Restoration of wetlands
- Enhanced research and innovation in the field of climate change

Act No. 70/2012 on Climate Change is the first comprehensive act on climate change in Iceland. The purpose of the legislation is twofold, to set a comprehensive act covering regulations set with the purpose to mitigate and adapt to climate change, and to cover the regulatory framwork related to the European Union Emisson Trading System, EU-ETS. The legislation replaces Act No. 65/2007 on the emissions of greenhouse gases.

A carbon tax on fossil fuel use was introduced on 1 January 2010 by Act No. 129/2009, on environment and natural resources taxes. The tax is levied on fossil fuels in liquid or gaseous form with respect to the carbon content of the fuels. The carbon tax is among 10 key actions in the 2010 Climate Mitigation Action Plan.

Energy

The Icelandic energy sector is unique because of the large share of renewable energy in the total primary energy budget and the isolation of the distribution network. Iceland's reserves of renewables are mainly used for district heating and production of electricity. The share hydro and geothermal energy of the primary energy use in 2014 was 86.2% while 12.2% came from oil and 1.6% from coal.

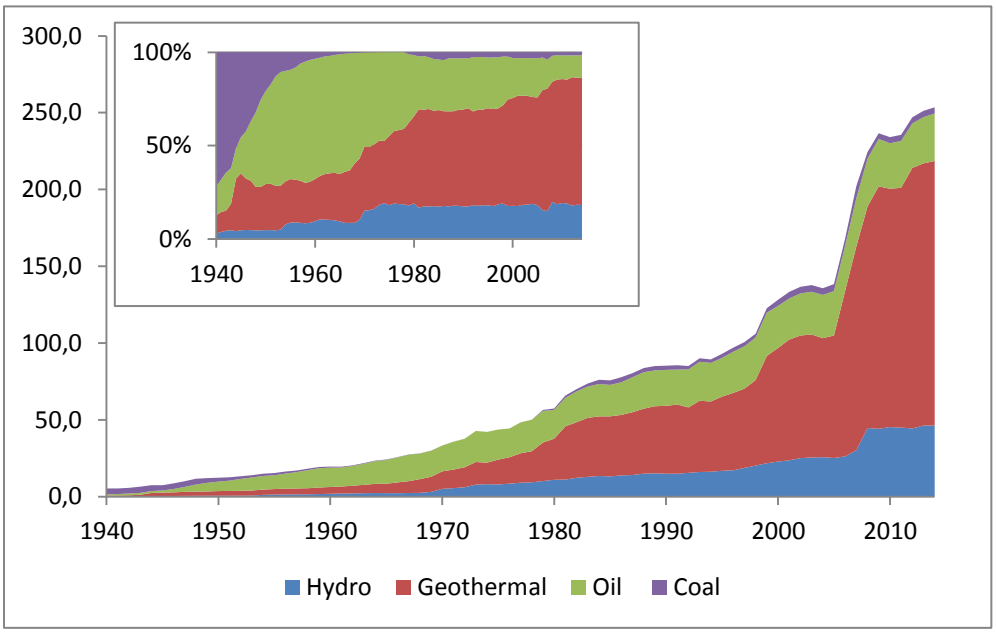

Figure 3.1. Primary energy use in Iceland, 1940 – 2014, in petajoules and as a percentage of total (insert).

Coal is primarily used as raw material in the production of ferro-silicon. The main uses of oil in 2014 were for road transport (53%) and fishing (31%). Other uses were in construction (9%), domestic aviation (2,8%), industry (2,1%), and national navigation (1,4%). Only miniscule amounts of oil are used for residential heating (0,7%) and energy industries (0,3%) in Iceland (Figure 3.2). The electricity and space heating sectors in Iceland are close to full saturation of renewable energy sources.

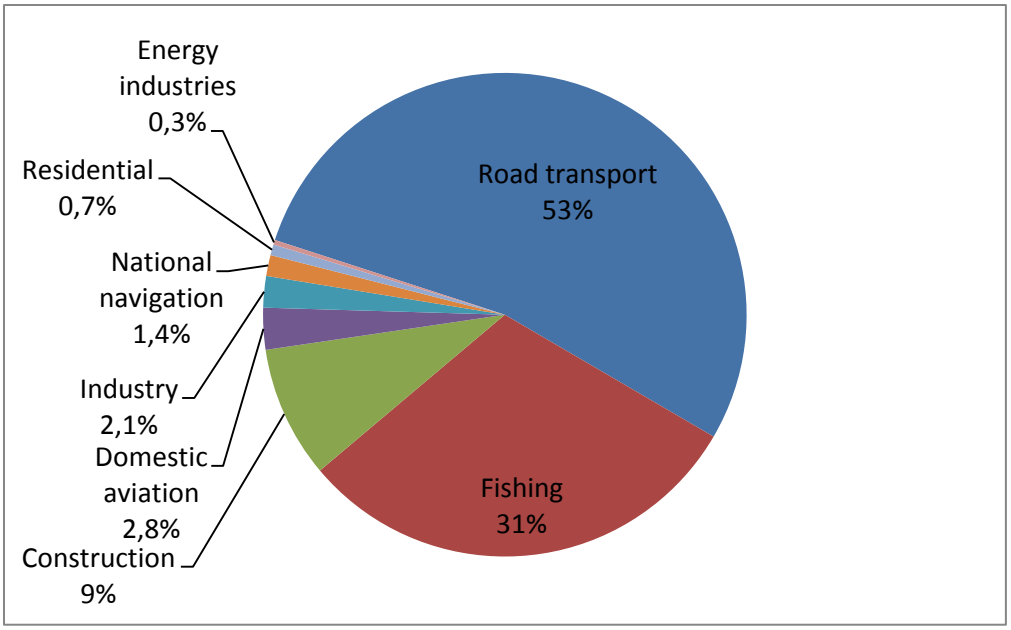

Figure 3.2. Use of liquid fossil fuels (wt %) in Iceland in 2014

A strategic approach on how to meet mandatory targets regarding renewable energy sources has been set out in the National Renewable Energy Action Plan, in accordance with Article 4 of Directive 2009/28/EC that was transposed into Icelandic legislation by Act No. 40/2013 and Act No. 30/2008. The target for share of energy from renewable energy sources (RES share) in gross final consumption of energy for 2020 is 72%. The RES share was 63,4% in 2005, and had increased to 76% in 2012, surpassing the 2020 target by 4%.

Transport and fisheries

Five of ten key actions outlined in the Climate Mitigation Action Plan concern transport and fisheries. The carbon tax, which has a wider application is described under cross cutting measures. Four key actions are described in this section:

- Change the system for taxes and levies on vehicles and fuel
- Procurement of low-emission and environmentally friendly vehicles for government and local authorities uses
- Increased walking, cycling and use of public transportation
- Use of biofuels for the fishing fleet

Changes have been made in taxes and levies for vehicles with the aim of reducing emissions of greenhouse gases. These comprise changes in excise duty, biannual fees and VAT.

The excise duty on passenger cars has from 1 January 2011 been based on carbon dioxide emissions. Excise duty is based on the registered emissions of carbon dioxide (CO_2), measured in grams per kilometer driven (Table 3.1). There are special provisions for vehicles that drive on methane gas, which get a discount from the levied excise duty and pay a minimum semiannual car tax. Zero-emission vehicles, powered by electricity and hydrogen, enjoy exemption from VAT. The semi-annual road tax is based on the registered emissions of carbon dioxide (CO_2) of the vehicle concerned measured in grams per kilomer driven.

Table 3.1 Registered emissions and excise duty (%) for passenger cars

Price Band	**Registered emissions (g CO_2/km)**	**Main Category**	**Exception Category***
A	0–80	0	0
B	81–100	10	0
C	101–120	15	0
D	121–140	20	0
E	141–160	25	5
F	161–180	35	10
G	181–200	45	15
H	201–225	55	20
I	226–250	60	25

*Includes e.g. rental cars and taxis

Oils that are not fossil fuels are exempt from a levy on fuels. Fuels that are not of fossil origin blended with gasoline are exempt from a levy on gasoline. The fossil fuel parts of oil and gasoline mixtures are not exempt from the levy.

The use of minimum percentage of renewable fuel in fuel used for land transportation is stipulated by law. A minimum of 3.5%, calculated as part of the total energy content of the fuel, was required from 1 January 2014 and a minimum of 5% from 1 January 2015. Iceland‘s National Renewable Energy Action Plan sets out a strategic approach and measures on how Iceland will meet the mandatory national targets for 2020 laid down in Directive 2009/28/EC, including the overall target and the 10% target on share of energy from renewable sources in transport.

Icelandic regulations are harmonized with European regulations on environmental performance requirements for motor vehicles and tyres.

Official procurement of low-carbon and fuel efficient vehicles and increased share of public transport, walking and bicycling in transport are among the 10 key measures in the 2010 Climate Mitigation Action Plan.

Act No. 70/2012 on Climate Change was amended in 2015 with a requirement that energy and environmental impacts linked to the operation of vehicles over their whole lifetime be taken into account in purchases of road transport vehicles covered by public procurement.

The city of Reykjavik has adopted a policy with the aim e.g. to reduce negative effects of vehicle traffic on the environment and enhance environmentally friendly transportation. Procurement of low emission vehicles has been emphasized as part of the policy. The proportion of electric vehicles and vehicles powered with methane from the city's landfill of the vehicle fleet owned by Reykjavik city was 82% in 2014.

The trend in average emissions of CO_2 from new passenger cars from 2005 to 2014 is shown in Figure 3.3. In 2005 the average emissions were 201 grams CO_2 per kilometer but had dropped by 33% to 135 g CO_2/km in 2014.

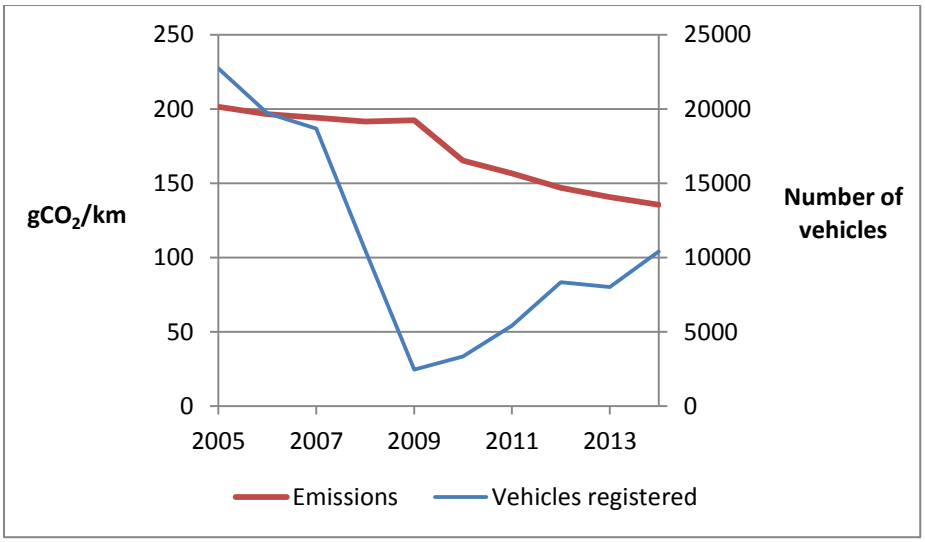

Figure 3.3. Average registered emissions (gCO_2/km) from new passenger cars and the total number of passenger cars registered in a given year

The graph shows a dramatic drop in car sales following the bank crisis in Iceland in 2008. It also shows that a trend toward lower-emissions passenger cars continues despite recovering car sales after 2009.

Increased share of public transport, walking and bicycling in transport is an important component of the Transport Policy Plan 2011-2022 and the four year Transport Policy Plan 2011-2014 adopted as a parliament resolution on 19 June 2012.

Municipalities in the capital area and the government have initiated a 10-year pilot project, with the objective of doubling the share of public transportation in the greater capital region. An agreement was made between the Icelandic Road and Coastal Administration (IRCA) and the municipalities in the capital region in 2012. The IRCA supports, with matching municipal funds, the construction of bike and walking paths in the capital region and trunk routes for

bicycles. The IRCA also supports public transportation between Reykjavik and three municipalities within the capital region‘s economic impact area.

Reykjavik city issued the action plan, „Hjólaborgin Reykjavík“ (Reykjavik the bike city) in 2010 with the objective of greatly increasing the use of bicycles in the city . The total length of bike paths shall increase from 10 km in 2010 to 50 km in 2015 and 100 km in 2020, a tenfold increase in ten years.

The Icelandic fishing fleet used 262 thousand tons of oil in 1996, when the use peaked. The oil use has declined since 1996 and was down to almost half in 2014 when the fleet used 139 thousand tons of oil (Figure 3.4).

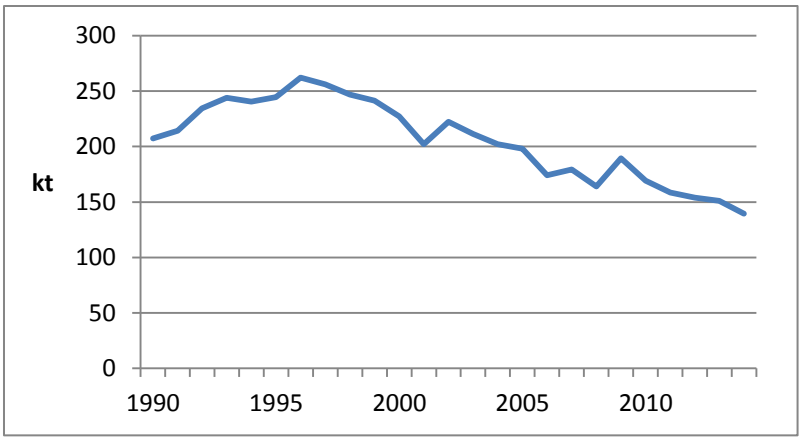

Figure 3.4. Oil used by the fishing fleet 1990 - 2014

The fuel forecast prepared by the National Energy authority predicts increased use of alternative fuels such as biodiesel for the fishing fleet in the future. The Icelandic Maritime Administration has surveyed possibilities for using rapeseed oil, and worked in cooperation with farmers studying the feasibility of growing rapeseed. The Ministry for the Interior provided 50 millions IKR in research grants in 2013 for projects in the field of energy shift in shipping.

Industrial processes

The EU Emissions Trading Scheme (EU-ETS) has been implemented in Iceland under the provisions of the EEA Agreement and took effect with respect to aviation at the beginning 2012. Three aluminium plants, a ferrosilicon plant and one fishmeal factory fall under the ETS from 1 January 2013. Total emissions from these companies amount to 43% of greenhouse gas emissions from Iceland. Four small installations, three fishmeal factories and a mineral wool producer, have been excluded from the ETS and are subject to equivalent measures.

Industrial processes represent a relatively large source of GHG emissions in Iceland. Aluminium production is most prominent with 70% of industrial process emissions. In 2013 841 thousand tons of aluminium were produced in Iceland, resulting in 1274 Gg CO_2 emissions and 88 Gg CO_2-eq of PFC emissions. The average emissions factors were thus 1.515 t CO_2/t Al for oxidation of the anodes and 0.105 tCO_2-eq/t Al for the PFC emissions, which gives a total of 1.62 t CO_2-eq/t Al.

In 2013 the weighted average GHG emissions from electricity production in Iceland were 11.2 g CO_2-eq /kWh and total electricity used for aluminium production amounted to 12539 GWh. Average electricity consumption to produce one ton of aluminum in 2013 was thus 14.9 MWh and emissions from the electricity produced to make one ton of aluminium were 0.17 t CO_2-eq/t Al. Total emissions from the production of aluminium and the electricity consumed equalled 1.79 t CO_2-eq/t Al.

The global average emission factor for PFC emissions in 2013 was 0.63 tCO_2-eq/t Al[2] and the global average emission factor for the electricity produced was 9.2 tCO_2-eq/t Al[3]. Given an emission factor of 1.5 CO_2/t Al for anode oxidation, 0.63 tCO_2-eq/t Al for PFCs and 9.2 tCO_2-eq/t Al for electricity production the world average emission factor becomes 11.3 tCO_2-eq/t Al. Emissions from the aluminium production in Iceland (1.79 t CO2-eq/t Al), for each ton of aluminium produced, therefore amount to only 16% of the world average (11.3 tCO2-eq/t Al).

The carbon tax (see the section on cross cutting measures) covers emissions from fossil fuels that are not included in the trading system. Economic instruments cover more than 90% of CO_2 emissions in Iceland with these measures. Responsibility and management of emissions from activities covered by the EU-ETS will be only in a minor way be influenced by the Government and specific measures to reduce emissions therefore focuses mainly on sectors outside the ETS.

Legislation on fluorinated greenhouse gases (PFCs, HFC and SF_6) was passed in 2009, which covers limitations with respect to releases, uses, management, as well as registration, marketing, labelling and leakage checks and sets requirements regarding training and certification.

The fishmeal industry has for decades been the biggest industrial user of oil in Iceland. Oil boilers used in the industry have gradually been replaced with electric boilers resulting in less oil consumption. In 2013 the use of electricity had reaced 70% of the energy used in the fishmeal industry (Figure 3.5).

[2] International Aluminium Institute: Results of the 2013 Anode Effect Survey
[3] World Aluminium: ENVIRONMENTAL METRICS REPORT YEAR 2010 DATA

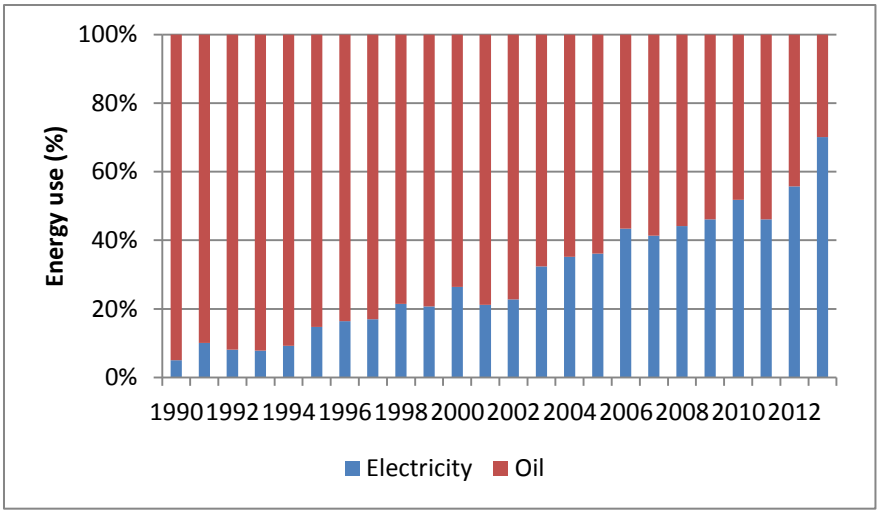

Figure 3.5. Energy use in the fishmeal industry, 1990 - 2013

Waste

Waste management policy in Iceland is manifested in legislation, regulations and national plans for waste management. Iceland has transposed into national law the acquis on waste covered by the EEA Agreement.

The Environment Agency published a National Plan for waste management 2004-2016 that applies to the whole country. Most municipalites have developed regional waste management plans based on the National Plan. A new National Plan (2013-2024) was published by the Ministry for the Environment and Natural Resources in 2013.

Waste management in Iceland has changed considerably in recent years. Recovery of waste has increased and primitive waste incinerators and unmanaged landfills have been closed. Landfill gas is collected at the largest landfills in Reykjavik and Akureyri and used for powering vehicles in these areas.

About 69% of waste was recovered in 2013 compared with 15% in 1995. The percentage of landfilled waste was 30% in 2013 compared with 79% in 1995.

Land use land use change and forestry (LULUCF)

Land use land use change and forestry is a sector of major importance and has figured prominently in Iceland's climate policy. Iceland elected revegetation under Article 3.4 for the first commitment period of the Kyoto Protocol. The revegetation activity involves establishing vegetation on eroded or desertified land or reinforcing existing vegetation.

Activities in the LULUCF sector are among 10 priority actions in the 2010 Climate Mitigation Action Plan.

The main tasks of The Soil Conservation Service of Iceland, founded in 1907, are to combat desertification, sand encroachment and other soil erosion, promotion of sustainable land use and reclamation and restoration of degraded land.

A land restoration training program was launched in 2007. The program has been a United Nations University program since 2010 open for post-graduates and/or professionals from the developing countries.

The goals of Act No. 95/2006 on regional afforestation projects are, *inter alia*, to build forest resources, grow multi-functional forests and shelter belts. Afforestation on at least 5% of land area below 400 m above sea level should be aimed for in each of the regional projects. Regional afforestation plans spanning 40 years shall be made for each of the five regions.

The Mt. Hekla afforestation project, launched in 2007, is based on a 10 year funding agreement and is run in collaboration between The Soil Conservation Service of Iceland and The Iceland Forest Service. The area covers about 90 thousand hectars of eroded land with little vegetation in the vicinity of Mt. Hekla.

A new forestry strategy was presented to the Minister for the Envionment and Natural Resources in January 2013. Among goals and means to achieve them are enhancement of the role of forests as carbon sinks and to adapt forestry to climate change.

A Wetland Center was established at the Agricultural University in 2008. Among the objectives is to carry out research linked to restoration of drained wetlands. The government set out work in 2014 to develop an action plan for wetland restoration and to suggest how to institutionalize the implementation of wetland restoration projects.

Carbon sequestration in 2013 by revegetation and afforestation amounted to 384 Gg CO_2 in 2013. Revegetation accounted for 201 Gg CO_2 and afforestation for 183 Gg CO_2. Carbon sequestration increased by 55% between 2008 and 2013, which amounts to an average increase of 27 Gg CO_2/year.

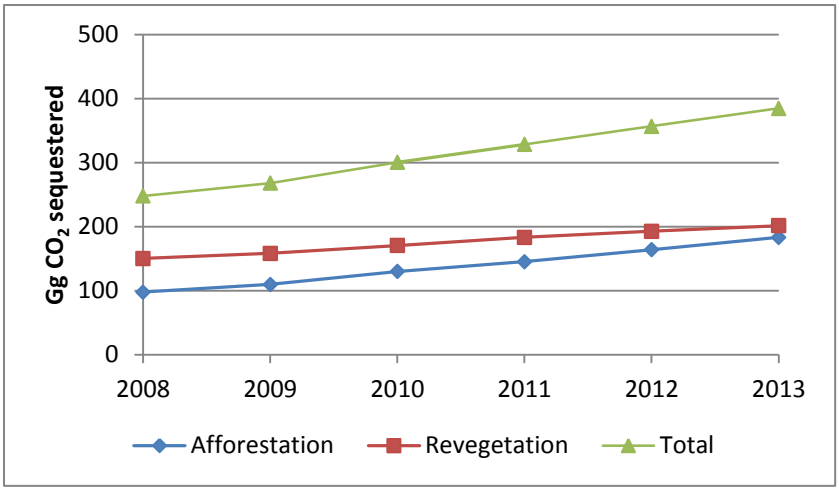

Figure 3.6 Annual sequestration of CO_2 by revegetation and afforestation in 2008 – 2013

Information on minimizing adverse effects, economic and social consequences of reponse measures

IPCC's fifth assessment report confirms that warming of the climate system is unequivocal and that there is a clear human influence. Continued emissions of greenhouse gases will cause further warming resulting *inter alia* in more frequent weather extremes, increased contrasts in precipitation, melting of sea ice and glaciers, sea level rise and ocean acidification. Adverse effects of climate change can be reduced by limiting global warming through reductions in greenhouse gas emissions. Iceland's efforts to reduce emissions and increase carbon seqestration can therefore be expected to contribute to limiting adverse effects in particular in developing countries that are most vulnerable to the impacts of climate change.

Iceland has focused on supporting developing countries bilaterally, and through multilateral channels and training programmes with the aim of strengthening infrastructure and climate change resilience.

Iceland has a longstanding commitment to four United Nations University (UNU) training programmes based in Iceland, in the fields of geothermal energy, fisheries and sustainable land management, and gender equality. The training programmes help developing countries to enhance their capacity to adapt to and mitigate climate change.

Among the mitigation and adaptation programmes Iceland has supported are the two World Bank programmes focused on the fisheries and renewable energy sectors. PROFISH aims at strengthening sustainable fisheries management, promote economic growth, ensure healthy fish stock and enhance their yield. ESMAP is a renewable energy programme within the World Bank, which assists low and middle income countries to increase know-how and institutional capacity to achieve environmentally sustainable energy solutions for low carbon development, poverty reduction and economic growth. As part of the World Bank's response

to the UN's Sustainable Energy for All Initiative, the Bank made an agreement with Iceland to collaborate on advancing geothermal energy utilisation in East Africa.

Table 3.2 Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects

Name of mitigation action[a]	*Sector(s) affected*[b]	*GHG(s) affected*	*Objective and/or activity affected*	*Type of instrument*[c]	*Status of implementation*[d]	*Brief description*[e]	*Start year of implementation*	*Implementing entity or entities*	*Estimate of mitigation impact (not cumulative, in kt CO_2 eq)*
Climate Change strategy	Cross cutting	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	Cross cutting	Strategy	Ongoing	A framework for action and government invlovement in climate change issues	2007		
Climate Change implementation plan	Cross cutting	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	Cross cutting	Action plan	Ongoing	An instrument for implementation of policies and monitoring of progress	2010		
National strategy for sustainable development 2002 - 2020	Cross cutting	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	Cross cutting	Strategy	Ongoing	A general framework for policies set by authorities in fields relating to sustainable development in the near future	2002		

National Renewable Energy Action Plan	Energy/transport	CO_2	Reduce emissions from energy production and use	Action plan	Ongoing	Strategic approach and concrete measures on how Iceland will meet mandatory antional targets for 2020	2012	Ministry of Industries and Innovation, National Energy Authority	
Implementation plan for transport - 2011-2014 and 2011-2022	Transport	CO_2	Sustainable transportation	Policy and action plan	Ongoing		2011	Ministry of the Interior, Municipalities	
Implementation plan for waste 2004-2016 and 2013-2024	Waste	CO_2, CH_4, N_2O	Waste reduction and more efficient use of natural resources	Implementation plan	Ongoing		2004	Environment Agency of Iceland, Municipalities	
Carbon tax	Transport/energy	CO_2	Reduce emissions from fossil fuels	Fiscal	Implemented	Tax on liquid and gaseous fossil fuels	2010	Ministry of Finance and Economic Affairs	NE
EU emission trading scheme	Industry	CO_2, PFCs	Reduce emissions from industry	Economic	Implemented	Cap set on emissons from certain activities. The cap is reduced over time. EEA wide market with emission permits	2013	Environment Agency of Iceland	NE

EU emission trading scheme	Transport	CO_2	Reduce emissions from transportation	Economic	Implemented	Tradable emission allowances for flights within the EEA-area	2012	Environment Agency of Iceland	NE
Excise duty on vehicles based on CO_2 emissions	Transport	CO_2	Reduce emissions from transportation	Fiscal	Implemented	Excise duty increases progressively with increased emissions	2011	Ministry of Finance and Economic Affairs	NE
Biannual fee on vehicles based on CO_2 emissions	Transport	CO_2	Reduce emissions from transportation	Fiscal	Implemented	Biannual fee increases progressively with increased emissions	2011	Ministry of Finance and Economic Affairs	NE
No VAT on zero-emission vehicles (with a cap)	Transport	CO_2	Reduce emissions from transportation	Fiscal	Implemented	Zero-emission vehicles are exempted from VAT	2012	Ministry of Finance and Economic Affairs	NE
Exemption from excise duty and carbon tax for CO_2 neutral fuels	Transport	CO_2	Reduce emissions from transportation	Fiscal	Implemented	No excise duty and carbon tax on CO_2 neutral fuels	2011/2010	Ministry of Finance and Economic Affairs	NE
Reduced excise duty and semiannual car tax on methane vehicles	Transport	CO_2	Reduce emissions from transportation	Fiscal	Implemented	Reduced excise duty and semiannual car tax on methane vehicles	2011	Ministry of Finance and Economic Affairs	NE
Increased public transportation and cycling	Transport	CO_2	Reduce emissions from transportation		Implemented	Support for public transport and construction of bike and walking paths	2012	Ministry of the Interior, Municipalities	NE

Parking benefits for low emission vehicles	Transport	CO_2	Reduce emissions from transportation	Fiscal	Implemented	Low emission vehicle are eligible for free parking	2007	City of Reykjavik	NE
Renewables in fuel for transport	Transport	CO_2	Reduce emissions from transportation	Regulatory	Implemented	Requirement of blending fossil fuels with renewables	2014	National Energy Authority	NE
Public procurement of low-emission vehicles	Transport	CO_2	Reduce emissions from transportation	Regulatory	Implemented	Low emission vehicles favored in public procurement	2011	The city of Reykjavík	NE
Reduced emissions of fluorinated gases	Chemicals	HFC, PFC, SF_6	Reduce emissions of HFC, PFC, SF6	Regulatory	Implemented	Regulation of emissions, use and handling of fluorinated GHGs	2010	Environment Agency of Iceland	NE
Landfill policy	Waste	CH_4	Reduced organic waste in landfills	Regulatory	Implemented	The share of organic wasate shall have been reduced to 35% of total waste in 2020 with 1995 as reference year	2014	Municipalities	NE
Landfill policy	Waste	CH_4	Reduce emissions of landfill gas	Regulatory	Implemented	Collection of landfill gas is required	2003	Environment Agency of Iceland	NE
Regional afforestation projects	LULUCF	CO_2	Carbon sequestration	Action plan	Implemented	Afforestation	1999	Regional implementation Committees	

Mt. Hekla afforestation project	LULUCF	CO_2	Carbon sequestration	Action plan	Implemented	Afforestation	2005	Soil Conservation Service of Iceland and Iceland Forest Service	

4. Projections

Introduction

Iceland‘s 2010 Climate Change Action Plan was based on business-as-usual emissions projection scenario and a „with-measures“-projection derived by subtraction of estimated mitigation gains from individual actions. A new with measures projection was finalized in 2013 for the submission of the 6th National Communication and 1st Biennial report. The new projection was the first to estimate emissions and carbon sequestration up to 2030.

A new projection has not been prepared for this report. Key parameters and assumptions for the projections are therefore the same as presented in the 1st Biennial report. Global warming potentials from the 2nd AR were used for the projections as in the National Inventory Report submitted in 2013.

Key parameters and assumptions

The key parameters and assumptions are shown in Table 4.1

Table 4.1 Summary of key variables and assumptions used in the projections

Key assumptions		**Historical**						**Projected**			
Assumption	**Unit**	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2015**	**2020**	**2025**	**2030**
General economic parameters											
GDP	**Index**	63.0	63.9	81.1	100	100.6	103.3	118.1	134.8	153.1	171.3
GDP growth rate	**%**	0.6	0.8	2.6	8.1	1.6	4.7	3.0	2.7	2.6	2.3
Population	**1000**	256	268	283	300	318	320	331	348	364	378
International oil prices	**USD/ barrel**	33	25	33	40	79	90	105	127	133	139
Energy sector											
Total gross inland consumption											
Oil	**PJ**	15.6	16.7	16.4	15.1	11.0	10.1	9.7	10.1	11.8	12.5
Total gross electricity generation by type											
Oil	**GWh**	6	8	4	8	2	2	4	4	4	4
Hydropower	**GWh**	4,159	4,677	6,350	7,015	12,592	12,507	13,451	13,451	13,793	14,112
Geothermal	**GWh**	283	290	1,323	1,658	4,465	4,701	5,250	5,800	6,000	6,100
Other	**GWh**							5	10	15	20

Summary of projections by sector

Table 4.2 shows Iceland´s historical and projected greenhouse gas emissions by sector from 1990 to 2030, excluding LULUCF. Emission projections estimate that total emissions without LULUCF will decrease in comparison with 2011 levels by about 75 Gg CO_2-eq until 2020 and 100 Gg CO_2-eq until 2030.

Table 4.2 Historical and projected greenhouse gas emissions by sector (Gg CO_2-eq)

Sector	1990	2000	2010	2011	2015	2020	2030
Energy	1,158	1,368	969	906	827	855	1,030
Transport	621	674	900	864	886	802	603
Industry (incl. PFC/HFC/SF_6/Solvents)	878	985	1,896	1,805	1,902	1,909	1,914
Agriculture	706	653	643	641	642	650	667
Waste management	145	196	210	198	147	121	101
Total without LULUCF	3,508	3,876	4,618	4,413	4,404	4,338	4,314
Memo Items:							
International bunkers	322	632	565	626	782	901	1,099
Aviation	222	411	381	426	574	695	890
Marine	100	221	184	201	208	207	209

Summary of projections by gases

Table 4.3 shows Iceland´s historical and projected greenhouse gas emissions by gas from 1990 to 2030 (excluding LULUCF) based on the National Inventory Report submitted in 2013.

Carbon dioxide emissions made up 75% of Iceland´s total emissions in 2011. CO_2 emissions are projected to decrease by 74 Gg between 2011 and 2020 and by an additional 17 Gg until 2030. The main driver behind this trend is decrease in emissions from the transport sector.

Methane emissions amounted to 10% of Iceland´s total emissions in 2011 and are projected to be 8% of the emissions in 2030. The change in emissions can be attributed to decreased emissions from waste disposal.

Nitrous oxide made up 10% of Iceland´s total emissions in 2011 and is projected to be 11% in 2030. The main driver behind this trend is an increase of N_2O emissions from agricultural soils.

The share of PFC emission decreased from 12% of Iceland´s total emissions (without LULUCF) in 1990 to 1.4% in 2011. The emission reductions were accomplished through improved process control in the aluminium industry. PFC emissions are estimated to increase from 80 Gg in 2012 to 100 Gg in 2017 due to increased production capacity in the aluminium industry and then remain constant until 2030.

HFC emissions amounted to 3% of Iceland´s emissions in 2011. The emissions are projected to increase to 4% in 2030 due to an ongoing switch from CFCs and HCFCs to HFCs.

Emissions of SF_6 emissions are projected to remain constant at their 2011 level.

Table 4.3 Historical and projected greenhouse gas emissions subdivided by gas (Gg CO_2-eq)

Greenhouse gas	1990	2000	2010	2011	2015	2020	2030
CO_2	2,160	2,776	3,432	3,333	3,312	3,259	3,241
CH_4	406	440	459	444	389	364	346
N_2O	521	495	454	448	456	461	467
PFCs	420	127	146	63	99	100	100
HFCs	0	36	123	121	145	151	156
SF_6	1	1	5	3	3	3	3
Total without LULUCF	3,508	3,876	4,618	4,413	4,404	4,338	4,314

Projections by sector

Energy (including transport and fugitive emissions)

The Energy sector in Iceland accounted for 40% of the total GHG emissions (excluding LULUCF) in Iceland in 2011, based on the National Inventory Report submitted in 2013. The main sources were fuel combustion (90%) and geotherma energy extraction (10%). The main subsectors in the energy sector in 2011 were transport (49%, mainly road transport), fishing (29%) and manufacturing industries and construction (11%). Remaining emissions came from geothermal energy (10%) and residential/commercial/institutional (1%). Mobile sources therefore accounted for over 80% of the Energy sector emissions. The projections of emissions from fuel combustion are mainly based on the National Energy Authority's (NEA)[4] forecast for use of fossil fuels for the period 2008 – 2050.

[4] http://www.orkustofnun.is/media/eldsneyti/Eldsneytisspa-2012.pdf

Electricity and heat

Electricity and heat production in Iceland is based on renewable energy sources. Emissions from geothermal power plants are included under fugitive emissions and emissions from hydropower reservoirs are accounted for under the LULUCF sector. Electricity produced with fuel combustion (0.01% in 2011) is limited to two remote islands located off the grid. Some public electricity facilities have emergency backup fuel combustion power plants, which are seldom used except for testing and during maintenance. Fuel combustion for heat production in the commercial, institutional and residential sectors include heating swimming pools and commercial buildings and the use of LPG for cooking. Most swimming pools use geothermal water and electricity is by far the most common energy source for cooking. Historic and projected emissions are shown in Table 4.6.

Table 4.6 Historical and projected emissions from electricity and heat production

	Unit	1990	1995	2000	2005	2010	2011	2015	2020	2025	2030
Electricity and heat (oil)	Gg	57	47	36	28	23	25	15	14	14	14

Manufacturing and construction

Emissions from Manufacturing and Construction accounted for 10.9% of the Energy sector emissions in 2011, based on the National Inventory Report submitted in 2013. Mobile sources accounted for 51.2% of the emissions. Emissions from fishmeal production, the most important stationary source, have decreased since 1990 due to replacement of oil with electricity and less production. Fuel use in the metal production industry has also decreased due to replacement of oil with electricity. The construction sector collapsed in 2008 due to the financial crises but emissions are projected increase slightly with slow recovery in the sector. Fuel use in the metal production industry, which falls under the EU ETS, is projected to remain the same per tonne of produced metal as it was in 2012.

Historical and projected emissions are shown in Table 4.7.

Table 4.7 Historical and projected emissions from manufacturing industry and construction

	Unit	1990	1995	2000	2005	2010	2011	2015	2020	2025	2030
Manufacturing industry and construction	Gg	377	378	450	447	213	193	182	184	195	201

Fishing

Emissions from fishing amounted to 29% of the energy sector emissions in 2011, according to the National Inventory Report submitted in 2013. Emissions from fishing peaked in 1996. Improved fishing techniques and increased catch per day at sea have led to improved fuel efficiency. Emissions have have decreased steadily since the peaking year in 1996.

Historical and projected emissions are shown in Table 4.8

Table 4.8 Historical and projected emissions from fishing fleet

	Unit	1990	1995	2000	2005	2010	2011	2015	2020	2025	2030
Fishing	Gg	662	780	728	633	540	505	447	478	590	633

Fugitive emissions

Emissions from geothermal power plants amount to 99.8% of the fugitive emissions in Iceland. Distribution of oil products is also a source but very small.

Emissions from geothermal power plants are site and time-specific, and can vary greatly between areas, between the wells within an area and by the time of extraction.

Emissions from geothermal power plants in the projection period were calculated as a five-year average 2007 - 2011. Emissions from distribution of oil products were estimated by adding up all the projected fuel use for the projection period and multiplying with the EFs from the 2013 GHG inventory.
Historical and projected development of fugitive emissions is shown in Table 4.9.

Table 4.9 Historical and projected development of fugitive emissions

	Unit	1990	1995	2000	2005	2010	2011	2015	2020	2025	2030
Geothermal power plants	Gg	62	83	154	118	193	182	181	181	181	181
Distribution of oil products	Gg	0.4	0.4	0.5	0.5	0.5	0.4	0.5	0.5	0.5	0.5

Transport

Transport accounted for 49% of the emissions in the energy sector and 20% of the total greenhouse gas emissions in Iceland in 2011 according to the 2013 GHG inventory. Road transport is the dominant source while domestic aviation and navigation accounted for less than 5% of the emissions. Emissions from road transport peaked in 2007.

Projected fuel consumption is based on NEA's fuel forecast adjusted for the share of renewable energy in the sector.

Historical and projected emissions from road transport, aviation, and navigation are shown in Table 4.11.

Table 4.11 Historical and projected emissions from road transport, aviation, and navigation.

	Unit	1990	1995	2000	2005	2010	2011	2015	2020	2025	2030
Road transport	Gg	529	561	633	800	844	824	812	728	576	527
Aviation	Gg	32	30	28	26	21	20	24	25	27	28
Navigation	Gg	60	37	13	23	35	19	49	49	48	48

Industrial processes

Industrial processes accounted for 41% of emissions in Iceland in 2011 according to the 2013 GHG inventory. The dominant source is production of non-ferrous metals, aluminium and ferro-silicon, which accounted for 92% of the emissions in 2011. Consumption of halocarbons and SF_6 accounted for 7% and emissions from mineral products for 1%.

The projections of emissions from industrial processes are mainly based on the projected production statistics, relative to installed capacity, and plant specific emission factors.

Historical end projected GHG emissions from industrial processes are shown in Table 4.13.

Table 4.13 Historical end projected GHG emissions from industrial processes

	Unit	1990	1995	2000	2005	2010	2011	2015	2020	2025	2030
Aluminium production	Gg	558	213	480	443	1,383	1,278	1,369	1,370	1,370	1,370
Ferrosilicon production	Gg	208	243	374	375	369	375	377	377	377	377
Cement production	Gg	52	37	64	54	10	20	0	0	0	0
Other production	Gg	49	44	20	2	1	2	2	2	2	2

HFC and SF_6

Hydrofluorocarbons (HFCs) are mainly used as refrigerants in Iceland and banned for most other uses. HFCs substitute ozone depleting substances like (CFC) R-12 and HCFCs. HFCs are used on board fishing vessels, in commercial, industrial, and domestic refrigeration, vehicle air-conditioners and metered dose inhalers. SF_6 is used as an insulation gas in switchgear and circuit breakers.

Ongoing switch from CFCs and HCFCs to HFCs has led to a build-up of HFCs in the stock of refrigeration systems, which will lead to higher emissions in the future. Future emissions estimate is based on emission factors in Coenen et al. (2012)[5] by multiplying 2010 emissions with a gas and application specific emission factor (called grade 2). SF_6 emissions are kept constant at their 2011 level.

Emission estimates and projected amounts for HFCs are shown in Table 4.15.

Table 4.15 HFC emission estimates and projected amounts from refrigeration and metered dose inhalers (Gg CO_2-eq)

Application	2010	2011	2015	2020	2025	2030
Domestic refrigeration	0.1	0.1	0.0	0.0	0.0	0.0
Commercial refrigeration	12.9	13.8	8.9	9.8	10.2	10.5
Transport refrigeration	85.8	82.6	110.4	116.4	120.8	124.9
Industrial refrigeration	17.1	17.9	17.7	18.0	18.1	17.2
Stationary A/C	0.4	0.6	0.6	0.8	0.9	1.0
Mobile A/C	5.6	5.6	6.1	5.0	3.0	1.4
MDIs	0.8	0.8	0.8	0.8	0.8	0.8
Total HFC emissions	122.5	121.4	144.5	150.8	153.8	155.7

[5] Coenen et al. (2012). Development of GHG projection guidelines. (http://ec.europa.eu/clima/policies/g-gas/monitoring/studies_en.htm)

Agriculture

Agriculture accounted for 640 Gg CO_2-eq. of greenhouse gas emissions in 2011 or 14.5 % of Iceland´s total emissions (excluding LULUCF) according to the 2013 GHG inventory. Agricultural methane emissions originate from enteric fermentation of livestock and management of livestock manure. Application of synthetic fertilizers and animal manure is the main source of N_2O emissions from agricultural soils. Livestock populations are key drivers for methane emissions and nitrous oxide emissions from manure application.

Assumed changes in livestock populations, animal performance, fertilizer use, and cultivated area, are projected to result in an increase of total emissions from agriculture by 1.5% until 2020 and 4.1% until 2030 compared to 2011.

Historic emissions and estimates for agriculture emissions are shown in Table 4.17.

Table 4.17 Historic emissions and estimates for agriculture sector subcategories (Gg CO2-eq)

Subcategory	GHG	1990	2011	2012	2015	2020	2030
Enteric fermentation	CH_4	244	227	226	222	223	226
Manure management	CH_4	30	30	30	30	30	32
Manure management	N_2O	52	44	43	43	44	46
Agricultural soils	N_2O	380	340	351	348	353	364
Sum of sector	CH_4 and N_2O	706	641	650	642	650	667

Waste

Emissions from the Waste sector accounted for 198 Gg CO_2 eq in 2011 corresponding to 4.5 % of Iceland´s total emissions (excluding LULUCF) according to the 2013 GHG inventory. The main source is methane emissions from solid waste disposal on land (89%). Other sources are waste water handling, waste incineration and biological treatment of solid waste. The composition and annual amount and of landfilled waste are key drivers for the methane emissions.

Decreased amount of landfilled waste has led to slightly decreased methane emissions since 2008. This trend is projected to continue mainly due to reduction of organic waste being landfilled and increased recovery of methane. Net CH_4 emissions from SWD are projected to decrease from 8.4 Gg in 2011 to 3.5 Gg in 2030. Other waste sector GHG sources are expected to increase slightly.

Historic and projected emissions from the waste sector are shown in Table 4.18

Table 4.18 Historic and projected emissions from the waste sector (Gg CO_2-eq)

Subcategory	GHG	1990	2011	2012	2015	2020	2030
SWD emissions	CH_4	119	193	193	178	144	100
SWD recovery	CH_4	0	18	31	53	47	26
SWD emissions – recovery	CH_4	119	176	162	125	97	74
Wastewater	CH_4, N_2O	8	12	12	12	13	14
Incineration	CO_2, CH_4, N_2O	18	9	6	6	7	7
Biological treatment	CH_4, N_2O	0	3	3	4	4	6
Waste sector	CO_2, CH_4, N_2O	145	198	182	147	121	101

Land use land use change and forestry

Forests

The main source of information used to estimate both area and removals/emissions of GHG regarding forest and forestry is the data sampled in the Icelandic national forest inventory. Other sources are activity data sampled and aggregated at Icelandic Forest Research. The methods used to estimate biomass are defined as Tier 3 approaches.

A current estimate of the area of natural woodland in Iceland is 146 kha for 2011. Most of the natural birch woodland does reach height at maturity between 2-5 m height (58%), but the rest, shrubland, covers 35% of the total. The minimum height for the in country definition of forest in Iceland is 2 m, consequently 65% of the natural birch woodland is defined as forest.

After the Second World War afforestation and reforestation by planting of seedlings increased slowly up to 1 million seedlings planted annually just before 1990 when afforestation through planting increased to 4 million in the 1990s and 5 million in the first seven years of the 2000s. After the financial crisis in 2008 afforestation decreased and annual plantation rate was down in 3.3 million seedlings in 2012. State supported afforestation on farms and private owned land has become the main channel for afforestation activity in Iceland, comprising about 80% of the afforestation effort today.

Planted or direct seeded forest and naturally propagated forest originating from cultivated forest are named cultivated forest. Estimate of the area of cultivated forest was 38 kha in 2011. The total area of forest, natural and cultivated, was 133 kha in 2011.

Projected development of afforestation and deforestation area and corresponding emissions and removals are shown in Table 4.19. Areal extent and net removals from forests falling under Forest Management are shown in Table 4.20.

Table 4.19 Area, emissions and removals from afforestation and deforestation for selected years from 2008-2030.*

Activity	Specification	Parameter	Unit	2008	2011	2015	2020	2030
Afforestation	Cultivated forest	Area since 1990	kha	27.21	32.20	36.49	41.86	52.60
Afforestation	Cultivated forest	Removal biomass /soil/litter	Gg CO_2-eq	82.46	138.63	176.51	234.95	336.80
Afforestation	Cultivated forest	Emissions organic soil	Gg CO_2-eq	-1.53	-1.67	-1.89	-2.17	-2.72
Afforestation	Cultivated forest	Emissions N-fertilizer	Gg CO_2-eq	-0.11	-0.13	-0.11	-0.11	-0.11
Afforestation	Cultivated forest	Emissions wood removals	Gg CO_2-eq.	0.00	0.00	-5.37	-3.11	-20.45
Afforestation	Cultivated forest	Net removals	Gg CO_2-eq	80.82	136.83	169.14	229.56	313.52
Afforestation	Nat. birch woodland	Area since 1990	kha	7.87	9.11	10.76	12.83	16.97
Afforestation	Nat. birch woodland	Removal biomass /soil/litter	Gg CO_2-eq	22.43	25.97	30.69	36.59	48.39
Deforestation	Forest land	Area since 1990	kha	0.04	0.05	0.07	0.10	0.16
Deforestation	Forest land	Emissions biomass /soil/litter	Gg CO_2-eq	-0.08	-0.46	-0.41	-0.48	-0.63
ARD	Forest land	Net removals	Gg CO_2-eq	103.16	162.34	199.42	265.67	361.29

* Positive values denote removal, negative values emissions.

Table 4.20 Areal extent and net removals from forests falling under Forest Management.

Specification	Parameter	Unit	2008	2011	2012	2013-2020	2021-2030
Cultivated forest	Area before 1990	kha	5.72	5.72	5.72	5.72	5.72
Cultivated forest	Net removals	Gg CO_2-eq	59.26	73.10	72.27	69.51	57.57
Nat. birch woodland	Area before 1990	kha	86.40	86.40	86.40	86.40	86.40
Nat. birch woodland	Net removals	Gg CO_2-eq	14.64	14.68	14.68	14.68	14.68
Cultivated forest	Revised reference level	Gg CO_2-eq				84.19	72.24

Prediction assumptions

Afforestation, reforestation and deforestation

1. The rate of afforestation in cultivated forest will be 3.38 million seedlings annually equal to 1.08 kha.
2. The ratio of afforestation on different land use categories, the relative emission effect of annual deforestation in relation to net-sequestration and the use of N-fertilizer per area unit afforested are the same as in the 2013 National Inventory Report.
3. The afforestation and carbon sequestration rate of natural birch forest is the same as estimated for 1990 - 2011.
4. Growing stock available for wood supply does exclude cultivated birch forest (protection afforestation) and 30% of other species.

Forest Management

1. With regard to the prediction for wood removal in the period 2012 to 2020 the same figure is used as in the report "Prediction of Reference Level for the Period 2013-2020 for Forest Management in Iceland", where Forest Management Reference level was estimated and reported.
2. Growing stock available for wood supply excludes cultivated birch forest (protection afforestation) and 30% of other species in the model used for the period 2021 to 2030.
3. The Carbon sequestration rate of natural birch forest is the same as estimated for 1990 - 2011.

Revegetation

Revegetation activities before 1990 involved spreading of seeds and/or fertilizer by airplanes and direct seeding of lyme grass and other graminoids. Since then methods have been changed with increased cooperation with farmers and other groups interested in land reclamation work.

The Soil Conservation Service of Iceland keeps a national inventory on revegetation areas. Carbon stock changes are estimated using IPCC 2006 GL Tier 2 methodology and country specific emission factors. The factor for annual CO_2 removal per area is assumed to be constant. The trend in CO_2 sequestrated by revegetation is therefore dependent on the development of revegetation area since 1990. Losses of area revegetated before 1990 play only a minor role. Annual increase of revegetation area peaked in 2004 when it was almost 7 kha but has declined since. The average area subject to revegetation activities during the period 2009-2011 was 3.7 kha/year. The annual revegetation area increase for the projection period from 2012-2030 is assumed constant at 2.5 kha per year. Net removals from revegetation amounted to 174.3 Gg CO_2 in 2011. It is projected that these removals will increase linearly until 2030 when they will reach 273.6 Gg CO_2.

5. Provision of financial, technological and capacity-building support to developing country Parties

Introduction

International development cooperation is one of the key pillars of Iceland's foreign policy, with the main goal of contributing to the fight against poverty in the world's poorest countries. For nearly four decades, Iceland's official development cooperation has placed particular focus on the sustainable utilisation of natural resources, including fisheries and renewable energy. This has been grounded on Iceland's experience and expertise in utilising its own resources for its social, economic and human development.

This legacy is maintained in Iceland's Strategy for International Development Cooperation 2013-2016, which identifies three priority areas: natural resources, human capital and peace-building, with gender equality and environmental sustainability as special cross-cutting themes.

Iceland's development cooperation is based on the principles of sustainable development and commitments to environmental sustainability. This is particularly important in projects that relate to the utilisation of natural resources, but all projects financed by Iceland's development cooperation must factor in environmental concerns and impact.

In recent years, increased focus has been on addressing the challenges of climate change. Climate change mitigation and adaptation are more likely to be built into the programming and projects than before. New targeted interventions have been designed to help develop the capacity of developing countries to adapt to climate change and build resilience to climate impacts as well as increasing the participation of women in international negotiations on climate change.

Financing

Iceland is committed to assist developing countries adapt and mitigate the adverse effects of climate change. One of the priority areas in Iceland's strategy for international development cooperation is environmental sustainability. Accordingly, as shown in table 7-2 in the annex, 28% of Iceland's total ODA in 2014 or 10.4 million US dollars had mitigation or adaptation to climate change as a significant or primary objective. Thereof 4.4 million US dollars were allocated to projects with adaptation objectives only, 0.4 million for mitigation objectives only and 5.6 million for projects with both mitigation and adaptation to climate change as a

significant or primary objective. This amounts to a 7% increase in climate related aid compared to the end of the previous reporting period in 2012, when 9.7 million US dollars were allocated to projects targeting mitigation or adaptation[6].

In Tables 2013 and 2014 below list all individual projects and programmes funded under Icelandic ODA in 2013 and 2014 respectively, which had mitigation or adaptation to climate change as a significant or primary objective.

[6] Figures relate to projects and programmes marked with the DAC Rio markers, indicating that a major element of the activity is targeting the objectives of the Rio Conventions. The activities marked with the Rio markers are assessed to be assistance to the implementation of the Climate Convention, directly and/or indirectly.

Overview of Iceland's Support to Climate related projects and programmes, 2013-2014

Table 2013

Recipient country and region	**Targeted area**	**Measures and activities**	**Sector**	**Activities undertaken by**	**Status**
	Mitigation / Adaptation			*Private /* *Public*	*Implemented/* *Planned*
Developing countries, unspecified	Mitigation	Iceland has contributed to a Trust Fund for a Donor Funded Staffing programme. The TF will fund two positions of Icelandic professionals in the World Bank, in fisheries and geothermal energy.	Multi-sector/ Cross-cutting	International Bank for Reconstruction and Development	Ongoing since 2012.
Nicaragua	Mitigation	Project to increase the use of geothermal resources by strengthening capacities at the government institutions that are involved.	Energy	Recipient government	Implemented 2008-2013

Developing countries, unspecified	Adaptation	Providing research and training in land restoration for experts from developing countries	Forestry	United Nations University	Ongoing
Developing countries, unspecified	Adaptation	Research and training for practicing professionals from the developing states in the field of fisheries.	Fishing	United Nations University	Ongoing
Developing countries, unspecified	Adaptation	Donations to funds under DOALOS.	Fishing	DOALOS	Ongoing
Malawi	Adaptation	Water- and sanitation project in Mangochi-district.	Water and sanitation	Recipient government	To be completed 2016.
Malawi	Adaptation	Seconded expert to work on WFP's school meal program in Lilongwe.	Multi-sector/ Cross-cutting	WFP	Implemented
Uganda	Adaptation	Aid to children and families returning to their home after protracted conflicts in North-Uganda.	Multi-sector/ Cross-cutting	Donor country based NGO	Implemented 2010-2013

West Bank and Gaza	Adaptation	Secondment of a project manager in the field of disaster risk management for a project titled "Resilient against Natural Disaster".	Disaster prevention and preparedness	OCHA	
West Bank and Gaza	Adaptation	Emergency Response fund for the Occupied Palestinian Territories.	Emergency Response	OCHA	Implemented
Developing countries, unspecified	Mitigation and adaptation	Support for the ESMAP project, for the advancement rational and responsible use of energy	Energy	International Bank for Reconstruction and Development	Ongoing
Developing countries, unspecified	Mitigation and adaptation	Research and training for practicing professionals from the developing states in the field of geothermal energy.	Energy	United Nations University	Ongoing
Developing countries, unspecified	Mitigation and adaptation	Providing specialists from developing countries with training and education in gender equality	Gender equality	United Nations University	Ongoing

Developing countries, unspecified	Mitigation and adaptation	Programme to ensure that gender equality perspectives are reflected in all international negotiations and policy formation on the subject.	Gender equality	UN Women	Supported 2012-2013
Developing countries, unspecified	Mitigation and adaptation	Increasing women participation in international negotiations regarding climate change. (Women's Environment & Development Organization, WEDO)	Gender equality	International NGO	Supported 2011-2014
South of Sahara, regional	Mitigation and adaptation	Promoting issues relating to renewable energy in developing countries.	Energy	International Bank for Reconstruction and Development	
South America, regional	Mitigation and adaptation	Support to IRENA's (International Renewable Energy Agency) Geothermal initiative in the Latin America region.	Energy	IRENA	Supported 2011-
Ethiopia	Mitigation and adaptation	Improve social and economic sustainability in rural Jijiga.	Multi-sector/ Cross-cutting	Donor country based NGO	Implemented

Table 2014

Recipient country and region	**Targeted area**	**Measures and activities**	**Sector**	**Activities undertaken by**	**Status**
	Mitigation / Adaptation			*Private* / *Public*	*Implemented/ Planned*
Developing countries, unspecified	Mitigation	Iceland has contributed to a Trust Fund for a Donor Funded Staffing programme. The TF will fund two positions of Icelandic professionals in the World Bank, in fisheries and geothermal energy.	Multi-sector/ Cross-cutting	International Bank for Reconstruction and Development	Ongoing since 2012.
Developing countries, unspecified	Adaptation	Providing research and training in land restoration for experts from developing countries	Forestry	United Nations University	Ongoing
Developing countries, unspecified	Adaptation	Research and training for practicing professionals from the developing states in the field of fisheries.	Fishing	United Nations University	Ongoing

Developing countries, unspecified	Adaptation	Donations to funds under DOALOS.	Fishing	DOALOS	Ongoing
Malawi	Adaptation	Seconded expert to work on WFP's school meal program in Lilongwe.	Multi-sector/ Cross-cutting	WFP	
Malawi	Adaptation	Water and sanitation project in Mangochi-district.	Water and sanitation	Recipient Government	To be completed 2016.
Mozambique	Adaptation	Water supply, sanitation and hygiene in rural communities and schools for children in Zambézia Province.	Water and sanitation	UNICEF	
Namibia	Adaptation	Final impact evaluation of interventions in the fisheries sector in Namibia, 1990-2010.	Fishing	Recipient Government	
Uganda	Adaptation	Water and sanitation project in Rakai, Uganda.	Water and Sanitation	Donor country based NGO	
Uganda	Adaptation	Water and sanitation project in Sembabule, Uganda	Water and Sanitation	Donor country based NGO	

West Bank and Gaza	Adaptation	Secondment of a project manager in the field of disaster risk management for a project titled "Resilient against Natural Disaster".	Disaster prevention and preparedness	UNDP	
West Bank and Gaza	Adaptation	Building Resilience against Natural Disasters in Palestine.	Disaster prevention and preparedness	UNDP	
Developing countries, unspecified	Mitigation and adaptation	Support for the ESMAP project, for the advancement rational and responsible use of energy	Energy	International Bank for Reconstruction and Development	Ongoing
Developing countries, unspecified	Mitigation and adaptation	Research and training for practicing professionals from the developing states in the field of geothermal energy.	Energy	United Nations University	Ongoing
Developing countries, unspecified	Mitigation and adaptation	Providing specialists from developing countries with training and education in gender equality	Gender equality	United Nations University	Ongoing

Developing countries, unspecified	Mitigation and adaptation	Increasing women participation in international negotiations regarding climate change.	Gender equality	International NGO	Supported 2011-2014
Developing countries, unspecified	Mitigation and adaptation	Support to the Sustainable Energy for All Multi-partner Trust Fund (SE4ALL MPTF).	Energy	UNDP	
South of Sahara, regional	Mitigation and adaptation	Promoting issues relating to renewable energy in developing countries.	Energy	International Bank for Reconstruction and Development	
South of Sahara, regional	Mitigation and adaptation	Assist countries in the East African Rift Valley in conducting geothermal exploration and to build capacity and expertise in the field of geothermal utilisation. Over a period of five years, the project could extend to 13 countries in the East Africa Rift Valley.	Energy	Recipient Government	Implemented 2013-2017
Ethiopia	Mitigation and adaptation	Improve social and economic sustainability in rural Jijiga.	Multi-sector/ Cross-cutting	Donor country based NGO	Implemented

Ukraine	Mitigation and adaptation	Geothermal mapping in Ukraine	Energy	Donor country based NGO	Implemented 2014-2015

Technology development and transfer and capacity building[7]

Iceland's Strategy for Development Cooperation 2013-2016 is based on the principles of sustainable development and commitments to environmental sustainability. Both in terms of technology development and transfer and capacity building, developing countries benefit through both bilateral and multilateral programmes from Icelandic funded expertise, including in the fields of renewable energy, sustainable fisheries and sustainable land management.

Iceland has bilateral agreements on development cooperation with three African states; Malawi, Mozambique and Uganda. Iceland channels half of its ODA through bilateral channels, including NGOs, and the other half through multilateral channels, including the four United Nations University (UNU) Training Programmes based in Iceland, which count for 13-14 per cent of Iceland's overall ODA budget. These programmes both count capacity building as well as technology transfer, depending on the training. Therefore, this section will cover both.

Iceland has a longstanding commitment to four United Nations University (UNU) training programmes based in Iceland: The UNU Geothermal Training Programme, since 1979, the UNU Fisheries Training Programme, since 1998, the UNU Land Restoration Training Programme, since 2010, and the UNU Gender Equality Studies and Training Programme, since 2013. The focus of three of the programmes is climate change mitigation and adaptation and the fourth has focused in part on gender and climate change. All four programmes are directly linked to national and public institutions in Iceland and draw on their experts for lecturing and training of fellows who mostly come from Least-Developed and other developing countries (see table below).

The fellows are trained in applicable science and research, relevant to their home country, and usually conduct their research with involvement from an official or research institutions in their home country. Through this method, the research is more likely to have an impact in the respective field in the home country and bring about further technological transfer, both through the research itself but also through sampling, statistical collection and analysis etc. Fellows are chosen for and encouraged to further develop their leadership skills in order to further the transfer of knowledge after they return to their home country, often to return to work in national expert institutions. Through the UNU training programmes, Iceland has helped enhance the capacity of participating countries to adapt to and mitigate climate change through training of officials in the fields of geothermal energy, fisheries and sustainable land management sectors, as well as in gender equality.

[7] Iceland's support to technology transfer in relations to the implementation of the Climate Convention includes a broad spectrum of activities. These activities comprise transfer of both hard and soft technologies. The extent of this technology transfer is significant and cannot be clearly separated from other activities in Iceland's international development cooperation, including financial flows. In fact many development projects funded by Iceland include technology transfer and capacity building components. Since they form an integral part of a project, it is not possible to account for them separately.

Nationality	Fisheries		Geothermal		Land Restoration		GEST		Total all programmes	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Total LDCs	**7**	**7**	**10**	**8**	**5**	**6**	**6**	**12**	**28**	**33**
(percentages)	32%	33%	29%	28%	50%	50%	75%	86%	38%	43%
Kenya	3	1	13	11					**16**	**12**
Other non-LDCs	12	13	11	10	5	6	2	2	**30**	**31**
Sub total	**15**	**14**	**24**	**21**	**5**	**6**	**2**	**2**	**46**	**43**
(percentages)	68%	67%	71%	72%	50%	50%	25%	14%	62%	57%
Total - all fellows	**22**	**21**	**34**	**29**	**10**	**12**	**8**	**14**	**74**	**76**

Among the mitigation and adaptation programmes Iceland has supported through multilateral channels are the two World Bank programmes focused on the fisheries and renewable energy sectors. PROFISH aims at strengthening sustainable fisheries management, promote economic growth, ensure health fish stock and enhance their yield. ESMAP is a renewable energy programme within the World Bank, which assists low and middle income countries to increase know-how and institutional capacity to achieve environmentally sustainable energy solutions for low carbon development, poverty reduction and economic growth.

As part of the World Bank's response to the UN's Sustainable Energy for All Initiative, the Bank made an agreement with Iceland to collaborate on advancing geothermal energy utilisation in East Africa through five year project between 2013 and 2017. It is the largest initiative of its kind for promoting the utilisation of geothermal energy in developing countries. In the beginning it was foreseen that participating countries should at the end of the project have three key outputs from the project: A realistic assessment of potential geothermal sites; plans for further action where applicable, and; capacity to move forward on the basis of those plans and submit exploration drilling projects into funding pipelines. The project could extend to up to thirteen countries[8] in the East Africa Rift Valley and is already under way in at least seven of them. The project in the East Africa Rift Valley is implemented in cooperation with a number of private partners and institutes, including technology transfer and capacity building to national experts and institutions in recipient countries.

Iceland has committed resources that are creating enabling environments for private sector investment, strengthening national and regional institutional and regulatory frameworks, and assisting developing countries to take practical actions to cut emissions. It should also be noted that financial resources and transfer of technology for the purposes of adaptation to and mitigation of climate change have in recent years not been channelled through the private sector. Activities reported are therefore all undertaken by the public sector.

The effects of climate change affect women more severely than men. It is therefore important to include gender aspects in all discussion about climate change and programming. As demonstrated in Tables 2013 and 2014, Iceland has actively promoted the important role of gender in the international climate negotiations, as well as supported several climate projects

[8] Burundi, Comoros, Djibouti, DR Congo, Eritrea, Ethiopia, Kenya, Malawi, Mozambique, Rwanda, Tanzania, Uganda and Zambia.

with the emphasis on women empowerment and gender equality, e.g. through organizations such as UN Women, WEDO and FAO.

Recognising that climate change has disproportionally more impact in developing countries, the Government of Iceland remains fully committed to development cooperation with poor countries on mitigation and adaptation of these effects.

Bilaterally, Iceland will continue focusing its work on Malawi, Mozambique and Uganda, where it has longstanding cooperation with governments and civil society, as well as completing the regional project for geothermal energy exploration in the East Africa Rift Valley, which is under way in cooperation with several East African governments and the World Bank's ESMAP. Multilaterally, Iceland's financial contributions will remain concentrated on efforts to provide support to climate change adaptation and mitigation in the poorest developing countries with additional emphasis on gender mainstreaming and capacity building through the UNU training programmes. In this spirit, Iceland has committed to regularly contributing in the coming years to the UNCCC Least-Developed Countries Fund and the Green Climate Fund. Equally, Iceland will continue to actively participate in the work of international organisations on renewable energy and fisheries.