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Report on the in-depth review of the second national communication of Iceland

Review team:

Taghi Ebtekar (Islamic Republic of Iran)
Ivan Mojik (Slovakia)
Didier Goetghebuer (Belgium)
Tina Dallman (UNFCCC secretariat, coordinator)

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I. INTRODUCTION AND NATIONAL CIRCUMSTANCES

1. Iceland ratified the United Nations Framework Convention on Climate Change (UNFCCC) on 16 June 1993. Its first national communication (NC1) was submitted on 4 March 1996 and the second national communication (NC2) was submitted on 6 August 1997.

2. The in-depth review was carried out between August 1998 and June 1999 and included a review team visit to Reykjavik from 14 to 18 September 1998. The team consisted of Prof. Taghi Ebtekar (Islamic Republic of Iran), Mr Ivan Mojik (Slovakia), Mr Didier Goetghebuer (Belgium) and Ms Tina Dallman (UNFCCC secretariat, coordinator). During the visit, the team met officials from government ministries and agencies, members of environmental non-governmental organizations (NGOs) and industry representatives.

3. Iceland is an island of some 103,000 km^2 located in the North Atlantic with its most northerly extremes bordering the Arctic Circle. The NC2 describes 58 per cent of Iceland as barren land, 24 per cent as open rangeland, 11 per cent as glaciers, 6 per cent as inland water and only 1 per cent as woodland. This is largely a man-made situation as a result of, *inter alia*, excess forest felling and overgrazing over many centuries, resulting in severe problems of land degradation and soil erosion. Despite the latitude, Iceland has relatively mild winters with a mean January temperature of around 0ºC, owing to the warming influence of ocean currents, whilst in summer the mean July temperature in lowland areas is about 10ºC. Given the low mean temperature, interior heating is needed throughout the year, but the impact of this on greenhouse gas (GHG) emissions is negligible due to the fact that approximately 85 per cent of buildings have geothermal heating and most of the remainder use electricity generated from renewable sources. The growing population, which stood at 270,000 in 1995, is primarily located in settlements along the coast, making potential sea level rise a particular problem of climate change. About 57 per cent of the population live in the capital, Reykjavik, and its immediate vicinity. The remainder are dispersed across the country and are particularly reliant on private motor transportation. Given Iceland's location and sparse population air quality is generally high and although it is a party to the Convention on Long-range Transboundary Air Pollution it is not a party to its protocols covering specific gases.

4. Iceland has a small open economy, highly dependent on fishing and fish processing, thanks to its exclusive 758,000 km^2 fishing zone, which has a rich variety of marine life. In 1995, in terms of the percentage share of gross domestic product (GDP), manufacturing, (including fish processing) and fishing accounted for 17 per cent and 9 per cent of output respectively. The share of agriculture in domestic production was only 2 per cent and, owing to the land characteristics, biased toward livestock. Provisional figures for 1996 and 1997 were approximately the same. In 1996, fish products accounted for about 76 per cent of exports of goods by value, whilst aluminium and ferrosilicon accounted for a further 10 per cent and 3 per cent, respectively. Fishing on a large scale results in substantial GHG emissions through diesel consumption for power and the use of hydrofluorocarbons (HFCs) in refrigeration. Heavy industry also makes a significant contribution to overall GHG emissions. Given the high degree of dependence on fishing, the path of economic growth can be closely linked to activities in this

sector. Whilst growth was buoyant during the 1970s and 1980s, there was a recession in the early 1990s, in part owing to reduced cod quotas, but this was followed by renewed growth in the four years prior to publication of the NC2. Officials expected annual economic growth of more than 4 per cent over the period 1997 to 2000. Attempts to strengthen the cod stock and reduce overcapacity in the fishing fleet will have an important influence on the future path of GDP.

5. Legislative power rests with the Icelandic parliament or Althingi, whilst the Government, made up of 13 ministries in 1998, holds executive power. Ministries can issue regulations on the basis of laws adopted by the Althingi. The country has 26 administrative districts and also has a system of 171 local authorities. The local authorities have revenue-raising powers and responsibility for a number of areas related to GHG emissions and policies, including planning, public transportation operations and aspects of education.

6. There are no important known fossil fuel reserves in Iceland, so all fossil fuels are imported, but the country benefits from an abundance of geothermal and hydroelectric power. At the time of the review, approximately one seventh of the technical hydroelectric potential production was being exploited and only about 1 per cent of the geothermal power potential. According to International Energy Agency (IEA) data, whilst total primary energy supply per capita in Iceland ranked amongst the highest in the world in 1995, at 7.9 tonnes of oil equivalent (TOE) per capita, compared to an OECD average of 4.5 TOE per capita, its carbon dioxide (CO_2) emissions at 8.8 tonnes per capita were lower than the average of 11.08 for countries of the Organisation for economic Co-operation and Development (OECD), although slightly higher than the European Community (EC) average of 8.5 tonnes per capita. Its emissions intensity, measured at 0.48 kg CO_2 per unit of GDP, was also lower than the OECD average of 0.65 kg CO_2 per unit of GDP. In absolute terms, Iceland was by far the smallest OECD emitter of CO_2 in 1995. Icelandic statistics show that primary energy consumption amounted to 106.4 PJ in 1997, of which 48 per cent was geothermal energy, 32 per cent oil, 18 per cent hydroelectric and 2 per cent coal. There was also a very small amount of gas used. Almost 100 per cent of electricity is either hydropower or geothermal. These sources also provide 98 per cent of the energy for space heating and nearly all stationary energy needs. Oil, about 90 per cent of which was used in either the fishing or transportation sectors, accounted for the most significant share of fuel imports. Coal consumption was limited mainly to a ferrosilicon plant and a cement plant.

7. Iceland's first sustainable development strategy, set out in 1993, included a national target to reduce net greenhouse gas emissions to the 1990 level by the year 2000, excluding emissions from industrial processes using non-fossil fuel generated electricity. An action plan was drawn up in 1995 and adopted by the Government covering existing and new policies to mitigate GHG emissions. The personal assistants to the ministers were given the responsibility of overseeing the implementation of the plan. In 1998, this was superseded by a Government Climate Change Steering Group, with a focus on attaining the goals of the Kyoto Protocol, comprising secretaries general from eight ministries and, underlying this, four task forces covering fisheries, transport, carbon sequestration and economic impacts. The last mentioned is to analyse the potential effects on the Icelandic economy, including employment, of policy proposals by the three former ones. A panel of experts on climate change and climate change

impacts has also been established, comprising government officials and non-government academics. Their first task is to assess the implications of the Intergovernmental Panel on Climate Change (IPCC) second assessment report for Iceland. In this framework, various 'stakeholders', including NGOs, are to be consulted when considering policies, especially in relation to fisheries and transport.

II. INVENTORIES OF ANTHROPOGENIC EMISSIONS AND REMOVALS

8. Iceland's NC2 includes summary tables for emissions of the direct GHGs CO_2, methane (CH_4), nitrous oxide (N_2O), perfluorinated hydrocarbons (PFCs) and hydrofluorcarbons (HFCs), and emissions of the indirect greenhouse gases nitrogen oxide (NO_x), carbon monoxide (CO), non-methane volatile organic compounds (NMVOC) and sulphur dioxide (SO_2) for the period 1990 to 1995 inclusive. A summary data table for GHG emissions in 1996 was provided during the review.

9. GHG emission inventories are prepared by the Environment and Food Agency, on the basis of information provided by other authorities as well as import statistics and the direct provision of some data from industry. The National Energy Authority provides data on fuel sales, collected from suppliers, industry, the fishing fleet, shipping companies and airlines, to estimate emissions from fuel combustion and on the harnessed quantity of steam, plus its characteristics to estimate emissions from geothermal exploitation. Industry provides data on feedstock quantities and characteristics in order to estimate industrial process emissions. The Public Road Works collects data on imports of solvents used in road surfacing and data on waste management and wastewater treatment come from the Environment and Food Agency. Agricultural emissions are based on industry data for artificial fertilizer production, livestock statistics from the Icelandic Association of Farmers and the Agricultural Research Institute's estimates of emission factors.

10. The inventories were estimated mostly, but not entirely, using the revised 1996 IPCC guidelines as manpower constraints have prevented a complete change in methods based on the former guidelines. It was noted during the review that aggregate emissions presented in the NC2 are based on the global warming potential (GWP) values of the earlier guidelines. To a large extent IPCC default emission factors were used, given a limited Icelandic research into domestic values, although country-specific emission factors are available, *inter alia*, for process emissions from feedstocks as well as for enteric fermentation from livestock. Officials noted that default values are likely to be reasonably accurate for CO_2, but very uncertain for the other gases. Due to resource constraints, where emissions were expected to be very small they were not estimated. So, the term NE in the tables presented in the NC2 denotes both 'not estimated' and 'not available'.

11. Uncertainties associated with the emission estimates were not quantified. CO_2 estimates from the energy and industrial process sectors are regarded as having 'high' certainty, whilst from other sectors the estimates are of 'low' certainty. Estimates of CH_4 emissions associated with energy and enteric fermentation are believed to have 'high' certainty, whereas from other

sectors the CH_4 estimate is regarded as having 'low' certainty. All of the N_2O estimates are thought to have a 'low' degree of certainty.

12. The team noted inconsistencies in the presentation of emission factors in the standard data tables shown in the NC2. This was attributed to an error in the underlying spreadsheet model, which was then corrected during the review visit. Similarly, the activity data for transport appeared to be erroneous and the correct data were supplied during the review.

A. Carbon dioxide

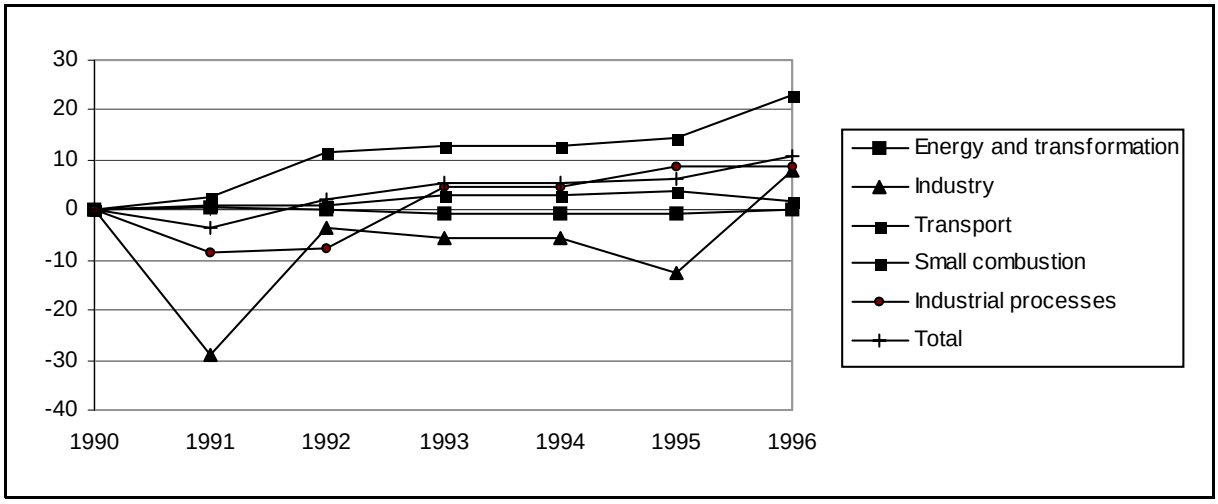
13. As observed in Table 1, emissions of CO_2 increased by 11 per cent between 1990 and 1996. Of the 2,376 Gg of emissions in 1996, about 82 per cent came from fuel combustion and 18 per cent from industrial processes whilst agriculture accounted for less than 1 per cent. Transport, primarily private cars, and fishing vessels accounted for 31 per cent and 35 per cent of total CO_2 emissions, respectively. Combining emissions from burning fossil fuels and from industrial processes, industry accounted for about 29 per cent of total CO_2 emissions, whilst the residential sector represented less than 2 per cent, in 1996. The greatest change between 1990 and 1996 was in emissions from the fishing fleet which increased by 26 per cent, in part because the catch was exceptionally good in 1996. An increase in emissions from industry in 1996 is partly attributable to higher activity in the construction sector and in fish meal production. Emissions from international transport are reported separately, in keeping with the IPCC guidelines, having risen from 319 Gg in 1990 to 396 Gg in 1996, an increase of 24 per cent. Given the sparse information about the composition of waste, the inventory does not include an estimate of CO_2 emissions from this source.

Table 1. Emissions of carbon dioxide by source, 1990 - 1996 (Gg)

	1990	1991	1992	1993	1994	1995	1996
Energy and transformation*	83	83	83	83	82	82	83
Industry	243	173	234	229	229	212	262
Transport	721	727	729	743	743	749	735
Small combustion**	706	724	787	797	797	809	868
Industrial processes	391	357	361	409	409	425	424
Agriculture	4	4	4	4	4	5	5
Total	**2 147**	**2 068**	**2 197**	**2 265**	**2 265**	**2 282**	**2 376**
Removals	NA	NA	NA	NA	NA	NA	- 47

* Includes geothermal energy
** Includes fishing
NA = not available

Figure 1. Carbon dioxide emissions, percentage change from 1990, by source



14. The CO_2 emissions were estimated on the basis of a bottom-up approach. Between publication of the NC1 and NC2 the total estimate of CO_2 for 1990 was revised downward from 2,172 Gg to 2,147 Gg. This change was due to adjustments in the fuel combustion category and, in particular, the estimate of transport emissions.

15. As a result of boring, the utilization of geothermal heat as an energy source results in higher emissions of CO_2 than would naturally occur. The IPCC guidelines do not contain instructions on how to estimate emissions from geothermal energy production. The National Energy Authority measures steam quantities from boreholes and estimates the CO_2 emissions for each area, deducting the expected natural volume to work out the marginal impact of boring.

16. The annual carbon sequestration resulting from afforestation and reclamation programmes has been analysed by a panel of experts using a carbon stock approach and including accumulation in the top 30 cm of low organic matter soils. The analysis covered four types of measure, namely planting lupins in poor soils, reclamation with grass seeds, general reforestation and forest plantations. For each, an average sequestration rate was estimated, taking into account a range of site conditions and management as well as soil carbon analysis. Grass seeding and fertilization has taken place on the largest scale over the period 1990 to 1996, leading to an estimated annual carbon sequestration of 18 Gg. The size of areas covered by forest plantations, lupins planted on poor soil and afforestation are similar, but the resultant annual sequestration rates by 1996 were around 13 Gg, 9 Gg and 7 Gg respectively. There is no wood production in Iceland and hence no losses due to felling. Forest fires are extremely rare and any losses are primarily due to regeneration failure caused by heavy grazing, soil erosion or the occasional landslide, but such losses are minimal and are not taken into account in this analysis. The carbon sequestration numbers are highly uncertain and officials note they are on the conservative side. It is possible that the approach to defining carbon sequestration for meeting commitments under the Kyoto Protocol could differ considerably from that used by Iceland in the NC2.

B. Methane

17. Emissions of CH_4 were less than 1 per cent lower in 1996 than in 1990, as observed in table 2. The most important source was agriculture, which accounted for over 80 per cent of CH_4 emissions throughout the period.

Table 2. Emissions of methane by source, 1990 - 1996 (Gg)

	1990	1991	1992	1993	1994	1995	1996
Fuel combustion	0.2	0.2	0.2	0.2	0.2	0.2	0.1
Agriculture	11.9	11.8	11.5	11.4	11.4	11.1	11.3
Waste	1.9	1.9	2.0	2.2	2.2	2.3	2.5
Total	**14.0**	**13.9**	**13.7**	**13.8**	**13.8**	**13.6**	**13.9**

18. The estimate for CH_4 emissions in 1990 fell substantially from 23 Gg to 14 Gg between the NC1 and NC2, owing to a revision in the estimate for waste. Officials commented that estimates of CH_4 from waste were still not accurate, even though a new collection system introduced in Reykjavik in 1992 had led to improved figures for waste volumes and weight. Previously, only the number of trucks depositing waste was known. Figures are extrapolated for the rest of the country. There have been no surveys on the composition of waste. The draft 1993 IPCC guidelines were used for the calculations. The estimates assume that shallow landfills do not produce CH_4, although there is no domestic study to show this. Approximately 80 per cent of waste was being landfilled at the time of the review, with the rest being either incinerated or recycled. Limited incineration occurs in open pits or in very basic incinerators, but there are efforts to put an end to this practice. The estimate for CH_4, NO_x and CO emissions from incineration were based on figures for the number of people living in areas where this practice occurs, along with assumptions about the average waste generation per person.

C. Nitrous oxide

19. Emissions of N_2O were estimated to be constant throughout the period 1990 to 1996, as observed in Table 3, although the composition of the total changed slightly. A growth in the use of catalytic convertors has meant that vehicles account for an increasing share of emissions, but chemical fertilizer and animal wastes remain the most important contributors to N_2O emissions. Officials noted that the estimates of N_2O emissions are highly uncertain.

20. Data from Iceland's state-owned fertilizer producer were used to estimate N_2O emissions from fertilizer application. Between 1990 and 1994 imports of manufactured fertilizer accounted for 3 to 8 per cent of total sales, but this was not taken into account in the inventory calculations.

Table 3. Emissions of nitrous oxide by source, 1990 - 1996 (Gg)

	1990	1991	1992	1993	1994	1995	1996
Fuel combustion	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Industrial processes	0.2	0.2	0.1	0.1	0.1	0.1	0.2
Agriculture	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**

D. Other gases

21. Data on HFCs emissions are based on import statistics. HFCs are used in cooling equipment on fishing vessels, where considerable leakage occurs. Prior to 1992 there were no imports but they have increased rapidly since, resulting in an emission estimate of 0.012 Gg in 1996.

22. The only source of PFCs is process emissions from production of aluminium. Emissions were estimated at 45 tonnes in 1990, although this figure is highly uncertain due to inherent difficulties in the estimation of this source. Technical improvements in production have reduced emissions by as much as 80 per cent in 1996, compared to 1990.

23. The only known source of sulphur hexafluoride (SF_6) is switchgear used by electricity companies. It is estimated that such equipment contains 11 tonnes of SF_6, of which 200 to 250 kg leaks annually. Officials noted that SF_6 had previously been used as an insulator in imported double-glazing, but did not have any statistics on this.

24. Under a 1996 regulation concerning HFCs, PFCs and SF_6, importers and sellers are now responsible for maintaining a record of all imports and sales of these gases as well as products which contain these substances, which should be forwarded to the Environment and Food Agency annually.

III. POLICIES AND MEASURES

25. Although Iceland is not a member of the EC, it is a member of the European Economic Area and, as a result, is obliged to implement most EC directives. Given the heavy reliance on renewable energy to provide electricity and heating, the team noted this obligation is unlikely to have much impact on emissions in practice as, thus far, most EC environmental directives relevant to climate policy relate to electricity generation or household energy efficiency.

26. There are no cross-cutting policies particularly aimed at reducing CO_2 emissions. Proposals for a revenue neutral tax reform which could lead to reduced fuel use have not been passed by the Icelandic parliament as a result of concerns expressed by industries using diesel oil as well as the agricultural sector.

A. Energy and transformation

27. Electricity and district heating are provided by the public sector with both state and municipality involvement. In the 1950s an energy fund was established to provide the infrastructure necessary to connect even the most remote farms to the electricity grid. This has also provided funds to explore and drill for geothermal energy. As a result, the use of oil in space heating fell from over 40 per cent of consumption in the early 1970s to less than 2 per cent by the late 1980s. Additional resources were provided to the fund in 1998 for expenditure on drilling in remaining areas without geothermal energy. The Government has made efforts to ensure wide access to and end-use of renewable energy to replace oil for stationary use. Since 1982, it has provided subsidies for the use of electricity for space heating, amounting to ISK 547 million in 1997 (ISK 600 million in 1999). In order for geothermal energy to become competitive with oil the Government has provided financial support to some district heating services. The Government also provides subsidies for research into renewable energy, spending ISK 225 million in 1997 ($1 = 72.2 ISK in 1997). Since 1990, all goods and services in Iceland have been subject to value added tax (VAT) at 24.5 per cent, other than geothermal energy and electricity for domestic heating which is charged at 14 per cent. The VAT is partly refunded in areas where the tariffs are higher than in the capital area.

28. There is now little scope for fuel switching from oil to electricity aside from vessels in harbour and some boilers used in industry. The later mainly applies to fish meal production where fuel switching has been taking place. Due to the high capital investment required in electricity production, transmission and distribution, it is unclear if this trend will continue.

29. The energy utilities supply energy efficiency advice to industry. In addition, the Organization for the Promotion of Energy Technologies, a cooperative forum of mainly European countries, is also responsible for disseminating information on technological innovations and encouraging better energy utilization. It has thus far focused mostly on fish processing plant, but is now considering space heating in detail with an aim of reducing energy demand in the rural areas, which are most costly to supply.

30. In 1998, the electricity generating capacity was 1,213 MW, comprising 78.5 per cent hydro, 11.5 per cent geothermal and 10 per cent reserve oil-fired plants, primarily used in the event of breakdowns. In 1998, 99.9 per cent of electricity was generated by either hydropower or geothermal plant. In 1998, the availability of interruptible power (secondary power) was limited and did not meet demand. That year the production capacity of one hydropower plant was increased by 60 MW and the capacity of one geothermal station by 30 MW. A new geothermal plant with a capacity of 60MW also came on line. In 1999, a 120 MW hydro plant is due to come on line, as well as a 30 MW geothermal unit. Decisions on further expansion of the electricity generating capacity should be based on economic, environmental and sociological concerns. The team was informed about a proposal to export 5,000 GWh of electricity annually to Scotland, via a submarine cable. However, given technical and cost considerations, this is not considered feasible before 2010 at the earliest.

B. Transport

31. Iceland does not have a railway system as the infrastructure costs could not be recouped, given the small population. Instead, it is highly reliant on road transport, supplemented by coastal shipping and internal air travel. Whilst cycling is promoted, the weather is a significant factor in limiting its popularity. Between 1990 and 1996 there was a slight increase in the number of passengers making use of domestic air transportation, but the number of flights was broadly stable. There has been a shift away from coastal shipping to road delivery of some goods. The road system links all the main settlements and the existing road programme focuses on improving road surfaces and shortening routes. It is not known whether shorter routes will reduce GHG emissions as it may also encourage more journeys. The number of cars increased slightly between 1990 and 1996, although, on a per capita basis, the figure showed a slight decline reaching 463 per 1,000 inhabitants. However, this was followed by a boost to car sales in 1997 and 1998, in line with improved economic performance. Long-distance coaches and local bus services receive public support at the national and municipal level, including the refund of annual taxation charges. Public transport fares are not subject to VAT. Including tax exemptions, the annual support for public transport amounted to about ISK 1,000 million in 1997. Between 1990 and 1997 there was a slight increase in the number of regularly serviced rural coach routes, but a 16 per cent decline in passenger numbers. In Reykjavik, during this period, the provision of bus services was increased, whilst the number of passengers was broadly constant.

32. The main policy in the private transport sector is taxation. A differentiated excise duty is levied on new vehicles, on purchase, ranging from 30 to 65 per cent, according to engine cylinder capacity, favouring lighter and more fuel-efficient cars. Vehicles are subject to an annual ownership charge which varies with weight to a maximum of ISK 36,200. In 1998 electric cars were made exempt of the excise duty and annual charge. All fuel is subject to VAT at 24.5 per cent. Leaded gasoline has been eliminated from the Icelandic market. Unleaded gasoline is subject to a 97 per cent excise duty. Furthermore, there is a special gasoline charge. As world oil prices have fallen the Government has increased taxation, so the consumer price has not been similarly reduced. Diesel-fuelled vehicles are subject to a kilometre charge, based on thrice-annual checks, differentiated by the weight of the vehicle, varying from ISK 6.67 to ISK 25.05 per kilometre. In addition, owners of vehicles of more than 14 tonnes pay a fixed fee of ISK 100,000 annually. There was an anomaly whereby a discount applied if more than 45,000 km was driven annually, but this was removed in 1998. Alternatively, owners of vehicles weighing less than 4,000 kg have the option of paying a fixed annual charge instead, ranging from ISK 94,273 to ISK 207,603 per annum, according to weight.

33. The team was presented with the main conclusions of a task force on transport appointed by the Ministry of Communication. Its main achievement, thus far, has been to bring the need for an overall plan to reduce transport fuel usage to the attention of the five communities responsible for town planning in Reykjavik. Other suggestions included ways to cut down on driving distances and save fuel through better road surfaces and measures to reduce congestion. There was also emphasis on improving the public transport system, including by improving

coordination between local and long-distance services. There was encouragement for continued research and promotion of alternative fuelled vehicles. The NC2 describes which aspects will be given emphasis as a result of these findings.

C. Fisheries

34. In 1984, the Icelandic Government first introduced fishing quotas. Now individual boats are given transferable quotas for each of the important fish stocks, including those in the more distant fisheries. The quota system protects the waters from overfishing and hence allows the maintenance of sustainable fish stocks. This should also permit greater efficiency and less fuel expenditure for a given catch. The quota system is believed sufficient to eliminate overcapacity in the fleet. In the absence of the quota system there would be more competition between vessels, more time spent at sea and greater fuel use and hence emissions. Furthermore, the fisheries industry does not receive government subsidies, so boat owners have an incentive to minimize costs, of which fuel is an important component. However, the fishing fleet has been exempt from fuel taxation, mainly due to concerns about competitiveness.

35. Changes in the fish stock over time affect the power of the boats required and journey length. The nature of the fishing fleet is changing, with longer distances being travelled and greater on-board fish processing. The impacts on GHG emissions are unclear, as a freezer trawler expends greater energy for cooling. This increase is balanced to some extent by the fact that freezer trawlers come to harbour less frequently and hence use less fuel for sailing than otherwise.

36. From 1990 to 1997 there was a gradual decline in the number of fishing vessels, but an increase in oil consumption from 229,000 to 266,000 tonnes, mainly attributable to larger quotas, in line with growing fish stocks. The total catch increased, especially in 1996 and 1997, whilst there was a growing trend to fish more in distant waters, so there were offsetting forces on fuel consumption per kilo of fish caught. Whilst overcapacity remains in the fleet, there are incentives to look for new stocks to exploit, which would then become part of the quota system, involving longer distances and more fuel use.

37. The Fisheries Association of Iceland conducted a project in the Icelandic fishing fleet for 1990 to 1996 to gather information on total fuel consumption and categorize fuel use by vessel type and per kilogram of biomass (fish). Future projects would involve the collection of more detailed data and analysis for each category with respect to fishing gear, type of machinery etc. It is intended that this information be provided to fishermen to help them identify energy-saving measures.

38. A committee established by the Ministry of Industry and Commerce, in 1992, developed a programme to promote the use of hydroelectricity generated onshore for vessels in port. This involved promoting the concept to fishermen and the Government ensuring price reductions, although in 1997 it was still cheaper to run a diesel generator than use electricity. The state electricity company and harbour authorities worked together to provide the necessary

infrastructure. The maximum potential was estimated at around 19 GWh per annum which, if fully utilized, could save around 2,000 tonnes of oil per annum. However, for practical reasons, including the difficulties of small vessels to use this source, no more than 16 GWh may be realised. This amounts to less than 1 per cent of the fleet's oil consumption. In 1995 around 9 GWh of the potential had been utilized, compared to around 3 GWh in 1992.

39. Most of the fishing fleet with refrigeration equipment uses HFCs. A key issue is whether, in response to existing and expected legislation, new equipment will be installed with either HFCs or ammonia. Current decisions will affect GHG emissions for many years to come, given that systems have an operating life of 10 to 30 years. The team noted that 10 of the most recent new trawlers have ammonia systems installed. Whilst it is up to individual owners to choose their refrigeration system, the Federation of Icelandic Fish Fleet Owners provides advice on technologies and is encouraging the use of ammonia.

40. In the future, it is expected that the number of fishing vessels will decline, that the fleet will be renewed with larger more fuel-efficient vessels and that fishing gear will be more efficient.

D. Agriculture

41. There are no direct measures to limit CH_4 emissions in the agricultural sector, partly because much of the livestock is free ranging. Of greatest importance to emissions is the number of livestock, which is influenced by agricultural policy. Overall transfers to the agricultural sector, as measured by the OECD producer subsidy equivalent, have been amongst the highest of OECD countries during the 1990s, especially for dairy and sheep production. This has both partially insulated farmers from import competition and promoted exports. In general, there has been a change in the nature of support payments designed to improve efficiency and reduce excess production. From 1990 to 1997 the number of cattle was broadly constant, whilst the number of sheep fell from around 548,500 to 477,300.

42. The Government has provided support for organic farming and farmers are given subsidies to store manure for use as fertilizer. This has resulted in some reduction in chemical fertilizer use and hence somewhat limits N_2O emissions although it may also impact on CH_4 emissions from bulk storage.

E. Industry

43. In the industrial sector, the highest percentage of CO_2 emissions is attributed to fish meal production. CO_2 and SO_2 emissions are produced from single cement, fertilizer, ferrosilicon and mineral-wool plants as well as two aluminium plants. The ferrosilicon plant burns waste timber that would otherwise decompose in waste dumps producing CH_4. A plant drying and processing diatomite plant causes emissions of CO_2 and NO_x. Voluntary agreements have been made between the Government and industry relating to energy and emissions. One example of this is an agreement on pollution control between the Government and aluminium smelter. This has

contributed to the fact that the aluminium industry now operates on the basis of best available technology (BAT), as a result of the OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic and has introduced technologies which have considerably reduced GHG emissions. Furthermore, the EC Integrated Pollution Prevention Control Directive also requires the use of BAT. The Icelandic Government has noted that individual plants can have a significant proportional impact on emissions from small economies and argued that process emissions from new industrial plants, constructed where it is possible to utilize renewable energy resources, should not be counted against greenhouse gas limitation objectives. Whilst this issue has not been resolved, consideration is being given to locating further industrial plant in Iceland. And, at the time of the review, several industrial plants were expanding or under construction with the expectation that process emissions will increase accordingly.

44. A regulation went into effect in 1998 banning the import or sale of HFCs, PFCs and SF_6 other than HFC as a coolant in cooling and heat pump systems and SF_6 in switches and electrical equipment where other gases are unsuitable.

F. Soil conservation, revegetation and reforestation

45. Land reclamation and reforestation is a high priority in Iceland and the team was impressed by efforts in this field. The public budget for reforestation and revegetation of degraded land has increased in recent years, reaching ISK 528 million in 1998. Additional funds were available from private enterprises and voluntary organizations. The National Power Company has revegetated extensive areas in connection with hydropower development. The prime objectives are to halt the erosion of soil and ground cover by the end of the century and reclaim as much lost vegetation as possible. Measures are also aimed at increasing the sequestration of CO_2 in soil, vegetation and forests with the goal of achieving an annual sequestration rate of 100 Gg in 2000.

46. Land reclamation first began in 1907 with the Forestry and Prevention of Erosion of Land Act and the foundation of the Soil Conservation Service. The law was changed in 1965 to encompass protection of vegetation and soil conservation. About 3 per cent of Iceland's land area has been treated by the Soil Conservation Service in over 140 fenced areas. Measures include planting lupins in poor soils, reclamation with grass seeds and spreading fertilizer.

47. Vegetation maps have been made of about three quarters of the country along with a complete national survey on the extent of erosion and records of soil conservation activities. This includes the use of aerial photography, satellite remote sensing and global positioning systems. Carbon in soil is also monitored at several sites. It has been found that volcanic soil, the most common soil type in Iceland, has a relatively high capacity to bind CO_2. Preliminary results suggest that CO_2 sequestration in reclaimed sites offers significant potential for enhancement of CO_2 removal from the atmosphere.

48. Amongst the factors determining the condition of vegetation and soil, livestock grazing is the only major one that can be controlled. In this regard, the team noted that horses are a particular problem with one horse having the land requirements of seven sheep. There are no policies to limit horse numbers and the population grew from around 71,700 in 1990 to about 79,800 in 1997. An information booklet provides information to horse owners on how to identify soil erosion by land type, which should also encourage steps to limit damage.

49. Iceland has the lowest forest cover in Europe, due to historic land-use patterns. Measures to rectify this situation include planting seedlings of native birch and some conifers on areas protected from sheep grazing, as although sheep numbers have fallen there has been little change in patterns of land use and even light grazing can prevent regeneration. Between 1990 and 1998 about 10,000 hectares had been planted with seedlings and another 3,000 hectares were expected to be planted by 2000. By 1998 the order of afforestation goals had reversed from1990 and were, in order of importance, future wood production, land reclamation and amenity. As well as general reforestation by the public and voluntary organizations, support is given to farmers, partly intended to establish commercial forest plantations. Farmers can receive subsidies to plant forests equivalent to what they would otherwise have obtained for raising livestock, but few have taken up this option as the favoured alternative is to maintain existing livestock production and to also gain grants for reforestation on spare land. Funding is limited in such a way as to only allow planting in high-growth soils. As part of the laws on forestry it has been decreed that once a forest has been planted it cannot be cut down without permission. Around 500, out of about 4,200 farmers, are involved in land reclamation and planting projects.

50. Research programmes in the areas of agriculture, land reclamation and forestry are gathering data, especially on the inventory, CO_2 sequestration, yields and growth. This should improve both inventory and projection estimates in future.

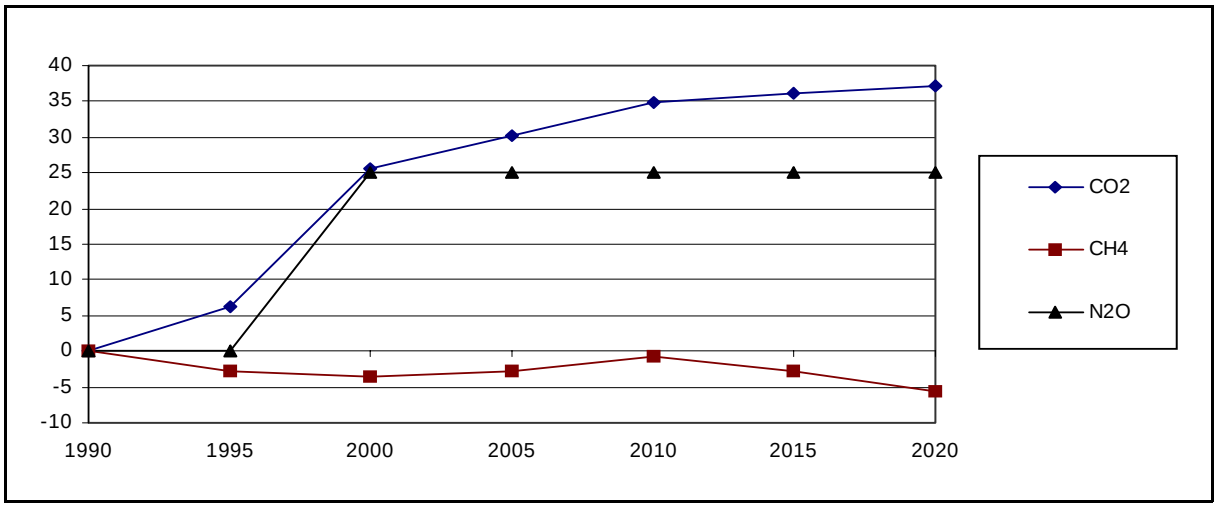
G. Waste

51. Iceland is implementing EC directives on waste. Part of the EC strategy is to take more out of the waste stream for recovery. In the Reykjavik area the amount of recycled waste increased from around 8 per cent in 1990 to over 37 per cent in 1996. The goal is to reach 50 per cent by 2000. The Reykjavik municipal landfill began collecting CH_4 in 1996. In a few years this is expected to accumulate about 1.5 Gg of CH_4 annually. The EC directive requiring CH_4 collection and flaring may be very difficult to implement at small sites, for technical reasons, as the formation of CH_4 at these sites is slow. A derogation may be granted to countries such as Iceland, where more than 80 per cent of waste goes to landfill, allowing extra time to fulfil the directive's goals. In small communities, especially those with less than 100 people, it may be very difficult and costly to implement the directive. Open-pit burning should come to a complete end in the next few years. The expected trend is toward fewer and larger landfill sites, with the expectation that transportation emissions may rise accordingly. This trend may also be expected to increase CH_4 emissions as many of the existing shallow sites are thought to produce low levels of emissions.

IV. PROJECTIONS AND THE EFFECTS OF MEASURES

52. Iceland provided data for projections of CO_2, CH_4, N_2O, NO_x, CO, NMVOC, SO_2, HFC and PFC over the period 1990 to 2020 and graphs covering the period up to 2025 in the NC2. The NC2 did not provide quantitative estimates of the effects of measures in all sectors. Only one scenario was presented, including existing policies. During the review, additional scenarios were discussed and attention was primarily given to considering assumptions underlying projections of the direct GHGs.

Figure 2. GHG projections, percentage change from 1990



53. Figure 2 shows that emissions of CO_2 are expected to increase 26 per cent by 2000, compared to 1990, reaching 2,700 Gg, mainly attributable to an 89 per cent increase in industrial process emissions, as capacity expands. A considerable increase is also attributed to emissions from the fishing fleet and transport, whilst small reductions are expected from domestic air transport, space heating and stationary energy generators. In contrast, the NC1 reported an expected 5 per cent increase, in the absence of policies, and a return to the 1990 level by the end of the century, if planned policies were implemented. The projection did not include process emissions from new power-intensive industry. Emissions from bunkers are excluded from Figure 2. Emissions of CO_2 from bunkers are expected to increase 18 per cent in 2000 and 74 per cent in 2020, compared to about 319 Gg in 1990, as the number of tourists and hence flights increases, despite expected improvements in fuel efficiency.

54. CH_4 emissions are expected to be around 3.5 per cent lower in 2000 than in 1990, compared to the 6 per cent reduction reported in the NC1. Over the whole period CH_4 emissions appear to be fairly stable, only falling from 14 Gg in 1990 to 13.2 Gg in 2020. A small increase in N_2O emissions is expected from 0.4 Gg in 1990 to 0.5 Gg, annually, in 2000 and beyond as nitrogen fertilizer use may increase slightly.

55. Emissions of PFCs from the aluminium industry are expected to be 0.013 Gg in 2000, a 60 per cent decrease from the 1990 level and stay at that level to 2020. There were no HFC emissions in 1990, but since their introduction, around 1994, they are expected to grow considerably in coming years.

56. The numbers in the NC2 for projections on a GWP basis were updated during the review to take account of the GWP values provided in the revised 1996 IPCC guidelines. Iceland's total emissions were about 2,880 Gg in 1990, on a CO_2 equivalent basis. Emissions of the direct GHGs CO_2, CH_4, N_2O, PFC and HFC, combined, are expected to increase by approximately 15 per cent in 2000 and 40 per cent in 2025. Much of this increase is due to rising emissions of HFCs. Excluding HFCs, aggregate GHG emissions could be broadly stable over the period 2000 to 2025. It is difficult to predict the likely expansion of a power-intensive industry such as aluminium. This sector can have a significant proportional impact on emissions however. For domestic policy purposes, projections were also presented with the exclusion of emissions from heavy industry established after 1990. In this circumstance, aggregate emissions only rise around 2 per cent by 2000 and 25 per cent by 2025, compared to the 1990 level. A third scenario provided an estimate of emissions if aluminium and ferrosilicon production plants expand to the extent allowed by their operating licences. In this case, emissions could expand very rapidly around 2002 and be about 58 per cent higher in 2025 than in 1990.

57. The projections of each gas drew on fairly detailed historic data for different sectors of the economy, but were based on relatively simple analysis, as opposed to detailed econometric modelling. Given the characteristics of the Icelandic economy, especially the impact of fish catches on many economic variables, the team noted that more sophisticated analysis was unlikely to have produced more certain projections. A new economic sector model has been developed recently and is now being used for policy analysis. In 1995, the Energy Forecast Committee, consisting, *inter alia*, of the National Energy Authority and public power companies, produced projections of oil consumption to 2025 for use in estimating emissions. This was based on information and assumptions provided by various ministries and agencies. Policies and measures were not explicitly taken into account. The main assumptions related to economic development, population growth and development of the transportation and fishing sectors. This Energy Forecast Committee does not attempt to predict the expansion of production capacity of power-intensive industry.

58. The Icelandic economy was stagnant over the period 1988 to 1993, but in subsequent years there was GDP growth. From 1997 onward, it was assumed that GDP would grow at 2.0 per cent per annum to 2000 and 2.5 per cent per annum for the remainder of the projection period. However, at the time of the review, it was noted that until 2002 economic growth of 3.0 per cent per annum was predicted, which could have a slight impact in increasing emissions in the short run, compared to the projected level.

59. Historic data shows a clear link between annual oil consumption and the fish catch, so to a large extent the future of Icelandic emissions hinges on the future of the fishing industry. Projections of fish stocks were based, *inter alia*, on consideration of the current situation,

environmental conditions and interactions between different fish stocks. Historically, these projections have sometimes proved to be inaccurate, but over a 15-year time horizon there is reasonable confidence in the projections as there is a good understanding of the main influences on the system. With expected increases in fish stocks currently being exploited, quotas are also expected to increase annually up to 2010 and thereafter remain constant. As well as quotas, detailed consideration was given to resultant distances travelled, the size of the fleet, engine power, efficiency and fish meal production etc. A shift toward greater processing at sea in preference to land was assumed, which increases oil consumption. During the review, the Federation of Icelandic Fish Fleet Owners questioned whether the projections were too high. In particular, it noted the Energy Forecast Committee assumption that 230 kg oil are required per tonne of bottom fish caught, which is in line with figures for the early 1990s, but much more than in 1997. The Committee assumed total main engine power requirements of 450 MW in 2010, whereas the figure had dropped to 417 MW in 1997. The Federation also noted that oil consumption by the fleet was expected to grow to 300,000 tonnes, whereas it dropped from 1996 to 1997 to 265,000 tonnes.

60. As demand for heating and electricity grows, the projections assumed that future needs would be met entirely by expansion of hydro or geothermal power. Potential increases in CO_2 emissions from geothermal sources were not reflected in the projections. Additionally it was assumed that half of the existing households using oil for space heating would switch to renewable sources up to 2005.

61. The population was assumed to continue growing throughout the projection period and the age profile was also taken into account in consideration of energy use and also car ownership patterns. Strong economic growth in1996 and 1997 led to higher car sales, such that the number of cars in 1998 was around that expected for 2005. A general upward trend in vehicle numbers was assumed for the whole forecast period and it was assumed that 15 per cent of all passenger vehicles and 10 per cent of other vehicles would be electric by 2025. A general improvement in the energy efficiency of all vehicles was also assumed over time resulting in lower emissions per kilometre of travel. Shortening of travel distances due to improved road infrastructure was assumed to be offset by an increase in journeys. Continuation of a recent trend to carry more domestic freight traffic by road than sea was also assumed. Aside from increased car numbers, it was noted by officials that in 1997 and 1998 transport emissions are likely to be higher than forecast due to unexpectedly high activity in the construction industry, in particular due to work on hydropower projects.

62. The projections assume that coal consumption by the two industrial companies receiving almost all coal imports will decline to about 80,000 tonnes in 2000, compared to 95,000 tonnes in 1990 and decline by a further 5,000 tonnes by 2020. Gas consumption was expected to increase from 1,200 tonnes in 1990 to 1,700 tonnes in 2000, equivalent to a 42 per cent rise and 2,300 tonnes by 2020. Oil prices were expected to be stable in the short run and after 2000 to increase steadily at a rate of up to 3 per cent per annum.

63. During the review, information was obtained about scenario analysis conducted by changing key assumptions relative to those used for projections contained in the NC2. The 'low' projection assumed annual GDP growth of only 1 per cent over the period, a lower birth rate, population reductions due to migration, a reduced fish catch, lower distances travelled per person and that passenger car fuel consumption improves 20 per cent over the period, as opposed to10 per cent in the main projection. In contrast the 'high' projection allowed for annual GDP growth between 3 and 3.5 per cent, higher birth rates, population increase through immigration, a higher fish catch and no improvements in car fuel consumption. Oil consumption, which was 536,000 tonnes in 1990, could range between 570,000 and 640,000 tonnes in 2000 or 6 per cent around the central projection of 604,000 tonnes and could be in the range 550,000 tonnes to 780,000 tonnes by 2020, which is 20 per cent lower or 15 per cent higher than the central projection of 687,000 tonnes. Given that oil consumption is the main source of CO_2 emissions, this suggests that emission projections could range accordingly.

64. The projection of CH_4 assumed that sheep numbers continue to decline and horse numbers increase, in line with trends observed in the 1990s, in the absence of policies or measures. The projections also assumed a reduction in the number of incinerators and landfills and that there would be four or five main disposal sites of which only one would have gas flaring. Population forecasts were used to predict growing waste volumes. Existing information about the generation of emissions from the Reykjavik site was applied to all sites. No account was taken of the EC directives which should limit waste arisings and also lead to CH_4 collection and gas flaring at most, if not all sites. So, future emissions may be lower than projected.

65. Projections of N_2O assumed a continuation of trends seen in the 1990s for fertilizer use and an increasing number of cars with catalytic convertors. PFC emission estimates were based on assumptions about aluminium production and assumed no further change in technology after the significant improvements that took place in the early1990s.

66. The HFC emissions forecast reflected import data for the 1990s, assuming that all imports are released as emissions. HFCs are mainly used in cooling equipment in the fishing fleet and officials noted that the leakage rate may be very high. It was further assumed that HFCs would entirely replace chlorofluorocarbons for refrigeration purposes as the existing fleet requires only minor modifications in this case, but major modifications for other gases. However, the team noted that the 10 most recent vessels constructed have chosen ammonia in preference to HFCs and that increased market penetration of such vessels would result in lower HFC emissions than forecast. CO emissions are forecast to decline, mostly as a result of the increased proportion of cars with catalytic convertors. NO_x emissions are projected to decline in the transport sector, but increase in the fishing fleet.

V. EDUCATION AND PUBLIC AWARENESS

67. Environmental studies feature as part of the general compulsory education for ages 6 to 16. Pamphlets covering climate change were issued to secondary schools in 1994 and again in 1997. At the time of the review, the Ministry for the Environment had not allocated specific

funds to expand public awareness about the environment. Of the limited expenditure, the greatest proportion had been spent on climate change issues. The team noted that energy saving campaigns, common in many countries, would not produce significant CO_2 savings given households' predominant use of either geothermal power or electricity generated by renewables for heating, so the main challenges are to affect driving behaviour and waste volumes. In this regard, about 7,000 copies of a pamphlet encouraging more environmentally friendly behaviour in relation to, *inter alia*, energy use, driving and waste recycling were produced for the general public in 1996.

68. To inform various government departments, agencies, parliamentary officials, industry representatives, the media and other interest groups, a simplified version of the NC2 was distributed and also made available on the Internet. This also included an outline of the Government's latest action programme. Three meetings were held with representatives of interest groups, mainly industry, to explain the UNFCCC and the potential implications of the Kyoto Protocol. A related information pamphlet for industry was due for distribution by the end of 1998.

69. One recommendation of the Iceland Research Council was to increase efforts to publicize global environmental change and its consequences, by, *inter alia*, facilitating publicity of findings from the IPCC and two status reports on Iceland due in 1998 and 2002.

VI. RESEARCH AND SYSTEMATIC OBSERVATION

70. The team was impressed by the extent of Iceland's involvement in various research programmes at the domestic, Nordic and international level, which is well described in the NC2. Overall, research grants more than doubled as a percentage of gross national product from 0.8 per cent in 1985 to around 1.7 per cent in 1997.

71. The number of weather monitoring stations rose from 130, as reported in the NC2, to 170 in 1998. In addition, various measurements of greenhouse gases are made as part of the Meteorological Office's work on atmospheric monitoring.

72. Iceland has for several decades measured many parameters, especially related to the oceans, such as temperature, salinity, plant production and fish stocks that could be useful for climate studies. It participated in a world ocean circulation project measuring currents and water characteristics around Iceland over the period 1993 to 1997. EC projects have helped to establish monitoring stations and provide simulation models to help understand changes, whilst work supported by the Nordic Council of Ministers has studied the distribution of CO_2 in water columns. Iceland has been involved in the European Greenland Ice-core Project to obtain information on earlier changes in the Earth's climate and also began an initiative in 1993 to construct long Icelandic paleoclimate records as part of the International Geosphere-Biosphere Programme.

73. Iceland does not have sufficient resources to conduct its own regional climate modelling, but takes a keen interest in checking whether international models can simulate the existing Icelandic climate.

74. As part of a Nordic project, research is being conducted on the effect of climate change on forest ecosystems. An Icelandic research facility can study the effect of elevated carbon dioxide concentration and soil warming on, *inter alia*, site energy balance, water balance and nutrient levels. Extensive research is conducted by a number of government agencies into land reclamation and afforestation.

75. Since 1995, the Iceland Research Council has been working, through a task force, on a programme for research and collaboration related to global environmental change. For 1998, the task force has recommended intensification of research on global environmental change and natural resources, increased links between domestic researchers and international research programmes and enhancing the Government's access to information about the nature and potential consequences of global environmental change. A wide range of 'stakeholders' including research institutions, schools and companies should be involved in an Icelandic programme on research in global environmental change. Funding will be provided to host conferences and invite lecturers to come to Iceland. For example, the team were informed of a workshop on North Atlantic climate impacts held in September 1998. The parliament approved the Research Council's proposed work programme and allocated ISK 240 million over a six-year period from 1999 to cover climate change and environmental issues.

VII. EXPECTED IMPACTS OF CLIMATE CHANGE AND ADAPTATION MEASURES

76. There is great uncertainty as to possible climate changes in Iceland and the potentially significant impacts, owing to heavy reliance on natural resources. Temperatures in Greenland and Iceland have, on average, decreased over the last 50 years, but considering the period since the early 1800s warming of about 0.5°C seems to have occurred. Over several centuries, climate variability is known to have had dramatic effects on the lives of Icelanders as yearly changes in temperature have led to substantial differences in agricultural yields, including hay for livestock. A 1°C change in annual temperature could alter hay production by 20 per cent in the most fertile regions and perhaps by more in the highlands. Experiments are being conducted on the long-term yield of grass-land, given climate change. Early in Iceland's history a deteriorating climate reduced the carrying capacity of vegetation in terms of livestock grazing. Given the harsh environment, small temperature changes could affect whether regrowth or erosion is the dominant force in many parts of the country. Of greatest concern is the potential effect of climate change on ocean circulation and the Gulf Stream, because even small changes could substantially affect fish stocks and fisheries in the surrounding waters.

77. Given the large uncertainty about potential climate change and its impacts, the Government has not yet instigated adaptation measures. However, there has been consideration of potential impacts and adaptation needs. For example, the National Energy Authority and the

Icelandic Meteorological Office participated in a Nordic project on climate change and hydroelectric energy production, which considered probable changes in climate and the effects of changed precipitation patterns, in particular, on electricity production. Warmer temperatures could increase melt-water flow from the glaciers, increasing the flow in glacial rivers and hence power production opportunities. Sea level rise is also a concern, so recently sea gates have been installed for its measurement. The Government commissioned analysis on the danger of flooding and land erosion, along with ways to minimize consequent damages. Potential sea level rise is taken into account when harbour infrastructure needs to be rebuilt.

78. A panel of scientists, formed in 1998, is to consider the science of climate change and its impacts and report to Government on its findings. This information will also be for public consumption.

VIII. FINANCIAL ASSISTANCE AND TECHNOLOGY TRANSFER

79. Iceland has not yet contributed to the Global Environment Facility (GEF) and the team was not made aware of any plans to change this situation. Official development assistance (ODA) was around 0.1 per cent of GDP during the mid-1990s and the Government's declared aim was to increase this figure to around 0.3 to 0.4 per cent by 2000. However, the team was informed that whilst ODA has increased in the 1990s in absolute terms, it has been outpaced by economic growth, so it is likely to remain at about 0.1 per cent of GDP in 2000.

80. Around a dozen graduate students annually receive training in geothermal science and technology under the United Nations University Geothermal Training Programme, which has been hosted by Iceland since 1979 and is 80 per cent funded by the Icelandic Government. Priority is given to applicants from developing country institutions already involved in geothermal energy research. Icelandic scientists have participated in a number of bilateral projects to harness geothermal energy, for example, in China, Africa, Central America and Central and Eastern Europe. The Icelandic Development Agency aims to provide Icelandic specialists in soil erosion to assist developing countries fighting desertification.

IX. CONCLUSIONS

81. In general, some parts of the NC2 contained much information in line with the UNFCCC reporting guidelines, especially in relation to the inventories, whilst discussion of policies and measures and projections, in particular, followed them less closely. In this regard, there was little information about the effects of policies and measures.

82. The review team was satisfied that good quality activity data were available for many emission sources and sinks, in particular fuel consumption. However, it noted that in other sectors, such as waste, whilst there were improvements between the NC1 and NC2, the quality of the data was still poor resulting in high uncertainty in emissions estimates. The team also noted the resource constraints which have prevented the complete adoption of the revised 1996 IPCC guidelines and non-estimation of GHGs from some minor sources.

83. Iceland's conversion, over a long period, to a system of electricity and heating supply based almost entirely on renewables limits the scope for GHG mitigation measures in these areas. Wherever possible, the use of electricity is promoted including for vessels in harbour. The tax system provides incentives to purchase more fuel-efficient cars and results in relatively high fuel prices. The provision of coach and bus services has grown yet public transport is being used less and emissions from private cars are expected to continue growing. In the waste sector, significant changes, in line with EC legislation, could increase emissions in the short run as more waste is disposed of in anaerobic instead of aerobic sites and transport distances for waste increase, but in the longer term the installation of CH_4 gas instillation and flaring should have countervailing effects.

84. The PFC, HFC and SF_6 gases are now subject to legislation which should limit their usage, although the choice of the fishing industry between HFC and ammonia for refrigeration will have an important influence on future emissions of this gas. Elsewhere, industry applies BAT in general, which should minimize emissions. In the agricultural sector little is being done to limit GHG emissions and the growth in horse numbers is of particular concern. Efforts at soil conservation and revegetation should improve CO_2 sequestration, even though this is not only the motivating factor. A good overall framework has now been established in Iceland in which to consider all aspects of climate change and increase participation of various 'stakeholders'.

85. The projections indicate that emissions of CH_4 may be slightly lower in 2000 than 1990, but that those of both CO_2 and N_2O may be around 26 per cent higher. Thereafter, emissions of CH_4 and N_2O may be broadly stable whilst those of CO_2 are likely to trend upwards. Growth in transport, the possible expansion of industry and the fishing fleet's choice of coolant gas are influential factors.

86. Whilst expenditure on environmental awareness campaigns has been limited there was a bias toward climate change related issues.

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