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Preface

This third OECD Environmental Performance Review of Iceland shows that the people of Iceland enjoy a very good environmental quality of life, with excellent water quality, low air pollution and easy access to nature. Indeed, one-fifth of the country's area is under some form of nature protection. Nevertheless, the report argues that the quality of some environmental services, such as waste disposal and wastewater treatment, could be further improved, and calls for additional efforts to achieve Iceland's green growth objectives.

Iceland's economy and environment are unique in many respects. The country has recently started to emerge from the deep economic recession sparked by the 2008 financial crisis. The natural environment is a key asset in Iceland's recovery: it provides plentiful renewable energy reserves, as well as the pristine wilderness and spectacular landscapes that attract thousands of tourists every year. This is why energy and tourism were chosen as focus topics for this review.

Nearly all Iceland's electricity and heat are generated from hydro and geothermal sources, by far the highest share in the OECD. Power production capacity has expanded enormously to meet the demand of aluminium smelters and other energy-intensive industries. However, building new power capacity exerts pressures on the country's unique landscape and fragile ecosystems, and has generated heated public debates. In response, Iceland developed an energy master plan, which is an innovative approach for resolving land-use conflicts related to energy projects. Road transport and fishing are the main users of fossil fuels. Reducing greenhouse gas emissions from these sectors remains a major challenge, largely due to the lack of alternatives.

The report highlights that nature-based tourism is an important source of economic growth. Over one million tourists per year are expected to visit Iceland by 2020, more than three times the country's population. Increased international arrivals and high seasonality exert growing environmental pressures. Iceland has made strides to ensure the environmental sustainability of tourism, but more needs to be done. Challenges include strengthening inter-institutional co-ordination in policy making and implementation, ensuring adequate finance and improving the environmental performance of tourism operators.

This review presents 28 policy recommendations. It suggests, for example, that institutional arrangements should be further rationalised, administrative capacity reinforced, and environmental assessment and licensing procedures streamlined. It calls for the reform of implicit and explicit subsidies for fossil fuel use and sheep grazing, and for a review of building energy efficiency standards.

The review also recommends that the independence of scientific assessments, the use of economic analysis and the role of public participation should be strengthened in the

next phases of the energy master plan. More effective urban planning and design of public transport services could help reduce urban sprawl and private car use. In addition, the opportunities and obstacles for greater use of electric vehicles merit further consideration.

Iceland would benefit from a comprehensive action plan for sustainable tourism developed in close co-ordination with land-use and nature conservation policies. A more effective mechanism is needed to co-ordinate the actions of governmental and other stakeholders. Well-designed financing mechanisms are necessary to support the construction and maintenance of infrastructure needed to allow access to tourist sites while protecting their vulnerable ecosystems.

This review is the result of a constructive policy dialogue between Iceland and the other members and observers of the OECD Working Party on Environmental Performance. Beyond the valuable findings and recommendations for Iceland, I am confident that this collaborative effort will help to improve the management of the environmental challenges faced by other OECD members and partner countries.



Angel Gurría

OECD Secretary-General

Foreword

The principal aim of the OECD Environmental Performance Review programme is to help member and selected partner countries improve their individual and collective performance in environmental management by:

- *helping individual governments assess progress in achieving their environmental goals;*
- *promoting continuous policy dialogue and peer learning;*
- *stimulating greater accountability from governments towards each other and public opinion.*

This report reviews the environmental performance of Iceland since the previous OECD Environmental Performance Review in 2001. Progress in achieving domestic objectives and international commitments provides the basis for assessing the country's environmental performance. Such objectives and commitments may be broad aims, qualitative goals or quantitative targets. A distinction is made between intentions, actions and results. Assessment of environmental performance is also placed within the context of Iceland's historical environmental record, present state of the environment, physical endowment in natural resources, economic conditions and demographic trends.

The OECD is indebted to the government of Iceland for its co-operation in providing information, for the organisation of the review mission to Reykjavík (12-19 May 2013), and for facilitating contacts both inside and outside government institutions.

Thanks are also due to all those who helped in the course of this review, to the representatives of member countries participating in the OECD Working Party on Environmental Performance and especially to the examining countries: New Zealand and Portugal. The team that prepared this review comprised experts from reviewing countries: Mr Mark Pickup (New Zealand) and Mr Pedro Liberato (Portugal); members of the OECD Secretariat: Mr Nils-Axel Braathen, Ms Ivana Capozza, Mr Brendan Gillespie, Mr Peter Haxton, Mr Reo Kawamura, Mr Krzysztof Michalak and Ms Alexa Piccolo. Ms Carla Bertuzzi, Ms Jennifer Calder and Ms Clara Tomasini (OECD Secretariat) and Ms Rebecca Brite (consultant) provided statistical and editorial support during the preparation of the report. Preparation of this report also benefitted from comments provided by other members of the OECD Secretariat.

The OECD Working Party on Environmental Performance discussed the draft Environmental Performance Review of Iceland at its meeting on 26 March 2014 in Paris, and approved the Assessment and Recommendations.

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General notes

Signs

The following signs are used in Figures and Tables:

. . : not available

– : nil or negligible

. : decimal point

Country aggregates

OECD Europe: This zone includes all European member countries of the OECD, i.e. Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

OECD: This zone includes all member countries of the OECD, i.e. the countries of OECD Europe plus Australia, Canada, Chile, Israel*, Japan, Korea, Mexico, New Zealand and the United States.

Country aggregates may include Secretariat estimates.

Currency

Monetary unit: Icelandic króna (ISK).

In 2013, USD 1.00 = ISK 122.25

Cut-off date

This report is based on information and data available up to the end of February 2014.

* The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Executive summary

Iceland's environmental quality is generally good

Iceland has a small, open economy built on plentiful and cheap renewable energy, energy-intensive industry, abundant freshwater, unique natural tourist attractions and fisheries. The people of Iceland enjoy a high standard of living thanks to high income, low inequality and good environmental quality. The severe financial and economic crisis that hit the country in 2008 reduced some pressures on the environment, including use of materials, generation of waste and emissions of greenhouse gases (GHGs). However, these are likely to increase as the economy recovers. The carbon intensity of the economy is very low as hydro and geothermal power covers about 85% of Iceland's energy needs, a share with no equal among OECD countries. Less than 1% of the land area is artificially built, and about 20% of the country's area is under some form of nature protection. Groundwater is of excellent quality and does not need treatment before consumption. Emissions of most air pollutants have declined and air quality is generally good in the Reykjavík area, home to one-third of the population.

Some environmental pressures are of concern

Several activities exert pressure on Iceland's biodiversity, including hydropower and geothermal exploitation, overgrazing, urban sprawl and tourism development. About half the country suffers from acute soil erosion and some species of flora and fauna are threatened, including about 40% of the bird species nesting on the island. While the share of population connected to wastewater treatment systems grew to 73%, it remains one of the lowest among OECD countries. Despite increased recycling, more than half the municipal waste generated still goes to landfills. Pollution from small particulates continues to exceed the limit value, mainly because of the use of studded tyres, which pulverise road asphalt. Geothermal power production is a major, growing source of sulphur oxides and hydrogen sulphide (H_2S). Concentrations of H_2S in the Reykjavík area have often exceeded exposure standards, with possible impact on human health and ecosystems.

Iceland has made progress in streamlining the institutional and policy framework for environmental management

As a member of the European Economic Area, Iceland has continued to align its environmental policies and legislation with those of the European Union. The financial and

economic crisis, however, slowed this convergence process. Iceland has strengthened its institutional framework for environmental management and enlarged the environment ministry's portfolio. Reducing the number of municipalities has helped improve efficiency in providing water, waste and transport services. However, with several environment-related agencies and many small municipalities, Iceland needs to further rationalise institutional arrangements and reinforce administrative capacity. This would help improve efficiency and policy coherence, as well as strengthen policy implementation. Despite the progress in streamlining environmental assessment and licensing procedures, they remain complex and slow, involving multiple national and local authorities and overlapping requirements. Iceland has a long tradition of open, free access to environmental information and of public participation in decision making. While collecting and reporting environmental data have improved, there are still important gaps and inconsistencies, and data are scattered among several central and local institutions.

Policy interest in green growth, use of economic instruments and promotion of eco-innovation has risen

In 2011, the Parliament released a report containing 50 proposals to promote Iceland's transition towards a greener economy. In the last ten years, Iceland introduced new environmentally related taxes, including an excise duty on diesel, a carbon tax and a vehicle tax based on carbon dioxide emissions, and joined the European Union Emissions Trading System. While the recession has made revenue from environmentally related taxes highly volatile, there is evidence that it is lower than in most OECD countries. Removing some fuel tax exemptions and increasing the tax rates on diesel and petrol would help reduce GHG emissions and other externalities cost-effectively. Unlike in most countries, the carbon tax is applied to fuels used by fishing vessels. Iceland has implemented an effective system for managing fish stocks, based on scientific estimates of total allowable catches and individual transferable quotas. In addition, in 2012 a special profit-based fee was introduced to capture the fisheries resource rent. Agricultural support is relatively high. A large share of it can have a potential negative environmental impact, such as subsidies that help maintain large numbers of grazing animals, which exacerbate soil erosion.

Despite being small, Iceland is a relatively innovative country. The Iceland 2020 strategy targets eco-innovation as a main growth sector. In line with this goal, in 2012, the share of the public R&D budget allocated to environment-related research was among the highest in the OECD. However, while patenting activity in general has been on par with that in other OECD countries, there have been very few Icelandic patent applications in environmentally relevant sectors.

Iceland adopted an innovative approach to land-use planning for energy projects

The abundance of renewable, cheap energy has attracted energy-intensive industries to Iceland, notably aluminium smelting. To meet industry demand, electricity production has more than doubled since 2000, and is now five times the amount needed by the population alone. Iceland is effectively locked into providing these industries with low-price energy

through long-term contracts. It is not clear if the rate of return earned by public utilities is sufficient to cover all costs, including environmental costs. Many areas with potential for hydropower or geothermal development are sites of exceptional beauty and unique biodiversity, and they are often major tourist attractions. Repeated conflicts over the environmental and social impacts of power capacity expansion prompted the government to develop the Master Plan for Hydro and Geothermal Energy Resources. The plan, adopted in 2013, is based on scientific analysis and wide public participation; it provides a valuable model for building consensus on complex energy-environment issues. The next phase and the four-year review of the master plan should further reinforce the independence and quality of the scientific and economic analysis.

There is scope for energy savings in the residential and transport sectors

Energy use for space heating grew by about 12% over 2000-11, partly due to low-cost, plentiful geothermal heating and relatively poor insulation of buildings. As geothermal heat may be exhausted in the long term, however, promoting energy saving in homes would be a prudent policy. This could be done, for example, by tightening energy efficiency requirements of buildings and removing subsidies to electric and fossil fuel heating. Transport and fishing are the main consumers of fossil fuels. Fossil fuel use in the fishing industry has declined, but it has continued to rise in the transport sector. Inland freight and passenger transport is virtually all on roads. Iceland should strengthen co-ordination among municipalities in the capital area to improve urban planning and public transport development, and reduce urban sprawl and private car use. While the use of electric vehicles in Iceland is still limited, increasing it is technically feasible within the current renewables-based power system.

Iceland's nature is a key tourism asset, but it is coming under increasing pressures

Tourism is one of Iceland's fastest growing sectors, representing about 6% of GDP. The number of annual visitors has increased in recent years to more than twice the country's population. Tourism is largely based on the country's unique combination of natural assets, including areas of pristine wilderness. Increased international arrivals and high seasonality exert growing pressures on fragile ecosystems and local traditions. Iceland developed a complete set of tourism accounts in 2008, which, however, does not include information on the environmental impact of tourism.

Ensuring the environmental sustainability of tourism is a major challenge

Iceland would benefit from developing a comprehensive action plan for sustainable tourism in close co-ordination with land-use and nature conservation policies. Co-operation among ministries with responsibilities related to tourism and environment could also be reinforced, for example by establishing an inter-institutional committee to oversee the development and implementation of tourism policy. The Tourist Site Protection Fund is used to finance tourism-related infrastructure, but financial resources are limited. Iceland

introduced a tax on lodging in 2011, but the tax has proved difficult to manage and raised less revenue than expected. Developing a multi-access "nature pass" could provide access to a set of sites, both popular and less well known, with a view to raising finance and reducing pressures on the most visited sites. In 2011, Iceland launched the VAKINN certification system to rate quality of tourism services, including some environmental aspects. The system is still in its infancy; further promoting it could help improve the environmental performance of tourism operators.

PART I

Progress towards sustainable development

PART I

Chapter 1

Key environmental trends

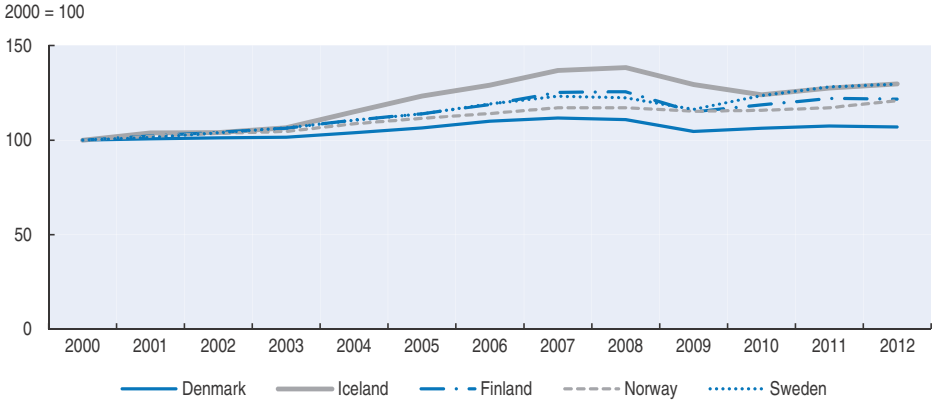
Iceland's population enjoys good environmental quality and a relatively high standard of living. This chapter provides a snapshot of key environmental trends in Iceland over the period since 2000. It highlights some of the country's main environmental achievements and remaining challenges on the path towards green growth and sustainable development. The chapter describes Iceland's progress in using energy and natural resources efficiently; in reducing the carbon intensity of its economy; in managing its natural asset base; and in improving its people's environmental quality of life.

1. Introduction

This chapter provides a snapshot of key environmental trends in Iceland. It highlights some of the main environmental achievements and remaining challenges on the path towards green growth and sustainable development, focusing on the period since 2000. Drawing on indicators from national and international sources, it broadly follows the OECD framework for monitoring progress towards green growth (OECD, 2011a). After a brief overview, the chapter describes Iceland's progress in using energy and natural resources efficiently, in managing its natural asset base and in improving its people's environmental quality of life. To the extent possible, it compares the state of the environment and key environmental trends with those of other OECD member countries and in relation to Iceland's national and international commitments. It thereby provides a baseline for subsequent chapters that assess the effectiveness of Iceland's environmental policies in influencing these trends and in using environmental objectives to generate economic opportunities.

Iceland has a small, open economy built on ample renewable energy potential, unique natural tourist attractions and fisheries. With about 1.5 million tonnes of fish catches in 2012, Iceland remains a major fishing country. After steep growth over 2003-07, the economy fell dramatically during the 2008/09 crisis, then started to grow again in 2011. With high per capita income, low inequality rates and good environmental quality, Icelandic citizens enjoy a high standard of living (Box 1.1 and Figure 1.1). As part of the European Economic Area, Iceland is committed to adopt and implement part of the EU environmental legislation (Chapter 2).

Figure 1.1. **Economic performance in Nordic countries in 2000-12**



Note: GDP at 2005 prices and purchasing power parities.
Source: OECD (2013), *OECD Economic Outlook No. 93* (database).

StatLink http://dx.doi.org/10.1787/888933087230

Box 1.1. **The economic and social context**

The economy

- Iceland's economy grew faster than the OECD average for most of the 2000s. The annual growth rate was 2.2% between 2000 and 2012, compared to 1.6% in the OECD as a whole. The economy faced a deep recession caused by the collapse of the country's three main banks in October 2008. It has slowly recovered since then, although growth weakened in 2012 to 1.4% (OECD, 2013a).
- The population enjoys relatively high living standards. In 2012, gross domestic product (GDP) per capita was about USD 34 000 (in 2005 prices and purchasing power parities), ranking it among the top 15 OECD member countries (Annex I.A).
- Iceland has a strong industrial base, mostly energy-intensive aluminium smelting. Industry accounts for about 25% of GDP, slightly above the OECD average. Services, including tourism, account for almost 68% of GDP.
- Iceland is a major fishing country: the fishing industry accounts for about 7% of GDP. Marine products represented more than 25% of total exports of goods and services in 2012 (measured in value); the share has been in decline since 2000.
- Tourism is one of the fastest-growing sectors of the economy. In 2010, its contribution to GDP reached 6%, compared with an OECD average of 4.7%. The number of visitors grew strongly, especially following the financial crisis in 2008 and the significant devaluation of the Icelandic króna. In 2012, 673 000 people visited Iceland, more than double the country's population (Chapter 5).
- International trade plays a significant role in the economy. The current account reflects a greater increase in exports than in imports as a share of GDP. In 2012, exports in Iceland amounted to some 59% of GDP, while imports represented about 53%, above the OECD averages of about 29% for both exports and imports (Annex I.A).
- The unemployment rate was 6% in 2012, below the OECD average (8%) (Annex I.B).
- Both income inequality (as measured by the Gini coefficient) and relative poverty are low compared to many other OECD member countries (Annex I.B). However, the unchanged share of population at risk of relative poverty reflects declines in both low-income households' incomes and in the median income (OECD, 2013b).

Public finance

- The fiscal balance of Iceland worsened during the banking and economic crisis to a deficit of 13.5% of GDP in 2008 (compared with an 8.5% average deficit among OECD countries). A sizeable improvement in the government's fiscal position (to -3.8% of GDP in 2012) has helped boost confidence in the financial system (OECD, 2013a). Public debt has increased sharply since 2000, from 33.8% of GDP to 81.3% in 2010.
- General government spending has generally been high in the last decade, accounting for about 47% of GDP in 2011. Environmental protection accounted for 1.3% of total general government expenditure that year, down from 1.8% in 2000 (Chapter 3).
- Icelandic taxation levels are slightly higher than the OECD average but significantly lower than in other Nordic countries. In 2011, the tax/GDP ratio stood at 35.9%, compared with an OECD average of 34.1%. The tax system relies on direct taxation of individual and corporate income more than the average for EU countries (Eurostat, 2013) (Chapter 3).
- Environmentally related taxes accounted for 2.2% of GDP in 2012, compared with an OECD Europe average of 2.5%. They consist mostly of energy taxes.

Box 1.1. **The economic and social context** *(cont.)*

The population

- In 2012, the population of Iceland was about 320 000. Population density is low: 3 inhabitants per square kilometre, compared to 109 on average in OECD Europe.
- About 63% of the population lives in urban settlements, which occupy only about 1% of Iceland's area.
- Life expectancy at birth reached 82.4 years in 2011, continuing a trend of improvement and putting Iceland in the top 10 of OECD member countries. The fertility rate was 2 children per woman in 2011.
- The population is relatively young: the share of people aged 15 and younger was 21% in 2012, among the highest in the OECD and above the OECD average of 18.5%. The elderly population (aged 65 and over) represents about 12.8% of the total, compared to an OECD average of 15%.
- About 71% of the working-age population (age 25 to 64) had at least upper secondary education in 2011, one of the lowest rates in the OECD (Annex I.B). However, the share of tertiary graduates within the same age group (32%) was above the OECD average (30.7%).

The carbon intensity of the economy, in decline since 2000, is among the lowest in the OECD. This reflects the fact that the share of renewable resources in the energy supply is the highest in the OECD. Power generation has been significantly expanded to meet booming demand by energy-intensive industry. As a result, the energy intensity of the economy has increased to four times the OECD average. Industry is by far the largest consumer of energy and source of greenhouse gas (GHG) emissions. Between 2000 and 2011, GHG emissions increased by 14%, but remained within the limits of Iceland's commitment under the Kyoto Protocol (Section 2.1).

Iceland has made progress in improving the material productivity of its economy, i.e. the economic output generated per unit of material used. Its material productivity is in line with the OECD Europe average. The amount of materials used in the economy fell sharply with the economic crisis, as did the generation of municipal waste. Municipal waste generated per capita was below the average level in the OECD in 2012. The implementation of EU waste-related legislation has helped divert waste from landfills and increase recycling, but half the municipal waste generated still goes to landfills (Section 2.2).

Glaciers, rivers and lakes cover 13% of Iceland's area, resulting in abundant freshwater supplies. This abundance, combined with the small population, results in one of the lowest intensities of water use among OECD countries. Less than 1% of the land area is artificially built, and agricultural land is scarce. Vegetation is mostly subarctic and characterised by abundant grasses, sedges and related species. In the highlands and lava fields vegetation is mainly mosses and lichens. National parks and reserves have been expanded since 2000, especially with the establishment of Vatnajökull National Park. About 20% of the land area is under some form of nature protection, among the highest shares in the OECD. About half the country suffers from acute soil erosion, partly due to overgrazing, and more than 290 species are threatened. Several activities exert pressure on Iceland's biodiversity, including hydropower and geothermal exploitation, urban sprawl and tourism development (Section 3).

Iceland's people appear to be more satisfied with environmental quality than in the OECD as a whole. Groundwater is of excellent quality and does not need treatment before

consumption. Concentration of nutrients has been historically low, although the nitrogen and phosphorus balance has increased in line with agricultural production (Section 2.2). About 73% of the population is connected to wastewater treatment systems (including individual treatment facilities), most of which do not provide secondary or tertiary treatment. Nevertheless, the burden of disease attributable to the environment, water and sanitation is among the lowest in Europe (Section 4).

Emissions of most air pollutants declined in the 2000s and ambient air quality is generally good in the Reykjavík area. However, the annual mean concentration of small particulates continues to exceed the limit value; the use of studded tyres, which wear away the road asphalt, is a major factor. Geothermal exploitation is a major source of sulphur oxides (SO_x) and hydrogen sulphide (H_2S). Emissions of both have risen considerably since 2000. Concentrations of H_2S in the Reykjavík area have often exceeded the exposure standards, with potential impacts on human health and ecosystems (Section 4).

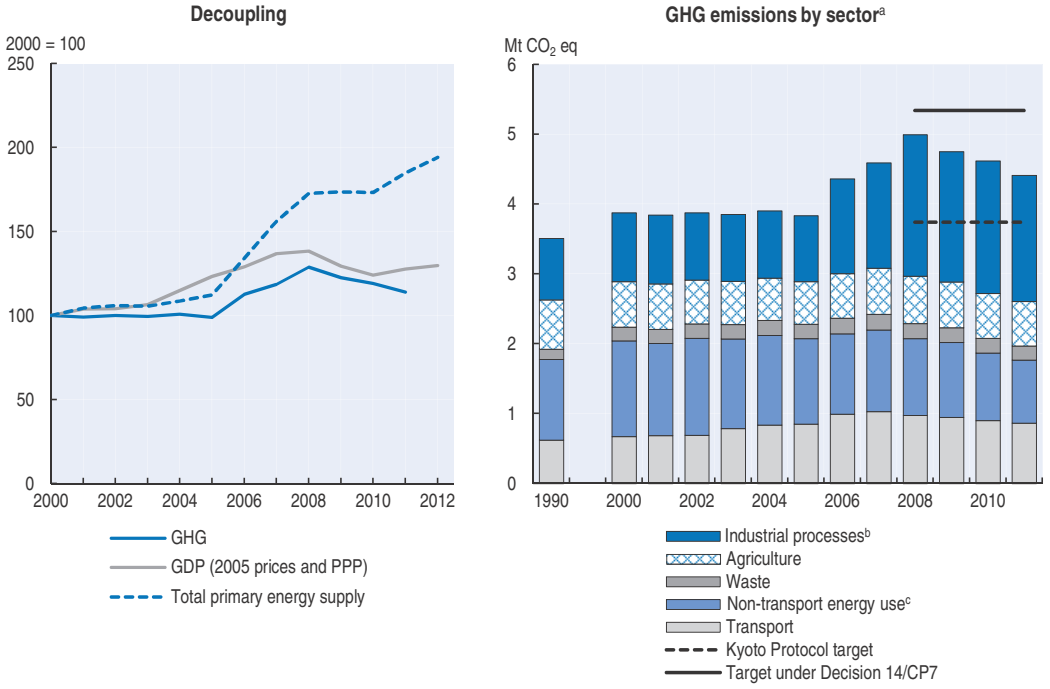
2. Transition to a low-carbon, energy- and resource-efficient economy

2.1. Carbon and energy intensities

Greenhouse gas emissions

- Iceland's GHG emission profile is unique in a number of respects: i) emissions from energy industries are negligible because of the extensive use of renewables for power and heat generation and the absence of refineries; ii) emissions from space heating and energy use in manufacturing are modest; and iii) industrial processes (mostly in the aluminium industry) are by far the largest contributor to GHG emissions.
- Overall, GHG emissions (excluding emissions and removals from land use, land-use change and forestry) have grown by 14% since 2000, at a lower rate than GDP (Figure 1.2). As of 2011, Iceland was on track to reach its Kyoto Protocol target to keep the increase in GHG emissions within 10% from the 1990 level in 2008-12, excluding carbon dioxide (CO_2) emissions from new heavy industry units (mainly aluminium smelters) that use renewable power sources and best available technology (Decision 14/CP.7) (Figure 1.2; Chapter 4).
- Aluminium production processes mainly emit CO_2 and perfluorocarbons (PFCs). Aluminium smelters in Iceland are among the least GHG-intensive in the world owing to the use of renewables-based electricity (Chapter 4). However, because of expansion in production capacity, GHG emissions from industrial processes grew by 83% between 2000 and 2011 (Figure 1.2), to reach 35% of Iceland's emissions (Figure 4.6).
- Energy use in transport, mainly by road, is the second largest single source of GHG emissions (17% of total emissions). Despite a decline since 2007, due to the economic crisis and higher fuel prices, in 2011 transport emissions were 28% above the 2000 level. CO_2 emissions from fuel use in fishing fell by 24%, reflecting a reduction in the fishing effort, improved efficiency and some switching to renewables.
- The carbon intensity of the economy (CO_2 emissions from fossil fuel combustion per unit of GDP) has continued to decline and is among the lowest in the OECD (Annex I.C). This reflects the very high share of renewables in the energy mix.

Figure 1.2. **Greenhouse gas emissions: Trend and sectoral breakdown in 2000-11**



a) Excluding emissions/removals from land use, land-use change and forestry.
b) Includes solvents.
c) Includes emissions from energy use in the following sectors: manufacturing and construction; agriculture, forestry and fisheries; and residential, commercial and institutional.
Source: OECD (2013), *OECD Economic Outlook No. 93* (database); UNFCCC (2013), *Greenhouse Gas Inventory Data* (database).

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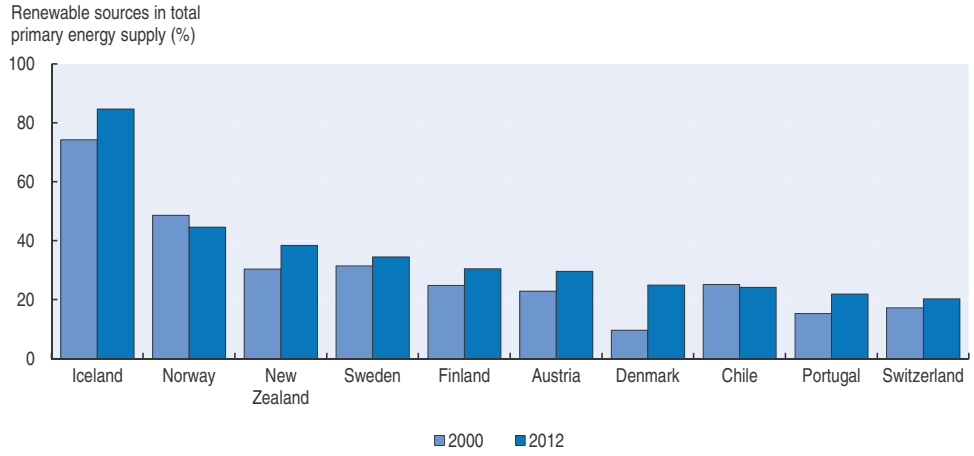
Energy use and intensity

- While the economy grew by 30% between 2000 and 2012, total primary energy supply (TPES) almost doubled (Figure 1.2). This mainly reflects booming energy demand associated with the installation of heavy industrial plants.
- As a result, energy intensity (TPES per unit of GDP) rose by 50% in the same period. It is now four times the OECD average (Annex I.A).
- Industry, mainly aluminium smelting, is the main energy user. In 2011, it accounted for 45% of all energy use, followed by the residential sector (18%), transport (9%) and fishing (8%). Energy consumption from the residential and transport sectors declined in the second half of the 2000s with the recession (Chapter 4).

Energy mix

- Iceland has a very low-carbon energy mix. Renewable energy sources accounted for 85% of TPES in 2012, far more than in any other OECD country (Figure 1.3). All electricity and 95% of heat are generated from renewables.
- Geothermal power is the primary energy source. It accounted for 67% of TPES in 2012, followed by hydropower (18%). Geothermal power is largely used to produce heat for several purposes, including heating homes, swimming pools and greenhouses; hydropower accounts for 70% of total electricity generation (Chapter 4).

Figure 1.3. **Energy from renewable sources: Top 10 OECD countries in 2000 and 2012**



Source: IEA (2013), *IEA World Energy Statistics and Balances* (database).

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- Over the last decade, net hydroelectric capacity nearly doubled and geothermal capacity more than trebled. The significant growth of the aluminium industry is the main factor underlying this increase of power generation capacity (Chapter 4).
- Iceland is dependent on imported fossil fuels (oil and coal), which accounted for 15% of TPES in 2012. Fossil fuels are used primarily in transport and fishing, and to a minor extent to produce electricity and heat in remote locations (Chapter 4).

2.2. Resource efficiency

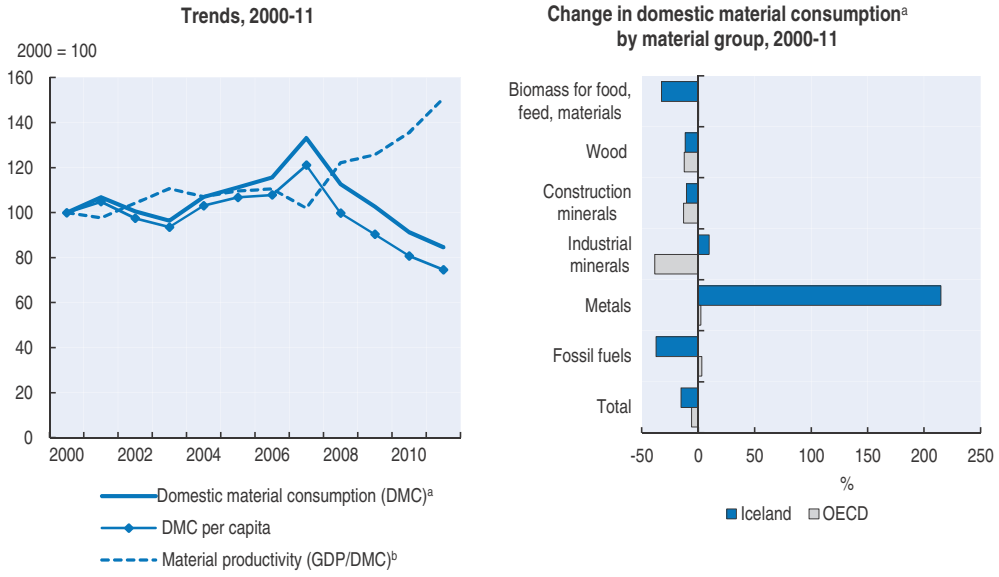
Material productivity

- Iceland has no indigenous production of oil, natural gas or coal and thus is 100% dependent on fossil fuel imports for domestic consumption; it is also highly dependent on imports of machinery and other equipment, foodstuffs, and textiles.
- Between 2000 and 2011, material productivity, defined as economic wealth generated per unit of material used, grew by 51% (Figure 1.4), more than on average in the OECD as a whole. Iceland's material productivity is in line with the OECD Europe average (Annex I.C).
- Iceland showed significant decoupling of domestic material consumption (DMC[1]) from GDP over 2000-11: the latter grew by about 28% while DMC declined by 15%. Consumption of metals grew by 215%, accounting for the largest share of total DMC. Fossil fuel consumption decreased by 37%.

Waste generation and recovery

- Iceland generated 524 000 tonnes of primary waste in 2011. The industrial metal production sector was responsible for the largest share (22%) of total waste, followed by fisheries (21%). Hazardous waste represented only 2%.
- Generation of municipal waste decreased by nearly 17% over 2000-12. Waste volumes fell dramatically (by 44%) between 2007 and 2010 due to the economic crisis and its impact on household income and consumption. Waste generation has started to pick up again with the economic recovery (Figure 1.5).

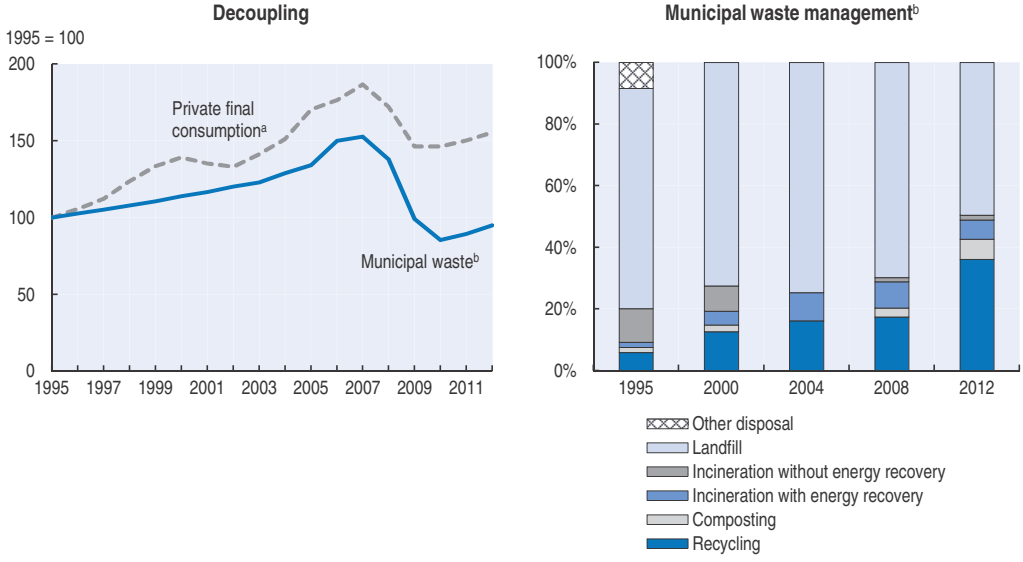
Figure 1.4. **Domestic material consumption and material productivity**



a) Domestic material consumption is the sum of domestic (raw material) extraction used by an economy and its physical trade balance.
b) Material productivity designates the amount of GDP generated per unit of materials used (ratio of GDP to DMC). A rise in material productivity is equivalent to a decline in material intensity (i.e. DMC/GDP). GDP is expressed at 2005 prices and purchasing power parities.
Source: OECD (2014), *Environment Statistics* (database).

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Figure 1.5. **Generation and management of municipal waste in 1995-2012**



a) Private final consumption expenditure at constant prices.
b) Waste collected by or for municipalities, including household, bulky and commercial waste, and similar waste handled at the same facilities.
Source: OECD (2014), *Environment Statistics* (database); OECD (2013), *OECD Economic Outlook No. 93* (database).

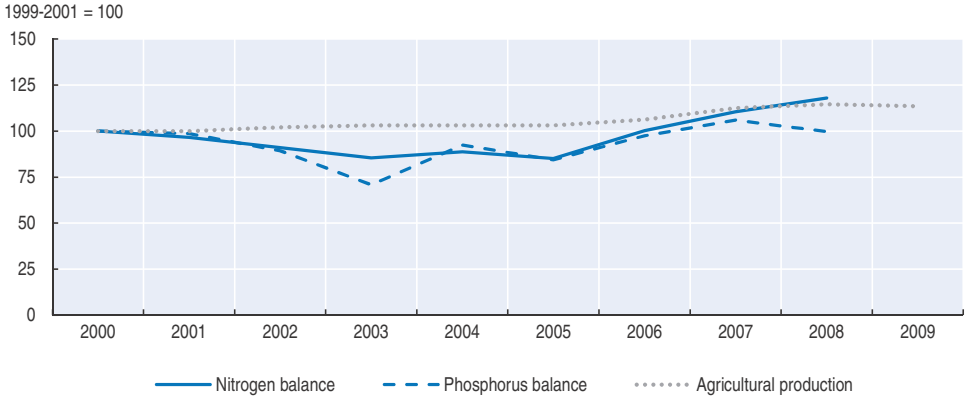
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- Municipal waste generated per capita decreased by about 27% over 2000-12, reaching 340 kg, compared with an OECD average of 530 kg (Annex I.C).
- Municipal waste disposed of in landfills decreased by 45% over 2000-12; nevertheless, landfills are still the main treatment method, accounting for half of total municipal waste treatment in 2012 (Figure 1.5). Recycling, along with composting and incineration with energy recovery, to a lesser extent, accounts for the remaining share.
- The implementation of EU waste-related legislation helped divert waste from landfills and increase recycling. Iceland has implemented EU recycling policy for various types of waste, including packaging, end-of-life vehicles, and electrical and electronic equipment (Chapter 3).

Nutrient balance and agricultural inputs

- The nutrient balance has remained roughly coupled to agricultural production (Figure 1.6). The gross nitrogen balance increased by an average of 0.8% per year between 1998-2000 and 2007-09. This was among the five highest nitrogen balance increases in the OECD. The phosphorus surplus declined by an average of some 0.5% a year in the same period, compared to an average decline of 5.4% for the OECD as a whole (OECD, 2013c).
- Nevertheless, use of nitrogen and phosphorus fertilisers dropped by 5% and 30%, respectively, in the 2000s. The amount of nitrogen fertilisers used per square kilometre of agricultural land is the second lowest in the OECD (Annex I.C).
- The quantity of pesticides sold rose by 4.6% per year between 1998-2000 and 2007-09, compared to an overall OECD decrease of 1%. The rise was mainly due to increased crop production (OECD, 2013c). Yet pesticide use per square kilometre of agricultural land is the lowest in the OECD (Annex I.C).
- The agricultural land area under certified organic management did not increase between 2002 and 2010; the share is one of the lowest in the OECD (OECD, 2013c).

Figure 1.6. **Gross nutrient balances and agricultural production in 2000-09**



Source: FAO (2014), *FAOSTAT* (database); OECD (2014), *OECD Agriculture Statistics* (database); OECD calculations.

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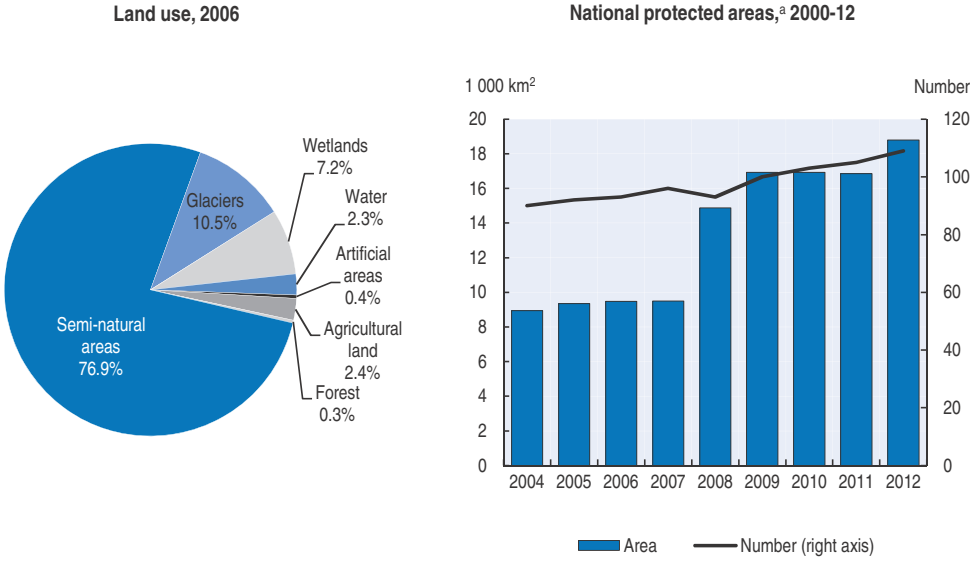
3. Managing the natural asset base

3.1. *Biodiversity and ecosystems*

Land use

- About 75% of Iceland is more than 200 meters above sea level, with most of the land being high plateaux and mountains. Glaciers, rivers and lakes cover 13% of the total area, resulting in abundant freshwater supplies. Artificial areas cover only 0.4% of the total territory, significantly less than in other European countries; only 2.4% of the land is arable (Figure 1.7). About 90% of the population lives in coastal areas, with fewer than 1 000 people living in the highlands.

Figure 1.7. **Land use and natural protected areas**



a) Nationally designated protected areas (including national parks, natural monuments, nature reserves and habitat protection, and country parks).
Source: Statistics Iceland (2014), "Geography and environment", *Statistics portal*; Statistics Iceland (2013), *Statistical Yearbook of Iceland 2013*.

- Forests cover only 0.3% of the total area (Figure 1.7). About 96% of tree cover has been lost since the first settlers ventured to Iceland over 1 100 years ago. Despite a significant afforestation effort in the last two decades, Iceland has one of the lowest levels of growing stock in forest and other wooded land in the OECD (Annex I.C).[2]
- About half the country suffers from acute soil erosion (OECD, 2001). This has resulted from the woodland clearing and sheep grazing.
- The number of participants in soil conservation activities increased over 2000-08. Representing one-third of livestock farmers, they have helped reclaim about 6 000 hectares of land per year (SCS, 2013).
- Iceland has the second lowest livestock density among OECD countries (Annex I.C). Sheep is the dominant livestock form. The number of horses increased by 5% between 2000 and 2012 as tourist interest in riding Icelandic horses has grown (Statistics Iceland, 2014a).

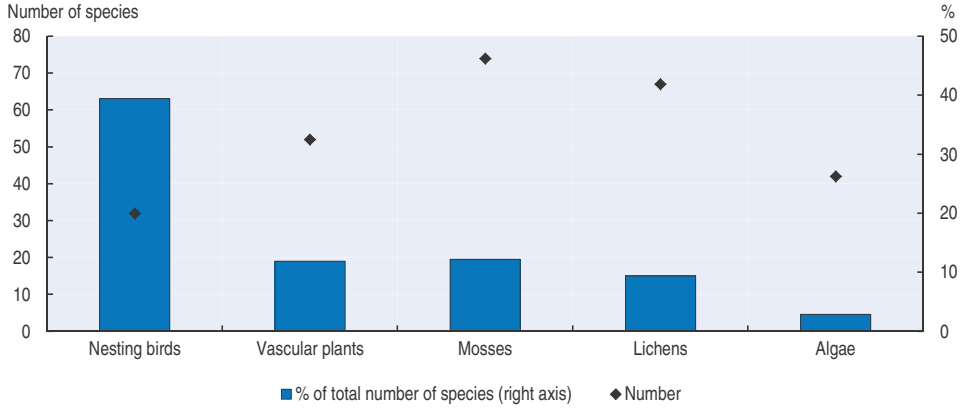
Protected areas

- About 20% of the total area is under some form of nature protection. This is among the highest shares in the OECD (Annex I.C) and exceeds the Aichi biodiversity target of establishing a system of protected areas and other area-based conservation measures covering at least 17% of terrestrial areas and inland waters by 2020.
- The total area under protection doubled between 2007 and 2012, mainly due to the establishment of Vatnajökull National Park in 2008. This park extends over 14% of the total land area; most of which is covered by the Vatnajökull glacier (Statistics Iceland, 2014b).
- Protected areas include a variety of legal designations. Three national parks make up over half the total protected area; 24 sites are designated for geological purposes and partial value for biological diversity; and the remaining areas are protected due to their biodiversity. The Nature Conservation Strategy aimed to designate 25% of the country's area as protected by 2013.

Ecosystems and species

- Vegetation covers 60% of the total area. It is mainly dry-land, low-growing vegetation and includes sparse birch woodlands. Vegetation is mostly subarctic and characterised by abundant grasses, sedges and related species. In the highlands and lava fields vegetation is mainly mosses and lichens.
- According to the 2007 Red List of Iceland, more than 290 species are threatened, including vascular plants, mosses, lichens, marine algae and birds. Nearly 40% of the bird species nesting in Iceland (mainly seabirds) are threatened, as are 12% of the country's moss species (Figure 1.8). However, Red List data have not been regularly updated and are incomplete.

Figure 1.8. **Species on the 2007 Red List of Iceland**



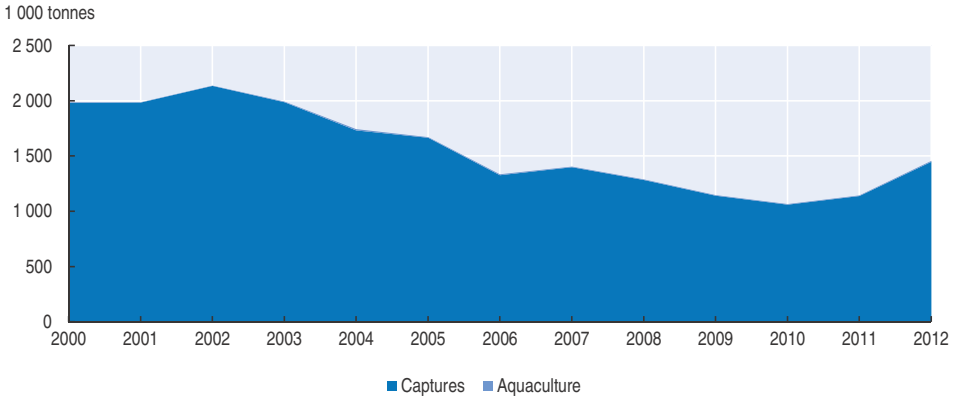
Source: MENR (2009), *Umhverfi og auðlindir. Stefnum við í átt til sjálfbærrar þróunar?* [Environment and Natural Resources. Are We Moving on the Right Path?].

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- Two seal species are found on Icelandic shores (the harbour seal and the grey seal), but their populations have declined over the past decade. Several whale species are found in Iceland's seas, including seven toothed whales and five baleen whales.
- Several activities exert pressure on Iceland's biodiversity, including hydropower development, geothermal exploitation, urban sprawl, tourism development, overgrazing and invasive species (Chapters 4 and 5).

- With a total catch of about 1.5 million tonnes in 2012, Iceland is a major fishing country. Total fish production decreased between 2000 and 2012 by some 27%, mainly due to fluctuations in the catch of pelagic species (Figure 1.9). Scientifically based total allowable catches and an individual transferable quota system form the foundations of Iceland's successful fisheries management (OECD, 2011b) (Chapter 3).

Figure 1.9. **Fish production in 2000-12**



Source: FAO (2014), *FAO Global Capture and Aquaculture Production* (databases).

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3.2. Water resources

- With abundant water and a small population, total abstraction is less than 1% of total available freshwater resources, among the lowest intensities of water use in the OECD. However, gross freshwater abstraction per capita is relatively high, exceeding the OECD Europe average (although Iceland's data are relatively old and not fully comparable) (Annex I.C).
- The rivers and lakes have suffered no significant pollution. Regular sampling of 20 rivers between 2003 and 2007 showed that the mean concentrations of nutrients was low (below 0.3 mg per litre for nitrogen and below 0.04 mg/litre for phosphorus).
- Iceland expects to have fully transposed the EU Water Framework Directive (WFD) and implemented the river basin management plan by 2015 (European Commission, 2011). Work is under way to identify heavily modified and artificial water bodies and assess their ecological status, in accordance with the WFD (EAI, 2014).
- The quality of freshwater and groundwater is extremely good. No rivers or coastal water bodies are considered at risk of not reaching good chemical status. Only one lake (Tjörnin) and one groundwater body are considered at risk.

4. Improving the environmental quality of life

4.1. Environment, well-being and health

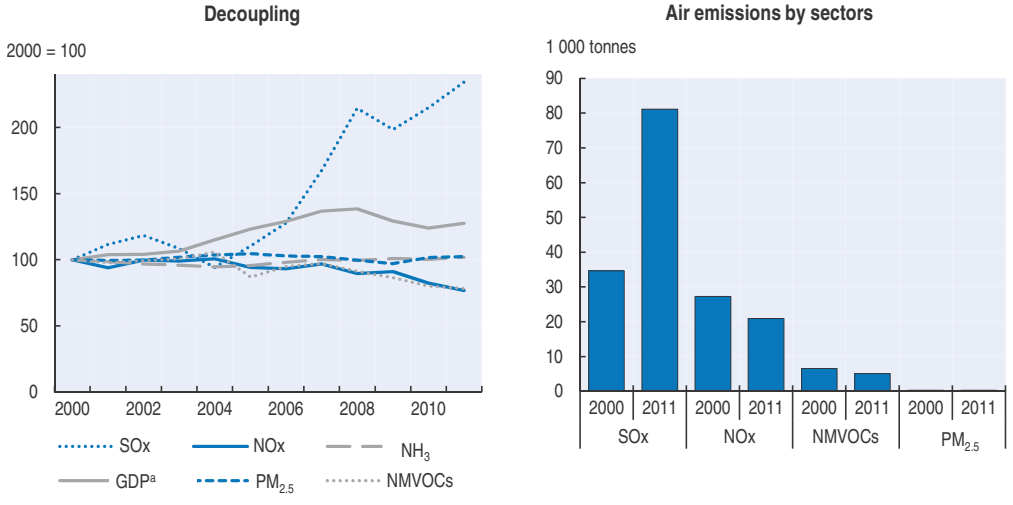
- More than half the Icelandic people are satisfied with the administration's efforts to preserve the environment, a level that has not changed significantly since 2008 (Gallup, 2014).
- Some 97% of residents say they are satisfied with water quality. This figure is higher than the OECD average of 84% and suggests Iceland has been successful in providing good quality water to its inhabitants (OECD, 2014).

- Icelanders are also generally satisfied with air quality. The level of satisfaction reached almost 90% in 2012 (Gallup, 2014).
- Icelanders are very active in terms of political participation; over a given 12-month period, 61% of the people take part at least in one civic activity such as contacting a politician, attending a demonstration or writing a petition. This level is significantly higher than the European average of 25% (Eurofound, 2013).
- The latest assessment by the World Health Organization (WHO) indicates that the burden of disease attributable to environmental factors is 14%, unchanged from the previous assessment. This is among the lowest levels in Europe (WHO, 2007; 2009).
- The share of the burden of disease associated with water, sanitation and hygiene corresponds to the world's lowest rate. WHO estimates that fewer than 100 deaths per year can be attributed to outdoor air pollution (WHO, 2009).

4.2. Air emissions and air quality

- Emissions of all major air pollutants except SO_x have declined or remained stable since 2000, showing a relative decoupling from economic performance. Emissions of nitrogen oxides (NO_x) and non-methane volatile organic compounds (NMVOCs) have decreased by more than 20% (Figure 1.10).[3]
- Mobile sources (including road vehicles and fishing vessels) are the main sources of NO_x and NMVOCs. The reduction of emissions from these sources is mainly due to the diffusion of vehicles with catalytic converters, improved fuel quality, and improved efficiency of vehicles and vessels.
- Between 2000 and 2011, emissions of small particulates ($PM_{2.5}$) increased slightly, by 0.8% (Figure 1.10), while emissions of PM_{10} grew by 33%. The use of studded tyres, which wear away the asphalt, is the main source. Soil erosion, traffic on gravel roads, volcanic ash and weather conditions contribute to increasing PM emissions and concentrations.

Figure 1.10. **Air pollutant emissions in 2000-11**

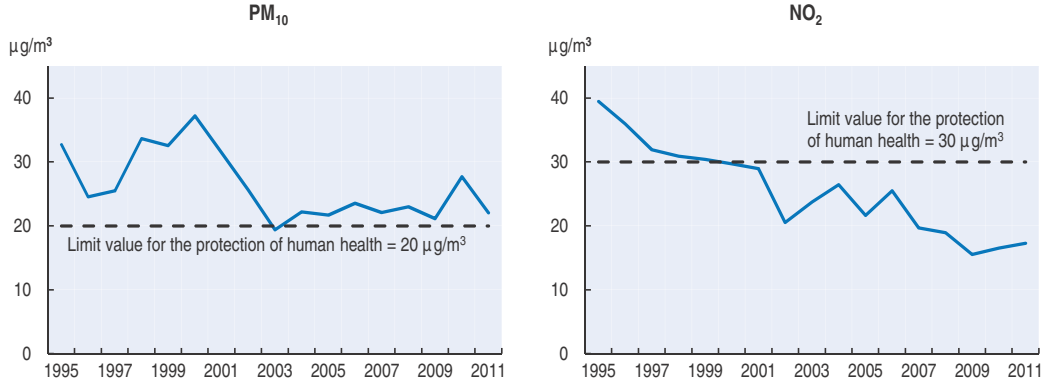


a) At 2005 prices and purchasing power parities.
Source: OECD (2014), *OECD Environment Statistics* (database); OECD (2013), *OECD Economic Outlook No. 93* (database).

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- Ammonia emissions[4] slightly increased, by 2%, due to manure deposition and management, the grazing of animals on pastures and fertiliser application. The main factor underlying the increase is the trend in livestock population: sheep and cattle account for more than 80% of total ammonia emissions, while fertiliser application plays a minor role (EAI, 2013a).
- Emissions of SO_x more than doubled between 2000 and 2011 due to increased geothermal exploitation, the largest source of sulphur emissions (Figure 1.10). Iceland's emissions of SO_x per unit of GDP are the highest in the OECD (Annex I.C).
- H_2S emissions from geothermal power plants have doubled since 2000. Concentrations of H_2S in the Reykjavík area have often exceeded the WHO standard. In weak concentrations, only the characteristic odour is detected, but in higher concentrations, H_2S can be corrosive and affect respiratory organs. The impact on human health and the environment of continuous exposure to low concentrations of H_2S over the medium and long term is still unknown (Chapter 4).
- In the Reykjavík area, concentrations of the main air pollutants (including ozone and NO_2) are generally below the EU air quality standards. The annual mean concentration of PM_{10} has declined since 2000. However, it has continuously exceeded the WHO Air Quality Guidelines (20 µg/m^3) (Figure 1.11).

Figure 1.11. **Air quality in the Reykjavík area in 1995-2011**



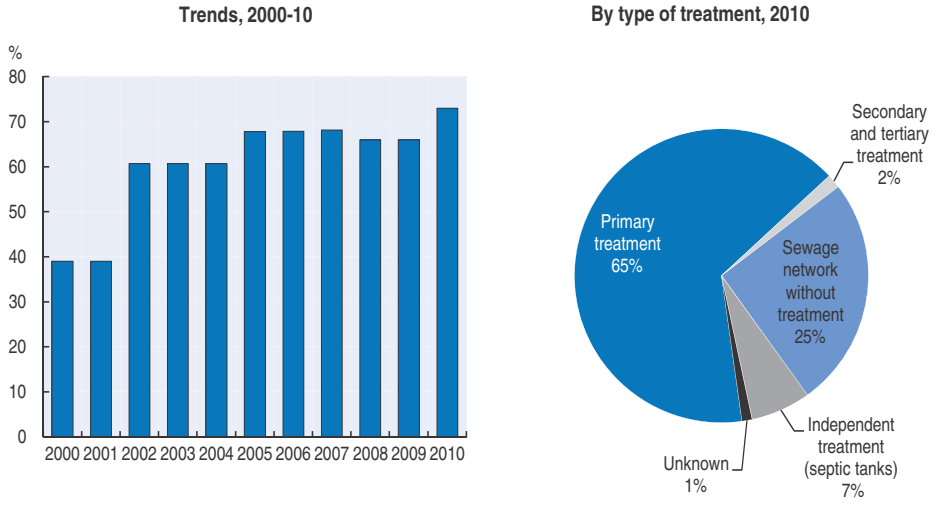
Source: MENR (2009), *Umhverfi og auðlindir. Stefnum við í átt til sjálfbærrar þróunar?* [Environment and Natural Resources. Are We Moving on the Right Path?]; country submission.

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4.3. *Water supply and sanitation*

- Iceland's local water supplies come almost entirely from groundwater reservoirs and do not need any treatment before consumption. By 2008, 31 water utilities, serving 81% of the population, had implemented the water safety plan methodology (launched in 1995). This resulted in increased compliance with Icelandic drinking water regulations.
- The share of the population connected to wastewater treatment systems has increased by 87% since 2000. It was 73% in 2011, including individual treatment facilities (EAI, 2013c), among the lowest levels in the OECD (Figure 1.12; Annex I.C). Only about 2% of the population is connected to treatment plants that provide secondary or tertiary treatment (Figure 1.12). This low level is partly a consequence of the very low population density.

Figure 1.12. **Population connected to wastewater treatment facilities**



Source: EAI (2013), Report to the EFTA Surveillance Authority regarding the implementation of Directive 91/271/EU on the treatment of wastewater from agglomerations; OECD calculations.

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Notes

1. DMC is the sum of domestic raw material extraction used by the economy and its physical trade balance (imports minus exports of raw materials and manufactured products).
2. The growing stock is the living component of the tree standing volume in an area of forest or wooded land.
3. Iceland is a party to the Convention on Long Range Transboundary Air Pollution but has only ratified the Protocol on Persistent Organic Pollutants. It is in the process of transposing the EU National Emission Ceilings Directive.
4. Ammonia emissions have only been estimated for the agricultural sector.

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PART I

Chapter 2

Policy-making environment

Iceland has strengthened its institutional and legislative framework for environmental management in line with its broader environmental agenda. This chapter analyses Iceland's environmental governance system, including mechanisms for horizontal and vertical co-ordination and for evaluating the environmental impact of sectoral policies. It reviews key environmental and sustainable development initiatives, including the country's National Strategy for Sustainable Development 2002-2020. It examines the regulatory framework for environmental management and the enforcement and compliance assurance activities. The promotion of environmental democracy is also discussed.

Assessment and recommendations

As a member of the European Economic Area (EEA), Iceland has continued to strengthen its environmental policies and legislation in line with those of the EU. Notable exceptions are nature conservation, which the EEA agreement does not cover (although there has been some harmonisation of legislation), and water-related legislation, as Iceland was granted an extended time frame to implement the Water Framework Directive. In 2002, the government adopted Welfare for the Future: Iceland's National Strategy for Sustainable Development 2002-2020. The strategy, together with two reviews in 2005 and 2009, stimulated a range of environmental policy initiatives, including on climate change, nature conservation and waste management. However, progress in developing and implementing environmental legislation and policies slowed due to the economic and financial crisis.

Iceland has strengthened its institutional framework for environmental management in line with its broader environmental agenda. In 2012, the portfolio of the environment ministry was enlarged to include natural resource management, the marine environment and coastal planning. The ministry is supported by 14 affiliated agencies, with the Environment Agency of Iceland (EAI) playing a particularly important role. However, a recent review of agencies indicated a need for institutional consolidation and clarification of the division of labour to improve efficiency and strengthen co-ordination in policy implementation. As this is a country with a small population and administration, careful policy evaluation can help ensure that proposed policies and laws are cost-effective and adapted to the Icelandic context. Building alliances with the research community could help augment limited administrative resources.

In the absence of a regional administrative level, municipalities play an important role in local environmental management and in making decisions on land use and licensing of projects that are subject to environmental impact assessment (EIA). Between 1995 and 2013, the number of municipalities was reduced from 170 to 74. This reform helped in realising economies of scale and strengthening the provision of a range of environment-related services, including waste collection, public transport, water supply and sanitation. Reykjavík, home to one-third of the population, has pioneered environmental initiatives on waste, air, transport and climate change. Mechanisms have been established to help co-ordinate policy development and implementation, along with information exchange between the Ministry for the Environment and Natural Resources, the EAI and local authorities. Local health and environment inspectors, health and environment committees, and water subdistricts support policy implementation between the national and municipal levels. However, there are opportunities to further streamline subnational institutional arrangements, improve vertical co-ordination and strengthen capacities in line with responsibilities.

Iceland has taken steps to strengthen the EIA of projects, for example by extending the range of projects subject to assessment, strengthening procedures for public participation

and developing guidelines to promote consistency and transparency. The roles of the National Planning Agency in assessing environmental impacts, and of local authorities in decision making, have been clarified; previously, ambiguities about these roles had fuelled conflict. Assessment of the environmental impact of local and regional plans has been extended to national policies and programmes. Plans for transport, oil exploration and waste management have been subject to strategic environmental assessment, and guidelines for conducting such assessment have been developed.

Despite the progress in strengthening environmental assessment procedures, there have been intense debates about some projects, for example involving hydropower and metal smelters. In some cases, developers have tried to circumvent conflict by limiting public participation; in others, cost-benefit analysis of alternatives has not been carried out, or cumulative effects considered. Further steps could be taken to improve the framework for such debates, particularly the finalisation of the national strategy for spatial and land-use planning. Iceland is home to exceptional natural sites and very fragile ecosystems. Establishing a clearer framework for land use could help keep more general issues about land use from becoming entangled with decisions about specific projects. In addition, better evaluation of the costs and benefits of projects and programmes would support more informed public debate. Similarly, public debate could be improved by strengthening the standards that organisations preparing environmental assessments should meet, with a view to improving the assessments' quality.

Responsibilities for EIA and for environmental permitting and licensing should be simplified and integrated. Currently they involve multiple agencies and overlapping requirements. Although some steps have been taken to reduce the regulatory burden, permitting procedures remain complex and slow. Responsibility is split between national authorities (for large installations) and local health and environment inspectors (for small and medium-sized enterprises), but capacity in both appears to be stretched. Despite charging for permits, a practice followed in many countries, there is no mandatory period for processing applications, and the requirements with which developers must comply are not always clear.

Enforcement of environmental requirements and response to non-compliance have been strengthened. Broader use of modern management tools has helped improve the use of existing resources; examples include databases of the regulated community and of inspections, better time planning by enforcement staff, inspection quality manuals and protocols, and the tracking of compliance records. These steps are supported by regulatory relief for companies with a good history of complying with environmental requirements and those with certified environmental management systems. Cases of non-compliance are generally resolved without recourse to courts.

Due to the country's low population density and historically low levels of pollution, the environmental monitoring system is rudimentary. Iceland's involvement in the European Environment Agency has helped standardise data and improve data gathering and reporting. However, a long-envisaged implementation plan for environmental monitoring is still pending. Environmental monitoring results are scattered among several institutions at various levels. Gaps in data, an abundance of untreated information, differences in the methodologies used by local authorities, and poor oversight of data generated by independent laboratories hamper policy development and priority setting.

Iceland has a long tradition of open, free access to environmental information and of public participation in environmental decision making. Although it signed the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters in 1998, Iceland did not ratify it until 2011. Ratification became possible after the creation of the Environmental Board of Appeals, which enabled review of decisions on permits and compliance with the convention provisions regarding access to justice. Neither the authorities nor members of the public face legal or financial obstacles to bringing environmental cases to courts or appealing administrative decisions. Iceland provides the possibility of free legal aid to individuals involved as parties in civil cases.

Recommendations

- Establish requirements, and strengthen capacity, for conducting *ex ante* and *ex post* assessment of environmental policies and regulations; systematically conduct regulatory impact assessment for new environmental laws and regulations; establish closer links between the administration and the research community to make better use of the latter's analytical capacities to support policy development.
- Further consolidate and clarify the roles of environmental agencies under the Ministry for the Environment and Natural Resources so as to improve efficiency and strengthen co-ordination in policy implementation.
- Adopt the national spatial planning strategy and extend the planning framework to coastal waters and the ocean.
- Integrate and streamline EIA and environmental permitting and licensing procedures with a view to reducing administrative costs and delay; establish the administrative capacities required; ensure that requirements for large installations and small and medium-sized enterprises are proportional to the risks they pose.
- Strengthen provisions for economic analysis in procedures for EIA and strategic environmental assessment (SEA); introduce a certification system for organisations that prepare environmental impact statements and SEAs, and provide regular training and guidelines to strengthen their capacity.
- Review the environmental monitoring and information system, including at the local level, with a view to establishing a comprehensive and well-co-ordinated system that better supports policy development and implementation.

1. Key environmental and sustainable development initiatives

1.1. Policies and initiatives at the national level

Welfare for the Future: Iceland's National Strategy for Sustainable Development 2002-2020, approved by the government shortly before the World Summit on Sustainable Development in 2002, defined the country's priorities for environmental protection and sustainable use of natural resources for the first two decades of the 21st century. The strategy was comprehensive, as it presented key environmental trends, identified major pressures and set forth specific policy objectives under 17 themes divided into four sections: i) Healthy and Safe Environment, ii) Conservation of Icelandic Nature, iii) Sustainable Use of Resources and iv) Global Issues (Ministry for the Environment, 2002).[1] The strategy also identified priority measures to achieve the objectives, including those

requiring closer integration of environmental consideration into sector policies. Each measure was accompanied by a set of indicators intended to monitor progress. The strategy was developed through a broad consultation process, involving government agencies, stakeholders and civil society. Its implementation has been overseen by an interministerial co-ordination committee, led by the environment ministry.

The adoption of Welfare for the Future stimulated new policy initiatives on environmental issues of national importance, including the 2003 Soil Conservation Strategy, the 2004 National Policy on the Ocean, the 2004 National Plan for Waste Management and the 2004 Nature Conservation Strategy. Welfare for the Future was also instrumental in giving new impetus to one of the most important policy developments in Iceland: the Master Plan for Hydro and Geothermal Energy Resources, which aimed to analyse and identify options for greater development of energy sources in Iceland (Chapter 4).

The implementation of Welfare for the Future was subject to systematic reviews (in 2005 and 2009) by the Environmental Assembly, a multi-stakeholder forum. The 2009 review pointed out the need to reinforce some actions because of the economic crisis Iceland faced from late 2008 (Ministry for the Environment, 2010). In particular, the review said additional attention was needed to promote more sustainable production and consumption and to step up education efforts for sustainable development. The review acknowledged that more work was needed on identifying better indicators to assess progress.

The reviews were followed by the launch of new policy documents, such as the Iceland's Climate Change Strategy in 2007 and the Action Plan on Climate Change in 2010. Existing policy documents were updated, such as the 2004 Nature Conservation Strategy in 2009 and the 2004 Waste Management Plan in 2013. All these documents presented progress in addressing priority problems, and tightened objectives and targets. Such progress notwithstanding, consolidation and setting of objectives in some policy areas have been slow. This was particularly the case concerning the national land-use planning policy, which has been under development since 2003 and is expected to be adopted by the Parliament in 2015. The lack of a national land-use planning policy has hampered more coherent and co-ordinated spatial and economic development, has created uncertainties in policy-making processes and has been a source of conflicts between the national and local authorities (Box 2.1). The preparation of the River Basin Management Plan and proposed programmes of measures are expected to be completed by January 2018.

While the Welfare for the Future strategy played an important role in advancing environmental policies as long as the economy was growing, the painful experience of the financial crisis uncovered the inadequacy of the strategy's provisions. The policy makers' attention shifted to new drivers of economic development and stimulated interest in the green economy. Responding to these new challenges, the report on the strengthening of the green economy in Iceland, adopted by a parliamentary committee in September 2011, presented 48 recommendations on greening Iceland's economy and allocated responsibilities for their implementation (Chapter 3). A planned assessment of Welfare for the Future implementation in 2014 will provide a good opportunity to identify new priorities and adjust objectives in light of the proposals contained in the green economy report. The assessment also offers a chance to apply more explicit cost-benefit analysis of objectives and identify trade-offs between policy measures.

Box 2.1. **Land-use planning**

The 1997 Planning and Building Act (No. 73/1997) shifted responsibility for land-use planning from central to local authorities. It also expanded the planning scope from urban areas to the entire land area at three planning levels: municipal, local and regional.

- Every municipality must develop and approve a municipal plan, covering all land within its borders and including the development of settlements, transport and other service systems, and protection of natural assets. The plan should define the local authority's land-use policy for at least 12 years. Every four years, after local government elections, local officials decide whether there is a need to review the municipal plan.
- The provisions of the municipal plan are further elaborated in local plans where design and construction requirements for physical development are described in more detail. All development on land must proceed in accordance with a municipal plan and a local plan.
- At the initiative of a local authority or the National Planning Agency (NPA), two or more municipalities can prepare a regional plan to co-ordinate policies on the development of settlements and other land uses. The regional plan, covering at least 12 years, is developed by a provisional planning committee consisting of representatives of all municipalities involved and the NPA. The plan becomes legally binding after its adoption by all relevant municipalities and approval by the environment minister.
- In addition to intermunicipal regional plans, the legislation requires the preparation of a Regional Plan for the Central Highlands, which covers some 40 000 km^2 of largely uninhabited interior. A planning committee appointed by the environment minister is responsible for developing this plan. The committee includes representation from all relevant stakeholders and from government agencies, including the social affairs ministry.

Although land-use planning at the national level has not been carried out, the government has had considerable influence on both municipal/local land-use planning and regional development. The municipal and regional plans are subject to approval by the environment minister, assisted by the NPA. Other ministries also play an important role in land-use planning at all levels, as well as regional development, through sector plans, especially in relation to transport, energy transmission infrastructure, and nature conservation. Should inconsistency or conflicts of interest arise in land-use proposals, the environment minister, after consulting with the prime minister and the Association of Local Authorities, may appoint a special committee to co-ordinate the proposals.

While most bigger municipalities have land-use plans, the planning of less populated areas has not been completed. Co-operation between municipalities has mainly been ad hoc. Overall progress has been affected by an ongoing reform of the administrative structure of the country that involved the number of municipalities being gradually reduced, from 170 in 1995 to 124 in 2000 and to 74 in 2013. Half of them have fewer than 1 000 inhabitants; municipal populations range from 54 to 119 000. Planning also suffered from insufficient active co-ordination of plans, even though the environment minister has the power to require local authorities to incorporate national considerations in their land-use plans. In several cases, policies that local authorities set forth in municipal plans do not correspond to national sector plans for the same area. Efforts at mediation by the environment ministry have encountered strong opposition from historically powerful municipalities.

Box 2.1. **Land-use planning** *(cont.)*

New planning legislation introduced in 2010 (No. 123/2010) tried to address these problems by mandating a comprehensive national land-use planning policy, to be presented by the environment minister, in the form of a resolution to the Parliament within two years of the next parliamentary elections (the most recent of which took place in April 2013). The policy, which would cover the whole country as well as its exclusive economic zone, is expected to co-ordinate official plans and strategies for transport, regional development, nature conservation, energy and other fields that affect land use, on the basis of sustainable development principles. Municipalities will be required to adapt their land-use and sector plans within four years of its adoption by the Parliament. A special guiding regulation for the content, presentation, consultation and procedures regarding a comprehensive land-use policy was issued in 2011 (No. 101/2011), which should aid in developing and approving the policy by 2015 as required by the 2010 legislation.

Source: Bjarnadóttir (2012), "Strategic environmental assessment in the context of land-use planning: The application of the EU Directive 2001/42/EC to Sweden, Iceland and England"; Nordregio (2004), "Regional planning in Finland, Iceland, Norway and Sweden".

1.2. Regulatory framework

Upon joining the European Economic Area (EEA) in 1994, Iceland committed to adopt and implement EU environmental legislation, except in the case of nature conservation. The Surveillance Authority of the European Free Trade Association (EFTA) regularly monitors Iceland's performance under the EEA agreement and publishes information about its implementation record twice yearly on an internal market scoreboard.

The transposition process has led to a significant upgrade of Iceland's legal framework (Government of Iceland, 2012). For example, the 2003 Act on Waste Management and subsequent amendments strengthened requirements for safe, effective waste management by incorporating EU rules on landfilling, treatment and disposal of hazardous and mining waste, and collection and treatment of specific waste streams, such as end-of-life vehicles, electrical and electronic equipment, and batteries. The EU legislation on air quality, such as the Air Quality Framework Directive (96/62/EC) and its four "daughter" directives, has been transposed and established more ambitious objectives related to air pollution emissions and ambient air quality. In some cases, Iceland's legislation is stricter that of the EU, for example concerning limit values for atmospheric pollutants such as NO_2 and lead. Recently, responding to concerns of people living in the Reykjavík area, the authorities decided to regulate ambient concentrations of hydrogen sulphide – a substance whose concentrations are not regulated by the EU – released from geothermal power plants (Chapter 4). Iceland is also well advanced on aligning with EU law on industrial pollution and control and on risk management. The Regulation on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) is being implemented (European Commission, 2011; 2012; 2013).

Although progress was made on the regulatory framework in the early 2000s, the work slowed when the economic crisis began in 2008.[2] In some areas, harmonisation with EU law has been delayed because implementation costs turned out to be too high and the administrative capacity of the Icelandic agencies not sufficient to carry analysis and to make necessary legal and operational adjustments. The Water Framework Directive

(WFD – 60/2000/EC), for example, was introduced through the Water Resource Management Law in 2011, but Iceland was granted an extended time frame to 2018 for implementing the directive, nine years more than EU member countries. The Waste Framework Directive (2008/98/EC) is expected to be transposed in 2014 (European Commission, 2013).

Late transposition affects implementation (Halleraker et al., 2013). Further steps are also needed as regards climate change, in particular concerning fuel quality, and geological storage of CO_2. In 2012, Iceland lost a court case brought by the EFTA Surveillance Authority for failing to evaluate the impact of road noise as required by the Environmental Noise Directive.[3] The case stimulated a speedy response by the authorities, who developed noise maps for major roads as required by the directive and court verdict.

Although nature conservation legislation is excluded from the EEA agreement, the aims and objectives of existing Icelandic legislation have been converging with those of the EU Habitats and Birds Directives (Chapter 5). The main aim of the 1999 Nature Conservation Act and the 2004 Nature Conservation Strategy has been to establish a National Ecological Network of Protected Areas encompassing sites important for animal and plant species, natural habitat types and geological formations in need of conservation.[4] The approach used is based on that of the Natura 2000 network but does not apply its designation procedures and criteria (European Commission, 2011).

1.3. Policies and initiatives at subnational level

Iceland's 74 municipalities develop their own plans and programmes to address air and water quality problems, optimise water and energy consumption, and strengthen waste management and noise control. A particularly important role is played by the city of Reykjavík, home to one-third of the population. It has been a pioneer in setting ambitious objectives relating to environmental management and in developing detailed planning tools. The city's Local Agenda 21, adopted in 2006, is its principal policy statement on environmental issues. The policy has led to increased environmental awareness and a steady rise in the number of certified environmental management systems despite a lack of targets for increasing such certification. It also stimulated the development of the annual Green Steps plan, implemented as part of the city financial planning, and of specific plans, such as the 2005 Waste Management Plan (revised in 2009), the 2006 City Transport Plan (the first of its kind in Iceland) and the 2009 Climate and Air Quality Policy. In 2005, the city Environment Department began to be administered directly by the mayor. In 2008, the department's remit was expanded to include transport management, which was seen as an important environmental issue. Many city initiatives have brought about significant results. For example, the proportion of vehicles using studded tyres in the city was reduced from 67% in 2002 to 39% in 2010, resulting in a decrease in air pollution from transport, and investment in water supply infrastructure reduced water losses from 40% of water supplied through the pipes in 1994 to around 10% in 2010 (City of Reykjavík, 2012).

Some plans and initiatives are undertaken jointly or in co-operation with the Association of Local Authorities. For example, in 2004, 43 municipalities in the south and west of Iceland established a project management group to draw up a common waste management plan covering 230 000 people. The plan, adopted in 2005, set projections and targets concerning waste generation, treatment and safe disposal.

2. Institutional and co-ordination framework for environmental management

2.1. *Key institutions*

Since its creation in 1990, the Ministry for the Environment – now the Ministry for the Environment and Natural Resources (MENR) – has expanded its responsibilities to cover policies related to protection of natural areas and biodiversity, revegetation and afforestation, soil protection, pollution prevention and control, and land-use planning. In addition to initiating and developing draft legislation and action plans, the ministry co-ordinates government environmental policy objectives, ensures follow-up and monitors results. As part of a 2012 government reorganisation (see below), its portfolio was enlarged to include management of natural resources, the marine environment and coastal planning. As a result of the 2013 elections, the minister of environment and natural resources now also serves as minister of fisheries and agriculture and shares the leadership of the Ministry of Industries and Innovation (MII).[5]

With around only 40 officials, the MENR is among the country's smallest ministries. Despite budgetary pressures, the number of staff was increased from 30 in early 2000, and the capacity of environmental institutions remains strong. The ministry's functions are supported by 14 affiliated agencies,[6] among which the Environment Agency of Iceland (EAI) plays a particularly important role. The EAI was created in 2003 in a reorganisation of the former Environment and Food Agency and consolidation of three other agencies and two councils. The EAI and its 77 staff members are responsible for environmental permitting, inspection of industrial operations, co-ordination of environmental quality monitoring, and environmental reporting. The agency is also responsible for supervising management of protected areas and for managing the labelling and handling of hazardous substances. Its headquarters are in Reykjavík and its operations are supported by eight local offices through which it co-ordinates municipal enforcement activities.

In 2008, two agencies and part of a third were transferred from other ministries to the Ministry for the Environment, along with their budgets. In 2012, two other agencies were brought in. While these changes further strengthened the institutional capacity of the environmental administration and increased its financial resources, the ministry has faced challenges managing its subsidiaries. Many agencies are small and their operations fragmented. The 2012 government reorganisation was accompanied by a review of the agency structure, with a view to optimising efficiency; final decisions are pending. The institutions need to be consolidated, and the division of labour should be clarified to improve efficiency and strengthen co-ordination in policy implementation.

In the absence of a regional administrative level,[7] municipalities play an important role in managing local environment by making decisions on land use and licensing projects subject to environmental impact assessment (EIA). The municipalities have been subject to administrative consolidation, in response to limitations on local management capacity, which resulted in gradual reduction of their number between 1995 and 2013 (see also Box 2.1). The reform strengthened their capacity to deal with more complex and wider responsibilities. Even before the reform, environmental services such as waste collection, public transport, water supply and sanitation were provided by companies owned by groups of municipalities. For example, the waste management company Sorpa is jointly operated by seven municipalities, including Reykjavík. By contrast, 94% of Reykjavík Energy, the country's largest water and energy service provider, is owned by the city of Reykjavík; it supplies both the capital and several municipalities in the greater Reykjavík area with drinking water and hot water from geothermal fields.

Although Iceland does not have a uniform regional-level administration, the country is divided into 10 health and safety districts, which are managed by health and environment committees. The committees are mandatory forms of intermunicipal co-operation and are financed by contributions from the municipalities and from charges for services they provide. All the committees operate local health and environment inspectorates (LHEIs), which are responsible for issuing permits to small low-risk sites, monitoring pollution, and supervising health and pollution control within the district. LHEIs are also responsible for inspecting food production and distribution, and carry out enforcement activities related to facilities that are not subject to EAI control. Four water subdistrict committees, created in 2011 to implement the EU Water Framework Directive, are another example of a division that cuts across administrative boundaries (Halleraker et al., 2013).[8] The committees are in charge of analysing water bodies and promoting co-operation among local authorities, the public and water users.

2.2. Horizontal and vertical co-ordination

In line with Icelandic tradition, government policies are developed through consultative frameworks that encompass virtually all stakeholders. The Welfare for the Future strategy was developed by an interministerial co-ordination committee led by the Ministry for the Environment. Every other year the ministry calls a two-day meeting, the Environmental Congress, which is legally required to discuss progress towards sustainable development and progress in nature conservation, alternating these two subjects every other year. The congress is open to all interested parties, including members of the Parliament, businesses, local authorities, academia and non-government organisations (NGOs). Participation is free of charge and the proceedings are streamed live over the Internet.

At the working level, ministries and agencies dealing with environment-related matters hold regular meetings, as in the case of the MENR and the MII, which hold a two-day policy conference each year to discuss major issues of common concern. The interagency co-operation is also carried out through topic-specific working groups. For example, the Steering Committee on Waste Electrical and Electronic Equipment is supported by the EAI, and the Co-ordination Group on Preventing Industrial Accidents was set up by the Icelandic Occupational Health and Safety Administration. Both involve government agencies, municipalities and business. A steering committee on climate change led by the MENR analysed Iceland's mitigation potential and the feasibility and cost-effectiveness of individual actions, and developed a post-2012 action plan to reduce net greenhouse gas emissions (Chapter 4). Although co-operation is not required by law, the EAI and other agencies ensure day-to-day co-operation while issuing environmental permits and licences.[9]

Advisory bodies have been created on cross-cutting priority issues. For example, the Water Council, composed of representatives of ministries involved in WFD implementation and of the Association of Local Authorities, advises the environment minister. A co-ordination committee on nature conservation and biodiversity, led by the MENR and consisting of representatives of key ministries, meets before conferences of the parties to the Convention on Biological Diversity and other key events.

The MENR is also active in ensuring co-ordination among its subsidiaries. Each agency's budget and operating plans are prepared in direct co-operation with the ministry. This allows for detailed planning and allocation of adequate resources. Formal co-ordination

and consultation meetings between the MENR and each agency are held once or twice a year. Contacts between the ministry and the EAI are even more frequent. In addition to two management meetings (usually in April and October) between senior staff, monthly meetings are held to discuss implementation of EU legislation.

Co-ordination of environmental policies between national and subnational levels is ensured through regular contacts between the EAI and the Health and Safety Committees. Other forms of co-ordination include an annual meeting in Reykjavík attended by all LHEI employees and most staff from the EAI Department of Environmental Quality; monthly teleconferences between EAI and LHEI directors to improve information flow; and regular contact in the context of thematic working groups on permitting and inspection, on chemicals and on local health issues.

3. Environmental policy and performance evaluation mechanisms

3.1. Environmental monitoring and reporting

With its low population density and historically low pressures on the environment, the country's environmental monitoring system has remained rudimentary. Most emphasis has been placed on monitoring contaminants in marine biota and seafood products from Icelandic waters under the obligations of the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) and the Arctic Monitoring and Assessment Programme. Sea water quality is measured in the dilution areas of two wastewater outfalls near Reykjavík, while monitoring of rivers and streams focuses on chemical composition and flows. Monitoring of Lake Mývatn has been carried out since 1970. Monitoring was extended to Lake Hafravatn in 2000 and Lake Þingvallavatn in 2006. Monitoring of drinking water quality is strict, as water used by Reykjavík residents is not treated before consumption. Ambient air quality is measured by 11 monitoring stations, all of them set up before 2002 and most of them around the capital city. Some of these stations, which measure key pollutants,[10] are operated by the EAI, others by municipalities and health inspectorates. Preparations are under way to expanding measurement, notably to cover heavy metals and polycyclic aromatic hydrocarbons (PAHs).

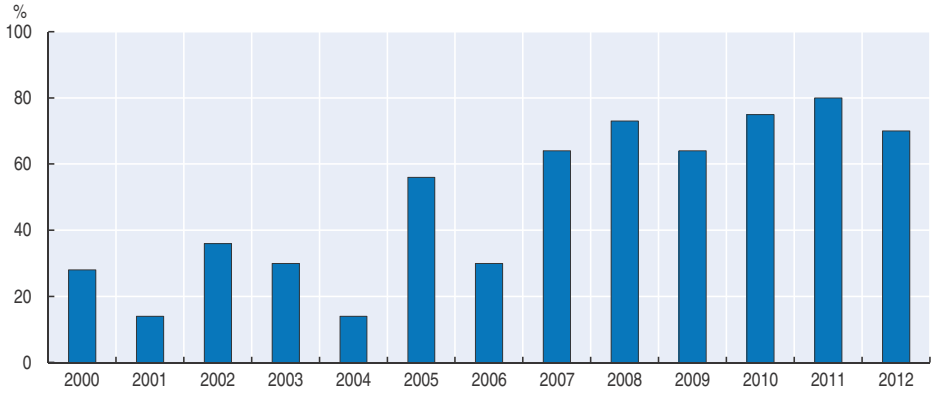
Requirements for self-monitoring by industrial facilities have been strengthened through environmental permits. For example, almost all lowland areas near the Alcoa Fjardaál aluminium smelter in Reyðarfjörður have to be monitored by the operator. This includes collection of air, water and soil samples to assess the smelter's possible environmental impact. The environmental permits contain lists of substances subject to monitoring, plus locations and schedule of measurements. Among the substances measured are sulphur dioxide, gaseous and particulate fluoride, airborne particulate matter and PAHs. The results are compared with the background levels recorded before the construction of the smelter.

Work is under way to improve monitoring of volcanic activities in Iceland and give earlier warning of possible volcano eruptions and associated pollution. The EU-funded FutureVolc project involves increasing the number of sensors and improving real-time data analysis.[11] It is a response to the 2010 eruption of Eyjafjallajökull, which closed down much of European airspace. It is hoped the work will enable better detection of imminent eruptions and mapping of their evolution. FutureVolc, led by the International Meteorological Organization and the University of Iceland, involves 26 groups, including research institutes from other countries. As part of the project, new monitors will be fitted

in the most active regions, including around Eyjafjallajökull and Katla, one of Iceland's largest volcanoes.

In recent years, Iceland has put increased emphasis on standardising and improving the gathering, transferral and reporting of environmental data. A key focus is active participation in the European Environment Agency and its work in establishing and improving the European Environment Information and Observation Network (Eionet). The increased efficiency in data collection and management is reflected in Iceland's improved scoring on Eionet priority data flows, from 30% in 2000 to 70% in 2012 (Figure 2.1).[12]

Figure 2.1. **Iceland's benchmarking results for data delivery to the European Environment Agency in 2000-12**



Source: EEA (2014), EIONET Priority Data Flows.

StatLink http://dx.doi.org/10.1787/888933087458

Despite improvements, the monitoring system may not provide sufficient information for protection of human health and ecosystems. In some instances, lack of measurement resulted in exposure of the population to higher levels of pollution. For example, the 2011 report by the National Audit Office concluded that the EAI and the MENR had not ensured adequate monitoring of waste incineration, which led to elevated concentrations of dioxins in urban areas (Box 2.2). In other instances, lack of adequate monitoring prevented appropriate identification of causes of environmental incidents. For example, an unexplained massive death of herring in Kolgrafafjörður in 2013 prompted the increase of funding for monitoring of the area to determine preventive measures.[13] There is also no adequate long-term monitoring of changes in terrestrial ecosystems, and indicators related to sustainable land use are missing. Iceland's environmental monitoring and information system, including at local level, would benefit from in-depth review aimed at creating a comprehensive, well-co-ordinated system that supports policy development and implementation. Such a review should facilitate adoption of a long-envisaged implementation plan for environmental monitoring.

3.2. Environmental impact assessment

The procedures for environmental impact assessment of projects, in place since 1994, were revised in 2000 and 2005 (EIA Act, No. 106/2000, and EIA Regulation, No. 1123/2005) to align with EU requirements. Similar to the EU legislation, the EIA Act lists in Annex 1 projects for which EIA is mandatory and in Annex 2 those that may be subject to EIA after

Box 2.2. **Investigation of dioxin pollution from waste incineration**

In 2010, a dairy products distributor in the West Fjords district reported high levels of dioxin in cow's milk. An investigation showed that the dioxins originated from a waste incinerator in Ísafjörður at times were 20 times higher than allowable limits. Further studies carried out elsewhere in the country showed that dioxin levels from incinerators in the Westman Islands and in Kirkjubæjarklaustur were even higher and that the exceedances had been recorded over several years.

Following the discovery, the National Audit Office (NAO) analysed in 2011 the implementation of environmental regulations concerning waste incineration plants in Iceland. Iceland had requested that its operating waste incinerators be exempted from the provisions of the 2000 EU directive that introduced strict requirements regarding maximum emissions of air polluting substances from waste incineration plants. The exemption, which was granted by the EU in 2003 to seven waste incinerator plants, was justified by low levels of pollution and excessive costs of meeting the requirements. The exemption from the provisions of the directive was granted under three conditions: first, the relevant waste incinerator plants had to measure annual emissions of specified pollutants and fulfil the provisions of an older EU directive which had been implemented in Iceland; second, the plants had to carry out spot check measurements of dioxin emissions; and third, the exemption was to be reviewed after five years, when less expensive technology would allow the plants to meet the requirements of the directive.

The 2011 NAO report concluded that the Ministry for the Environment did not sufficiently comply with the requirements of the exemption and did not ensure that all aspects of the requirements were explained to the waste incineration operators. The report also stated that the request for the exemption was not supported by appropriate documentation and that the Ministry for the Environment did not take the initiative in reviewing the exemption. The NAO asked the ministry to prioritise the formulation of a comprehensive policy regarding waste disposal in Iceland, based on the results of research and professional assessments, with a particular emphasis on evaluating which waste incinerator plants should continue operations. It also asked the EAI to ensure that waste incineration plants conformed with laws and regulations and that the results of pollution measurements were provided to incineration plant operators, the environment ministry and the public.

After the publication of the report, the EAI launched a process of improving its operations and tightened monitoring of all types of polluting operations. Exemptions from the EU directive were revoked at the end of 2012. The waste incinerator in Ísafjörður was permanently closed in 2011 and that in the Westman Islands in 2012. Currently only one out of the seven plants remains in operation.

Source: National Audit Office (2011), "A Comprehensive Policy Regarding Waste Disposal Needs to be Formulated".

screening procedures, which determine the effects of projects on the basis of thresholds/criteria, or a case-by-case examination. Iceland's regulations adjusted the thresholds, but also widened the scope of the projects subject to EIA, reflecting local conditions (Table 2.1). The new requirements were strengthened by laying down procedures, including time limits, for informing and consulting the public on projects falling under the scope of EIA criteria (Government of Iceland, 2009).

Table 2.1. **Examples of EU and Icelandic thresholds for projects subject to EIA procedures**

EU regulations *(Directive 85/337/EEC with subsequent amendments)*	**Icelandic regulations** *(EIA Act No. 106/2000 as amended by Act No. 74/2005, the EIA Regulations No. 1123/2005)*
Annex 1	
Thermal power stations and other combustion installations with a heat output of 300 MW or more.	Geothermal power stations and other thermal power installations with a heat output of 50 MW or more and other power installations with an electricity output of 10 MW or more.
Construction of a new road of four or more lanes, or realignment and/or widening of an existing road of two lanes or less so as to provide four or more lanes, where such new road, or realigned and/or widened section of road, would be 10 km or more in a continuous length.	New roads outside of urban areas which are 10 km or longer. Rebuilding of roads outside of urban areas where the planned new construction is at least 10 km in length.
Annex 2	
Initial afforestation and deforestation for the purposes of conversion to another type of land use.	Initial afforestation of areas 200 ha or larger, or in protected areas, and deforestation of natural forest areas.
Quarries, open-cast mining and peat extraction.	Quarrying on land or on the sea floor where planned extraction disturbs an area of 25 000 m^2 or more, or amounts to 50 000 m^3 or more. Quarrying where more than one extraction site for the same project and in the same area extend over a total area of 25 000 m^2.

Source: United Nations University (2010), *Environmental Impact Assessment: Iceland*.

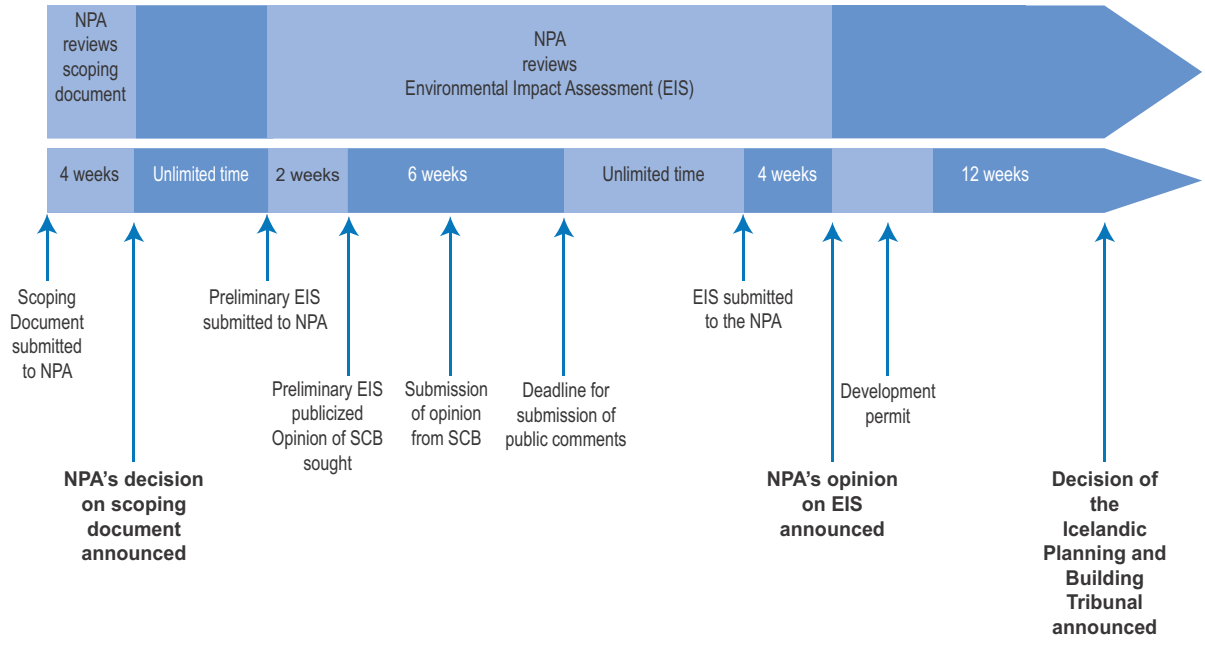
As in other countries, developers initiate the EIA process by assessing whether a project is covered by Annex 1 or 2 of the EIA Act, and, if so, notifying the National Planning Agency (NPA), the competent authority for EIA. The developers are responsible for preparing the assessment, which includes compiling data, overseeing research that is carried out at all stages of the assessment process, and preparing the scoping document, including the preliminary and final environmental impact studies. The developers also bear the cost of the EIA and of the NPA's case handling.

Since the introduction of the EIA legislation, the NPA has been the key government agency overseeing EIA procedures at all stages (Figure 2.2).[14] Regarding Annex 1 projects, the NPA makes a decision on the developer's scoping report proposal and finally gives an opinion on the developer's environmental impact study. Regarding Annex 2, the agency screens proposals and decides which are to be subject to EIA. It also seeks the opinions of other statutory consultative bodies, and consideration is given to criteria in the regulations (Annex 3) concerning the nature and characteristics of the project, as well as its impact.[15] The criteria are intended to ensure that decisions concerning EIA obligations are clear and transparent.

To facilitate preparation of the EIA, the NPA issues guidelines for classification of environmental factors, criteria, environmental impact attributes and concepts for assessing impacts. The NPA operations are transparent: anyone may report a project to it or submit a query on whether a project must undergo EIA. Stakeholders can appeal its decisions to a government-appointed board, e.g. on whether an Annex 2 project should be subject to full EIA or whether there should be reappraisal of the impact statement.

The revision of the EU EIA legislation and a controversy over a hydropower project in 2003 were a catalyst for change in how EIA is undertaken. In this case, the Kárahnjúkar hydropower plant project received a construction permit in spite of an initial rejection by the NPA after the EIA procedure (Box 4.4). In response, amendments made to the EIA Act in 2005, which aligned it with EU requirements, limited the role of the NPA to providing

Figure 2.2. **The environmental impact assessment process in Iceland**



EIS: Environmental Impact Study. It includes the Preliminary EIS plus comments from the public, opinion of the SCB and the developer's response.
Preliminary EIS: a report on the assessment of the environmental impact of the proposed project and resulting activities.
Scoping document: a document prepared by the stakeholder, describing the aspects of the project and the environment that will be emphasised in the EIS. It also contains a plan for public participation and consultation on the EIS.

NPA: National Planning Agency.
SCB: Statutory Consulting Bodies.

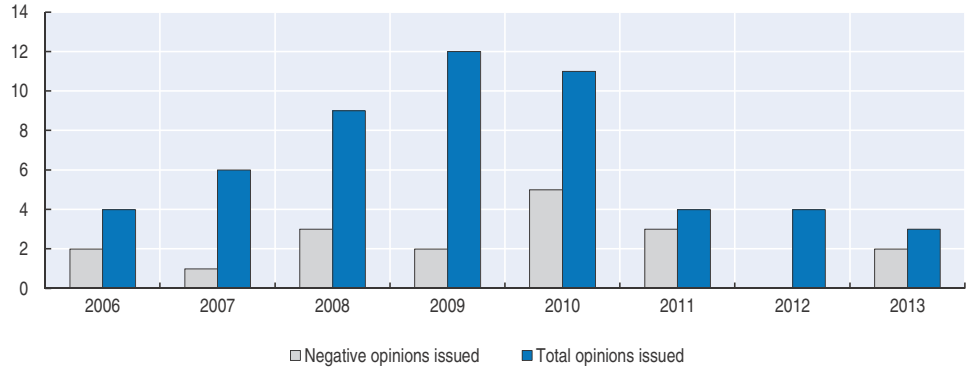
Source: Adapted from National Planning Agency

opinions on EIA rather than being able to approve or reject applications.[16] This change raised concerns that EIA procedures would become too lax, allowing local authorities to approve projects detrimental to the environment. However, the new arrangement contains precautions to address this concern; namely, that the NPA's advice must be taken into account when a local authority issues a permit, and the issuance of a permit can be challenged before a government-appointed body.[17]

The major aim of the change was to shift the locus of environment-related decision making to local authorities, and to allow the NPA to concentrate on assessing environmental impact rather than deciding whether projects could go ahead. Between 1994 and 2005, the NPA issued decisions regarding EIA for 178 Annex 1 projects, only two of them negative, and in four other cases the NPA partially rejected projects. From 2006 to 2013, the NPA issued 53 reasoned opinions, of which 18 were negative (Figure 2.3). No project that received a negative opinion after 2005 was implemented, but this was due to other, mostly financial, problems. Thus, there is evidence that the EIA legislation and NPA procedures have enabled the assessment of potential environmental implications of important investments to influence decisions about whether and how they should proceed.

However, some project developers claim that the EIA procedures, combined with other regulatory instruments such as permitting, are too complex and time consuming. They require multiple meetings, often with the same agencies (e.g. municipalities, the MII, the MENR, the EAI, the NPA). Other limitations include limited requirements for assessing costs and benefits of environmental impacts or proposed projects and alternatives, lack of assessment of cumulative effects and a limited pool and inadequate capacities of experts who are hired to carry out EIA research for the project backers. There seems to be scope for simplifying the process, while not relaxing any of the required standards, and building capacity for independent, professional preparation of EIAs.

Figure 2.3. **Number of EIA opinions issued by the National Planning Agency of Iceland in 2006-13**



Source: National Planning Agency of Iceland (2013), Ákvörðun um matsáætlun [Decision on EIA], website.

StatLink http://dx.doi.org/10.1787/888933087477

3.3. Strategic environmental assessment

Iceland has been among the pioneering countries in applying environmental assessment to plans. Since the early 1990s such procedures have been part of independent planning scenarios carried out as a part of municipal land-use planning. The procedure was formalised under the 1997 Planning and Building Act (No. 73/1997, 135/1997 and 58/1999), which required all local and some regional plans to be subjected to assessment of their environmental impact. Two early examples of strategic environmental assessment (SEA) of national plans for infrastructure projects were the Master Plan for Hydro and Geothermal Energy Resources (Chapter 4) and a 2003 afforestation plan for northern Iceland.

The EU SEA directive (2001/42/EC) was formally transposed in 2006 in the Act on Environmental Assessment of Plans and Programmes (No. 105/2006). In the early stages of transposition the SEA requirements were proposed as an integral part of the new Planning Act, but eventually a separate law was adopted. The bill was prepared by an interministerial committee appointed by the environment minister in 2002.

The act follows all main principles of the EU SEA directive, including requirements for types of plans and programmes subject to SEA, environmental effects identified, and principal procedures. SEA continues to be applied to municipal and regional land-use plans as well as plans and programmes that are prepared or adopted by government authorities and include projects that fall under the EIA Act.[18] Adopted plans must take into account

not only the report identifying and evaluating likely significant environmental effects of the plan or programme, but also the outcome of public consultations.

Formal responsibility for SEA rests with the MENR, though operational responsibility lies with the NPA, which decides which plans and programmes meet the legal criteria in case of uncertainty, reviews draft plans and programmes, and reports to the environment minister on SEA applications. These NPA decisions can be appealed to the environment minister.

Since the adoption of the SEA Act in 2006, assessments have been made of plans such as the National Transport Programme 2007-18, a regional 2005-20 waste management plan and a plan for oil exploration in the Dreki area on the Jan Mayen Ridge (United Nations University, 2010). The experience gathered through SEA has helped strengthen procedures and build the capacity to carry them out. In 2007, the NPA issued general SEA guidelines on meeting the legal stipulation that SEA is applied to municipal and regional plans as well as to sector plans and programmes. Building upon the approach used in municipal planning guidance issued in 2003, the guidelines provide detailed procedures for the screening of plans and programmes likely to become subject to SEA, for preparation of environmental reports and for consultations, decisions and monitoring.

Assessment of costs and benefits of pending legislation, a process known as regulatory impact assessment (RIA), can significantly improve the quality of new regulations. Although RIA was applied to selected regulations in the 1990s on a trial basis, currently there are no formal requirements for RIA, and no such analysis has been carried out thus far on proposed regulations.

4. Environmental permitting, enforcement and compliance assurance

4.1. Environmental permitting

Since the introduction of integrated pollution prevention and control (IPPC) permitting in 1998, this instrument has been applied to a growing number of industrial installations. To date, 129 installations have received an integrated permit, up from 20 in the late 1990s. Most permits for large installations (those falling under the EU IPPC Directive) are issued by the EAI. For historical reasons, some large food production facilities have permits issued by local health and environment inspectorates.[19] Licensing of small and medium-sized enterprises is carried out by the LHEIs in the 10 local health committees. The EAI uses its website to inform the public where all installations with IPPC permits are located. An interactive map shows the geographical location and links to a copy of the facility's permit, latest inspection report and recent enforcement activity.

Building on the experience accumulated from early application of integrated permitting, the procedures have been reformed to reduce the regulatory burden while ensuring environmental protection. The changes included extending permits' validity from 8-10 years to 16 years (or 12 years for permits issued by an LHEI),[20] consolidating good practices for permitting in the EAI Quality Manual and establishing co-ordination mechanisms, such as monthly meetings among permit writers. A regulation adopted in 2012 established closer links between permitting and EIA (IMPEL, 2012).

As with EIA, however, there are concerns that the permitting procedures are complex, haphazard and time consuming. Some developers claim that the EIA and permitting procedures still duplicate each other and require multiple meetings with the same agencies. The fact that the EAI charges between EUR 800 and EUR 4 000 to treat a permit

application (depending on the category of installation, which is in line with international practice), and has no mandatory deadline for processing the application, may contribute to complaints. The capacity of the EAI and LHEIs for permit preparation is also a limiting factor. The EAI is expected to process several permits a year and assist the LHEIs, but has only three full-time permit writers (one working temporarily), and there is no formal training available to upgrade skills or improve knowledge of the latest regulatory and technical developments. The regulated community is also concerned about too strict permitting requirements for operations with negligible environmental impact (IMPEL, 2012). The sharing of permit responsibilities among various state agencies and between the EAI and LHEIs is not conducive to coherence in the permitting process or to developing a critical mass of expertise. There are only limited opportunities for permitting agencies to exchange experience and good practices, and to provide explanations and support on permit conditions to the regulated community. An independent assessment of the permitting regime and related institutional framework would be useful to identify major bottlenecks and effective, efficient solutions. It should be accompanied by the elaboration of a performance measurement system with uniform input, output and outcome indicators and data reporting procedures.

4.2. Compliance monitoring and non-compliance response

Growth in the number of permitted installations led to development of a more comprehensive framework to ensure that they were operated in accordance with permit conditions. The frequency of inspection depends on the type and size of installation, with the largest and most complex (Class 1) being inspected twice a year and the low risk (Class 5) only upon a complaint. Provisions allow the EAI to reduce inspection frequency if the operator has an EMAS or ISO 14001 certification. This approach is now being used more widely as the number of ISO 14001 certifications issued annually increased from 2 in 2000 to 29 in 2012 (ISO, 2012). Inspection frequency may also be reduced upon request by the operator, if the operator has an internal control management plan or has complied with permit and legislation requirements for four years. An Inspection Quality Manual, based on provisions of the EU Recommendation for Minimum Criteria for Environmental Inspections, sets out procedures to help inspectors gather information prior to and during routine inspections. In early 2012 the EAI created a database of inspections, recording their scope, duration and the time the report was delivered to the operator. The data generated is used by managers in workload planning to allocate time and adjust inspection plans. Information about each permitted installation is publicly available on the EAI website, including its permit and, since 2011, all inspection reports. The EAI also holds records of an installation's environmental monitoring.

Compliance monitoring and inspections are mostly carried out by the LHEIs, which handle all small activities (those not within IPPC scope), as well as the IPPC installations for which they issue permits. The LHEIs also monitor some IPPC facilities on behalf of the EAI, which contracts out the work on these installations (e.g. 15 waste management, fish farming and fish food factories in eastern Iceland) to the LHEIs due to staff constraints but also, in some cases, because the installations have good environmental performance records. Even when the LHEIs carry out inspections, however, the EAI issues the inspection report to the operator (except for waste management facilities), and carries out enforcement actions in cases of non-compliance. The EAI charges each installation a fixed sum per inspection, ranging from EUR 1 000 for Class 5 sites to EUR 3 500 for Class 1 sites.

This includes a fixed (average) fee for preparation and travelling time, no matter where the installation is located or what type of installation it is (IMPEL, 2012).

In addition to regular planned inspections, the EAI carries out thematic inspections as part of its routine inspection plan. There is no set procedure for establishing priorities for these, though the topics are discussed and agreed within the EAI. Thematic inspections are usually based on recent or expected developments and include a specialist in the relevant field. Currently, thematic inspections are being carried out on REACH (information collection and communication) and the WFD (assessments of discharges). Inspectors can also undertake non-routine inspections in cases of complaints or of irregularities in the information provided by the operator, as well as enforcement fulfilment inspections and random checks. The EAI carries out desk-based "inspections" in some instances, such as the assessment of monitoring information four times per year, but does not record these as actual inspections and consequently does not charge the operator the usual inspection fee.

At the 123 installations inspected in 2011, 193 incidents of non-compliance were recorded, of which 129 were related to waste management. Response to non-compliance findings is generally good. Around 50% of the 193 incidents were corrected without further action, while in a further 25% of the cases the operators agreed a schedule for improvement that the EAI approved (IMPEL, 2012).

All incidents of non-compliance are followed up by an enforcement specialist at the EAI. Often the incidents are corrected shortly after the operator receives the inspection report. In case of continuous non-compliance, enforcement can include a formal warning and fines, usually ranging from EUR 325 to EUR 650 per day, up to a maximum of EUR 3 250. Fines are paid to the government, not the EAI, which discourages use of excessive penalties. If there is an imminent threat to the environment, the EAI can either order operations to stop or can close down a site. All fines imposed thus far have been paid, and no operator has ever appealed a fine. Decisions regarding formal warnings and fines are published on the EAI website and in a press release, so it is likely that operators respond quickly to avoid bad publicity.

Environmental court cases have been extremely limited. The EAI has not been successful with criminal prosecutions so far. It has attempted to bring criminal charges but most non-compliance conflicts have been solved out of court. In recent years the EAI has sent no pollution incidents to police or prosecutors. Very difficult cases of enforcement included the closure of waste incineration plants in 2011-12 in three villages (Box 2.2). The Environmental Board of Appeals for environmental and natural resource issues (Section 5.2) is the final step before the courts.

5. Promoting environmental democracy

5.1. Access to environmental information and public participation in environmental decision making

Iceland has a long tradition of open and free access to information, including on environment. The pioneering 1993 Public Access to Environmental Information Act established the rights of individuals, including non-residents, and legal entities to get access to environmental information without having to state an interest. The law also required government bodies to provide a written explanation for delaying information provision more than seven days. These rights were included in other laws[21] and strengthened in 2006 through the Act on the Right of Access to Information on

Environmental Matters (No. 23/2006), transposing the EU Directive on Public Access to Environmental Information (2003/4/EC). The act reinforced access to information on environmental matters held by public authorities "in order to promote stronger awareness of environmental protection, free exchange of ideas and better public participation in decisions related to the environment". It introduced requirements for proactive dissemination of information, set minimum requirements concerning the time within which public authorities must provide information and applied the access rights not only to documents held by public authorities but also those held by others on behalf of a public authority. The act also made it possible to appeal a government refusal of access to information on environmental matters to a special Appeal Committee for Information Access.

The right to access to information by the public is matched by the duty of public authorities to provide information. The MENR makes available lists of all valid legislation and regulations on environment and lists of all international environmental agreements ratified by Iceland. Many plans and policies regarding environment are publicly available, especially on the Internet, which has become the main means of providing access to information. As noted earlier, the EAI uses its website to inform the public about the location of every installation with an IPPC permit. An interactive map shows the location, and there are links to a copy of the facility's permit, its most recent inspection report and recent enforcement activity.[22]

Significant efforts have been made to present information on the state of the environment in ways that can encourage knowledge-based decision making and raise awareness on the part of the Icelandic population. The pioneering role was played by the city of Reykjavík, which since 2002 has presented a report on its environmental performance showing 15 indicators concerning six themes: impact of global warming, use of natural resources, water quality, transport, biodiversity and quality of the natural environment. This experience has allowed a nationwide system of environmental indicators to be built up. In 2005 the EAI published an extensive set of indicators to show progress in implementation of the Welfare for the Future strategy. The indicators, now updated annually, provided a basis for the development of a comprehensive state of the environment report, Environment and Natural Resources: Are We Heading towards Sustainable Development?, published in 2009. The EAI and Statistics Iceland publish detailed annual reports with environmental statistics and indicators. Detailed information on environmental quality is also provided at local level through municipal state of the environment reporting and, increasingly, in real time.

Wide access to information has been associated with the traditionally open participation of the public in policy and decision making. In terms of civic and political participation, Icelanders are more active than the citizens of any EU country. In all, 61% took part in some such activity over a 12-month period, compared with 25% in the EU27. This includes both direct personal participation – such as contacting a politician or official and attending a meeting or demonstration (37%, more than twice the EU27 average of 16%) – and self-expression via petitions, including online (46%) (Eurofound, 2013).

All stakeholders, including NGOs, extensively use opportunities to review and comment on policy proposals, both in writing and by appearing before parliamentary committees, sometimes at several stages of policy development. In the 2000s, public opinion was sought during the development of major government policy papers, such as

Welfare for the Future, the National Plan on Managing Waste and the Climate Change Action Plan. Every other year, the MENR calls a two-day Environmental Congress open to NGOs, academics, members of the Parliament and city councils, and any other interested parties (Section 2.2). Though there are no special requirements regarding public participation in the legislative process, stakeholders and NGO representatives are regularly appointed as members of ministerial committees in the preparatory phase for a bill or in reviews of existing legislation.

Several environmental laws include strong provisions for public consultation and participation in decision making. The laws on EIA, SEA, environmental permitting and land-use planning give the public the right to voice its opinion on proposals for public projects and programmes covered by these laws before final decisions are made. The legislation contains precise rules, including the scope of public consultations and the time needed for them.

The last decade witnessed several cases of applying these provisions in practice. While controversies have been dealt with within the consultation procedures on most projects, some larger proposals have generated heated debate. The construction of dams for hydropower production and metal smelters have generated particular tensions and resulted in protests by environmental groups. With areas of exceptional beauty covering most of Iceland's territory, there is constant fear of irreversible damage being inflicted, resulting in strong public sentiment against local development projects. This in turn has motivated developers to limit public participation, with negative consequences for quality of decisions. The lack of economic analysis of costs and benefits of the impact of investment decisions also contributes to the adversarial character of consultations. Recent steps in discussing the Master Plan for Hydro and Geothermal Energy Resources provided a good platform for consultation on controversial projects and led to consensus on various elements of the plan (Chapter 4).

5.2. Access to justice

The Icelandic legal system guarantees equal access for all to a judicial procedure that is fair, equitable, timely and not prohibitively expensive. The procedure for access to justice in environmental cases is the same as in general civil and criminal proceedings. For example, the 1991 Act on Civil Procedure (No. 91/1991) ensures that both natural and legal persons have the right to bring a case before the courts, provided that all conditions for so doing are met. Some acts set out restrictive conditions to be a party in a case before a court or a party to an administrative complaint. To appeal a decision made on the basis of the EIA Act, the Act on the Environmental and Natural Resources Board of Appeal (No. 130/2011) requires an NGO to be registered in Iceland, have public and open membership with at least 30 members, publish annual reports of its activities and have its accounts audited. The issue on which the complaint is made must be in line with the NGO's stated purpose (Government of Iceland, 2009).

Iceland signed the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters in 1998, but ratified it only in 2011. The delay was related to a lack of national legislation on access to justice, although the overall performance in implementing this part of the convention was good. Ratification was made possible by the adoption of Act No. 130/2011, which set up the Environmental and Natural Resources Board of Appeal for environmental and natural resource matters. This makes it possible to review decisions on permits for operations that

fall within the scope of the EIA legislation. The board's several members rotate after four years (five years in the case of the chairperson). If the EAI and the board cannot find a satisfactory solution, the courts are the next stage in the review process.

The board's activities help expedite appeal procedures and avoid extended, time-consuming courts proceedings. The duration for processing complaints related to environmental matters has not been generally established, but has averaged more than three months because the cases are often complex and require extensive data collection and research. No overall assessment of the length of judicial cases relating to the environment has been carried out, though there is nothing indicating that they take longer than other court cases. Lodging a complaint through the Environmental Board of Appeals is free of charge. Iceland's legal system also provides the possibility of free legal aid to individuals involved as parties in civil court actions.

5.3. *Environmental education*

Environmental education has been high on the agenda of Iceland's successive governments. The 2002 Welfare for the Future strategy identified environmental education among the key pillars of sustainable development. The 2005 and 2009 reviews of the strategy said additional attention was needed to step up environmental education efforts and set a number of specific objectives to deepen and broaden environmental awareness raising across the whole spectrum of educational institutions.

The policy framework has been supported by dedicated institutions – such as an environmental education committee, appointed by the environment minister – that promote collaboration on environmental education and carry out surveys on the status of environmental education in schools, with the aim of increasing and improving the environmental education that is offered. In recent years, the National Centre for Educational Materials has published a considerable amount of study material in the field of environmental education.

These continuous efforts resulted in the introduction of environmental components at all educational levels, from preschool to university. At the preschool level, nature and environment courses emphasise the values of nature and the environment and explain how to protect them. In recent years, many preschools have designed individual projects focusing on the environment. At the compulsory school level, education on environmental issues and sustainable development is interwoven with the objectives of courses in natural and social science, especially those related to geography, economics and life skills. Emphasis is placed on relating the subject matter of these courses to the interplay between humans and nature, the concept of responsible citizenship and the role of individuals as consumers, with reference to healthy consumer habits. Progress has also been made at the tertiary level: the University of Iceland now offers a master's degree in environmental studies and a growing number of higher schools offer areas of specialisation in natural science, ecology and environmental studies.

Many schools participate in the Green Flag programme, an international initiative aimed at enhancing environmental education in the school system. The Icelandic environmental association Landvernd has overseen this project with funding from the Ministry of Education, Science and Culture and the environment ministry. In 2006, Landvernd formally recognised the first upper secondary school for its participation in the Green Flag programme. School participation in the programme has increased since then: in

2013, over 200 schools (accounting for about half of all preschool and primary school children in Iceland) participated in the programme.

Educational efforts are supported by municipalities. For example, the city of Reykjavík operates the Reykjavík Municipal Work School in the summer and the Reykjavík Nature School in the winter, where children and young people receive focused information about environmental concerns while learning to cultivate gardens in the urban area (City of Reykjavík, 2012). The Nature School also provides training for teachers in primary/lower secondary schools and preschools in order to enhance their skills in environmental education methods. Over twenty schools in Reykjavík have been allocated adjacent areas to be utilised as outdoor classrooms to encourage knowledge and awareness of the natural value of the surrounding areas.

Notes

1. The themes were: 1. Clean Air, 2. Clean Freshwater, 3. Safe Food Products, 4. An Environment Free of Hazardous Materials, 5. Outdoor Activities in Harmony with Nature, 6. Protection Against Natural Disasters (in the Healthy and Safe Environment section), 7. Protection of Iceland's Biota, 8. Protection of Unique Geological Formations, 9. Wilderness Conservation (Conservation of Icelandic Nature), 10. Use of Living Marine Resources, 11. Sustainable Use of Vegetation and Reclamation of Land, 12. Increased Utilization of Renewable Energy, 13. Reduction and Improved Handling of Waste (Sustainable Use of Resources), and 14. Clean Ocean, 15. Limitation of Climate Change, 16. Protection of the Ozone Layer, 17. Protection of Biodiversity (Global Issues).
2. In May 2013, the Icelandic government put the EU accession negotiations on hold.
3. The authority can bring cases to court when a country fails to address harmonisation and implementation gaps.
4. In the first phase of the strategy (2004-08) the main emphasis was on sites important for some bird species and vascular plants. The second phase (2009-13) focused on sites important for the protection of vascular plants, moss and lichens, three natural habitat types and three invertebrate species.
5. The 2012 reorganisation resulted in the creation of the Ministry of Industries and Innovation (MII), which brought together parts of the Ministry of Fisheries and Agriculture, the Ministry of Industry, Energy and Tourism, and the Ministry of Economic Affairs. The MII is headed by two ministers: fisheries and agriculture (who also serves as the minister of environment and natural resources) and industry and commerce.
6. They are the Environment Agency of Iceland, the National Planning Agency, the National Land Survey, the Construction Authority, the Soil Conservation Service, Iceland Geosurvey (key provider of scientific and technical expertise to the geothermal industry), the Forest Service, the Institute of Natural History, the Recycling Fund, Vatnajökull National Park, the Meteorological Office, the Stefanson Arctic Institute, the Institute of Freshwater Fisheries and the Lake Mývatn Research Station.
7. Iceland has two levels of administrative division: central government and 74 municipalities. Each municipality is governed by a municipal council. Elections are held every four years. Most municipalities hire a professional executive manager (from the municipal council or independent), usually referred to as mayor (*bæjarstjóri*) in urban municipalities or commune manager (*sveitarstjóri*) in rural or mixed municipalities.
8. The country as a whole is classified as a single water district. For organisational purposes, the district is divided into four subdistricts, each managed by a subdistrict committee.
9. Examples of other agencies include the National Energy Authority, the Marine Research Institute and the Icelandic Tourist Board under the MII, and the Road Traffic Directorate under the Ministry of the Interior.
10. These are NO_x, SO_2, H_2S, O_3, CO, PM_{10}, $PM_{2.5}$, CH_4 and selected non-methane hydrocarbons.
11. The monitors can detect minute movements or tremors and detect curving of the Earth's surface around volcanic sites (known as "inflation"), which could indicate magma build-up.

12. Eionet priority data flows aim to show progress against agreed, stable and well-defined criteria, allowing countries to identify and confirm the institutional resources needed for regular reporting. Progress is assessed against criteria for 13 regular priority areas, now including reporting for the European Pollutant Release and Transfer Register. Information is also provided for three additional data flows: reporting to the European Environment Agency on near real-time ozone, water quantity, and emissions to water. A result of 0% means no data have been delivered; 100% means complete data sets for all areas have been delivered on time.

13. The value of around 10 000 tonnes of fish found dead in January 2013 was estimated at ISK 1.25 billion (EUR 8.4 million). Even more fish were found dead in December 2012. Icelandic researchers blamed low winter oxygen levels in a shallow fjord but some blamed recent construction of a bridge crossing the fjord for the incidents.

14. The NPA also provide advice on planning and building issues, assists local authorities in preparing spatial plans and reviews the completed plans.

15. The preliminary environmental impact study must be easily accessible at a location near the project site and at the NPA for six weeks, which is also the time limit for submitting written comments to the agency. Anyone may comment on the impact study. The statutory consultees must express their view as to whether the study has adequately discussed aspects within their area of concern and whether the proposed mitigating measures are satisfactory. If there is cause, they must also specify what should be investigated further and point out possible mitigating measures.

16. Before the 2005 EIA amendment, the NPA was responsible for determining whether a project was subject to EIA procedures, issuing decisions on the developer's EIA scoping document and issuing final decisions on proposed projects and resulting activities, based on the developer's environmental impact statement.

17. The 2005 revisions specified that only groups with over 30 members could bring such appeals, however.

18. Excluded from SEA requirements are plans and programmes solely intended for national defence or civil emergency, as well as financial and budget plans and programmes, including the national and municipal budgets.

19. They include slaughterhouses and facilities for disposal and recycling of animal carcasses.

20. Integrated permits are reviewed every four years, but this may not necessarily imply changing permit conditions. A review also takes place following reports of non-compliance with regulations, and when new pollution control rules or major changes in best available techniques are adopted.

21. An example is the 1996 Information Act, which broadened access to information to other public policy spheres.

22. Iceland has transposed EU Regulation EC/166/2006, establishing a European Pollutant Release and Transfer Register, but the system has not yet been launched.

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PART I

Chapter 3

Towards green growth

Part of Iceland's response to the 2007-09 economic and financial crisis has been an increased emphasis on green growth. This chapter examines the use of taxes and other pricing instruments to pursue environmental objectives and to reduce the impact of production and consumption on the environment. The removal of environmentally harmful subsidies, such as to agriculture and fossil fuels, is also discussed. The chapter examines the public and private investment in environment-related infrastructure and services, as well as the promotion of "green" goods and services and eco-innovation. Finally, Iceland's efforts to mainstream the environment in development co-operation programmes are reviewed.

Assessment and recommendations

Part of Iceland's response to the economic and financial crisis has been an increased emphasis on green growth. A 2011 parliamentary report, The Strengthening of the Green Economy in Iceland, is a potentially important means of promoting the transition towards this goal. It contains 50 proposals and identifies the ministries responsible for following their implementation, along with related timetables. The Prime Minister's Office will oversee implementation of this programme and should use its authority to provide direction and support for the process.

Iceland has implemented a range of market-based instruments that provide incentives to reduce the environmental impact of production and consumption. It has introduced several environmentally related taxes, though it is difficult to compare the revenue they generate with that in other OECD countries, largely due to the volatility of revenue during the economic and financial crisis. Nevertheless, there is evidence that the revenue from taxing energy products is lower than in most OECD countries. Broadening the tax base, notably by including kerosene, natural gas and coal, would make the taxes more cost-effective in limiting greenhouse gas (GHG) emissions and other externalities. There is also scope to increase tax rates, particularly on petrol and diesel, which are lower than in most OECD countries. The excise tax rate on diesel should be aligned with that for petrol, to reflect the higher emissions of local air pollutants (particulates, NO_x) generated from diesel combustion.

In addition to excise taxes, Iceland has implemented a number of new policy instruments that help limit GHG emissions relatively cost-effectively. Iceland joined the European Union Emissions Trading System (EU ETS) in 2007. Its impact has been limited, as Iceland uses no fossil fuels in electricity generation and has few energy-intensive industry sectors. The aluminium industry and intra-European aviation were included in the system in 2013. A carbon tax on most fossil fuels was introduced in 2010, with a rate reflecting the price of emission allowances in the EU ETS at the time. Unlike in most countries, the carbon tax is applied to the fishing fleet.

In 2011, an excise tax on vehicle purchase and an annual tax on vehicle use were introduced, both linked to CO_2 emissions. This has promoted a shift in the composition of the vehicle fleet, from petrol towards diesel vehicles. However, diesel generates more local air pollutants, though the exposure of the population to these pollutants is less of a problem in Iceland than in most other OECD countries. There are reductions in the excise tax for some vehicle categories, e.g. rental cars; these reductions significantly reduce revenue and provide incentives for the affected companies to buy high-emission vehicles.

Iceland is among the OECD countries that tax a relatively large share of employee benefits from being allowed to use a company-owned car. However, while the tax system captures most of the capital component of these benefits, there are no provisions to capture benefits related to distance driven, so employees face little or no cost per extra kilometre driven. Recent OECD work suggests that including a distance-based component

could generate EUR 3 million in revenue, and that the social benefits in terms of reduced congestion, accidents and pollution would be even higher.

Like most OECD countries, Iceland applies environmentally motivated tax preferences, e.g. for buses fulfilling the Euro V emission standard. Substantial tax reductions are given to methane-fuelled vehicles without any guarantee that the vehicles will actually be run on methane from landfills, which is only available in a small part of the country. The report on the strengthening of the green economy proposed other tax preferences as well. Yet tax preferences are the preferred instrument only in cases where positive externalities are involved. When addressing negative externalities, such as pollution and environmental degradation, instruments such as environmentally related taxes that directly incorporate the cost of damage into market prices are likely to be more cost-effective, and avoid risks of windfall gains and technology lock-in.

Iceland uses other market-based instruments for environmental and natural resource management. An extended producer responsibility programme has helped reduce waste landfilling and increase recycling, though it would be instructive to evaluate its costs and benefits. Iceland also has an effective system for managing fish stocks, based on scientific estimates of total allowable catches and a system of individual transferable quotas among fishers. The fishing industry has been subject to a fishing fee since 2001; in 2012 an additional profit-based special fee was introduced to capture the resource rent. The system is currently under review, because the implementation has proven challenging and there are concerns over increased taxation and the way the fee is levied on different fishing sectors. A well-designed resource rent tax has several economic advantages; however, a large share of the resource rent has already been capitalised in the value of quotas that have been traded since 1984.

Unlike many countries, Iceland does not seem to use many environmentally harmful subsidies, with two notable exceptions: tax exemptions on some energy products, and support to agriculture. The latter is well above the OECD average and entails a greater share of environmentally harmful incentives than in many other OECD countries. Measures that help maintain large numbers of grazing animals are of particular concern as they exacerbate soil erosion, which is a major problem in Iceland. Subsidies to sheep farmers are only in part conditional on meeting environmental performance standards.

Since 2000, public environmental expenditure has fallen as a share of government expenditure and of GDP. The main source of public environmental expenditure shifted from municipal to central level, particularly after 2008, probably in relation to fiscal consolidation policies. In keeping with this trend, expenditure on waste management, one of the main items of public environmental expenditure, declined in real terms, while revenue from user charges increased. Other environmental expenditure reflects Iceland's environmental profile: biodiversity and landscape protection are more important than in many OECD countries, water and air pollution less so.

A new policy on green public procurement (adopted in April 2013) emphasises education and collaboration with stakeholders to reduce environmental impact, and promotes the competitiveness of Icelandic enterprises that offer eco-friendly options. There is evidence that the educational efforts have influenced the procurement practices of institutions involved. The policy aims to raise the proportion of green tenders to 50% by 2016 through measures such as framework agreements between the State Trading Centre, which public institutions are obliged to use, and potential suppliers.

Iceland has developed innovation programmes supported by institutions, public finance and tax incentives for the private sector. Gross domestic expenditure on research and development (R&D) was 2.4% of GDP in 2011, in line with the OECD average but above that for the EU28. The Iceland 2020 strategy targets eco-innovation as a main growth sector in the decade. Industry is the main funder of R&D in general, and of environment-related R&D in particular. However, while the share of the public R&D budget allocated to the environment was among the highest for OECD countries, the energy-related share was the lowest. This seems surprising, given the importance of the energy sector in the Icelandic economy and the country's potential comparative advantage in geothermal energy. While patenting activity in general has been on par with that in other OECD countries, there have been very few Icelandic patent claims in environmentally relevant sectors.

Although Iceland only became a member of the OECD Development Assistance Committee (DAC) in 2013, it has been providing official development assistance (ODA) for many years. The level of ODA as a share of gross national income is below the DAC average: it increased during the first part of the last decade, but fell sharply after 2008. The information available for 2012 suggests that the share of ODA targeting general environmental protection, water and sanitation, and renewable energy was less than among most other donors. An important part of environment-related ODA takes the form of training in Icelandic institutions. In recent years, some DAC members have questioned the cost-effectiveness of this approach and have concentrated capacity-building initiatives in institutions in partner countries.

Recommendations

- Clarify the main priorities and roles of ministries and other stakeholders in implementing the parliamentary report on the strengthening of the green economy in Iceland; develop detailed implementation plans that specify the means of achieving objectives, taking account of the costs and benefits; establish a robust, independent system to monitor progress and to propose policy adjustments needed to achieve objectives.
- Broaden the carbon tax to cover kerosene, natural gas and coal, as well as non-CO_2 greenhouse gases; increase the excise and carbon tax rates on fossil fuels, including petrol and diesel; scale back the preferences in vehicle taxes given to rental companies, taxis and driving schools; remove incentives to purchase emission-intensive vehicles; consider introducing a distance-based component in the taxation of company cars.
- Review environmentally motivated tax preferences with a view to removing or reforming those that do not provide clear environmental value added (e.g. methane-fuelled vehicles).
- Keep the fisheries resource rent tax under review with a view to striking a fair and transparent balance between society as a whole and the fisheries sector, while maintaining stocks within biologically sustainable levels.
- Reform subsidies to sheep farmers to reduce negative environmental impacts; make them conditional on meeting strengthened environmental performance criteria.
- Continue efforts to green public purchases by providing information and support to public institutions, engaging the State Trading Centre and co-operating with potential suppliers.

Recommendations *(cont.)*

- Assess the outcomes of policies intended to promote environment-related innovation (such as the number of patents); consider how these outcomes could be strengthened, particularly in areas where Iceland has a comparative advantage, such as geothermal energy.
- Further strengthen the environmental component of official development assistance, while progressively expanding total aid in line with international commitments; systematically apply environmental and strategic impact assessment procedures; assess the cost-effectiveness of capacity-building programmes in Icelandic institutions and consider implementing such activities in institutions in partner countries.

1. Introduction

Between 2000 and 2007, real GDP in Iceland grew on average 4.6% per year; this was one of the highest growth rates among all OECD countries. As Figure 3.1 illustrates, growth was particularly strong in relation to financial and insurance activities, and, to a lesser extent, construction. Fishing and manufacturing (mainly aluminium production) shrank as a share of value added between 2000 and 2007. Eventually, aggregate demand ran well ahead of output and an unsustainable current account deficit developed. The real exchange rate rose far above its equilibrium value, encouraging the transfer of resources from the traded to the non-traded sector.

Figure 3.1. **Value added by sector in 2000-11**



Note: Based on data expressed at 2005 prices.
Source: OECD (2014), *OECD National Accounts Statistics* (database).

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With the onset of the global financial turmoil and recession, Iceland was struck by a banking crisis of unprecedented proportions and the economy plunged into a deep recession. Faced with events having potentially dramatic economic and social consequences, the government sought the assistance of the international community in support of a medium-term adjustment programme to restore policy credibility and economic growth.

The programme worked relatively well and the Icelandic economy continues to recover, although growth weakened from 2.7% in 2011 to 1.4% in 2012 before increasing somewhat to an estimated 1.8% in 2013 (OECD, 2013a).

The turnaround in the current account reflects a greater increase in exports than in imports as a share of GDP. A major factor driving the increase in exports has been the coming on stream of production capacity in energy-intensive industries (Chapter 4). Service exports have grown faster than goods exports, reflecting their greater price elasticity. Transport and tourism services have grown particularly rapidly (Chapter 5).

While stimulating green growth was a policy priority for several years, it was assigned a higher priority in the aftermath of the severe economic crisis. Having pursued an unsustainable growth model that brought the country close to collapse, Iceland now wants to get on a more sustainable track that builds on its comparative advantages, notably green energy, and takes account of the need to manage key resources (e.g. fisheries) and fragile ecosystems (e.g. soil) sustainably. Secure long-term access to clean energy has attracted foreign investment (e.g. in aluminium) and strengthened the global marketing position of technology sectors, since the combination of advanced technology and clean energy appeals increasingly to customers worldwide.

The national focus on green growth is exemplified by the report of the Parliamentary Committee on the Strengthening of the Green Economy (Box 3.1). Released in September 2011, it contained 50 proposals for action and indicated the ministries responsible for following up on each of them, as well as a schedule for their implementation. The report was developed through a wide consultative process, and is a useful framework for further action. To give high priority to follow-up on these proposals, responsibility for strengthening the green economy was placed with the Prime Minister's Office. This office continues to oversee the process, but implementation is being negotiated among the relevant ministries.

The Parliamentary Committee report has the potential to serve as an important driver in the transition to a green economy. The oversight by the Prime Minister's Office could provide important support for a comprehensive and committed implementation phase. Among other things, this will require further clarification of the main priorities, taking account of potential costs and benefits. For example, the proposal to lower VAT for environmentally certified products may not provide much additional incentive to change behaviour and mainly result in a loss of revenue. Responsibilities should be clearly allocated and detailed implementation plans developed. As experience from other countries shows, an important means of facilitating implementation can be through the establishment of a monitoring system that provides an independent and robust assessment of progress as well as proposals for policy adjustment.

2. Greening the tax system

A number of environmentally related taxes are used in Iceland on a range of tax bases. The revenue from these taxes has been quite volatile over the last decade, both as measured against GDP (Figure 3.2) and in terms of total revenue. In several ways, this volatility is linked to the economic crisis. For example, over 2003-06, one-off and recurrent taxes on motor vehicles, on average, raised revenue equal to 1.6% of GDP. The crisis drastically reduced sales of new vehicles, and for 2009-11 taxes on motor vehicles raised an amount equal to 0.6% of GDP, on average – a revenue reduction equal to 1% of GDP.

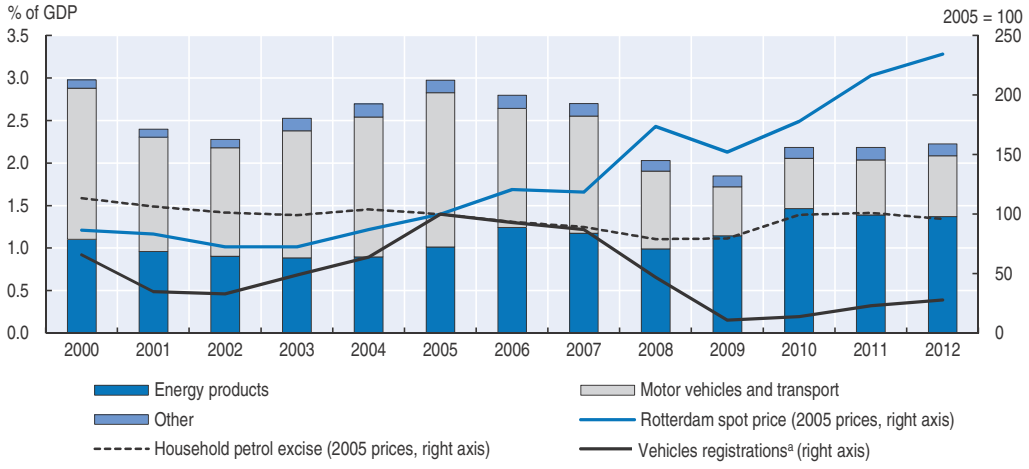
Box 3.1. **Recommendations of the Parliamentary Committee on the Strengthening of the Green Economy**

The report of the Parliamentary Committee on the Strengthening of the Green Economy in September 2011 contained 50 proposals for action. They varied from broad statements on future policy focus (e.g. regarding the use of cost-benefit analyses of all major policy areas, and a revision of waste policies aiming to stimulate recycling) to detailed specifications of actions in various areas (e.g. in relation to taxation, public procurement and energy audits of public buildings). The proposals included the following (along with the ministries responsible and schedule for implementation):

- The strengthening of the green economy shall be a priority in the government's employment policy. Responsibility: Alþingi/the National Government. Timing: 2012.
- The task of strengthening the green economy in Iceland shall be the responsibility of the Prime Minister's Office. The Prime Minister's Office shall be responsible for co-ordinating the implementation of an action plan based on the proposals presented in this document, with the participation of all the ministries of the cabinet. Responsibility: Alþingi/the Prime Minister's Office. Timing: From the adoption of the proposal by the Alþingi.
- The legislation pertaining to public institutions and their tasks shall be subject to a comprehensive review, in order to integrate the concepts of sustainable development and the green economy into the statutory roles/purposes of the respective institutions. Responsibility: Alþingi/the Prime Minister's Office. Timing: 2012.
- Provisions on cost benefit analysis shall be added to Act No. 105/2006 on Strategic Environmental Assessment and Act No. 106/2000 on Environmental Impact Assessment in order to ensure that the environmental cost is always assessed before construction is initiated. Responsibility: Alþingi/Ministry for the Environment. Timing: 2012.
- All ministries and public institutions… shall implement green procurement practices in accordance with the national policy on green public procurement. Responsibility: All ministries. Timing: Before end of 2012.
- A fund shall be established called the Green Competitive Fund as a department of the Technology Development Fund. Its purpose will be to fund projects in the field of environmental innovation… Responsibility: Alþingi/the Technology Development Fund. Timing: 2012.
- The Ministry of Finance shall develop pollution fees in accordance with the polluter-pays principle, taking into account lessons from the other Nordic countries. The pollution fees shall go to a green fund, which will finance reimbursements of costs related to pollution prevention in respective industries. Responsibility: The Ministry of Finance. Timing: 2012.
- Act No. 50/1988 on Value Added Tax shall be amended so that goods and services that are environmentally and/or organically certified will carry a lower VAT rate than comparable goods and services. Responsibility: Alþingi/the Ministry of Finance. Timing: At the next revision of the legislation.

Source: Alþingi (2011), "The strengthening of the green economy in Iceland".

Figure 3.2. **Revenue from environmentally related taxes as percentage of GDP in 2000-12**



a) Includes the new registrations of used vehicles; data cover passenger cars, buses, vans and lorries.
Source: OECD/EEA (2014), *OECD/EEA Database on Instruments Used for Environmental Policy and Natural Resources Management.*

StatLink http://dx.doi.org/10.1787/888933087515

The economic crisis also led to a major depreciation of the Icelandic króna, which, combined with international fuel price increases, has contributed to a large increase in the real price of motor vehicle fuels in Iceland. In isolation, an increase in the relative price of motor fuels will contribute to substitution away from fuel use towards other expenditures, and since motor fuels are among the most heavily taxed products in the economy, this will tend to reduce revenue from environmentally related taxes as a share of GDP. Up to 2008, this tendency was augmented by a gradual decrease in the real tax rate on petrol in particular, but since then, tax rates have increased in real terms, which has contributed to a recovery of tax revenue from energy products.

A comparison with other countries regarding the amount of revenue raised through environmentally related taxes is complicated by the high volatility of the Icelandic revenue. However, in 2012, when the revenue in percentage of GDP (2.2%) was significantly lower than it was before the economic crisis (2.7% on average for 2000-07), the revenue share in Iceland was lower that the arithmetic average of OECD countries (2.3%), but higher than the weighted average (1.6%). The revenue raised on energy products as a percentage of GDP (1.4%) was clearly lower than in most OECD countries, partly for the reasons explained above, but also because the tax rates per litre of petrol and diesel are among the lowest in the OECD.[1]

2.1. Taxes on energy products

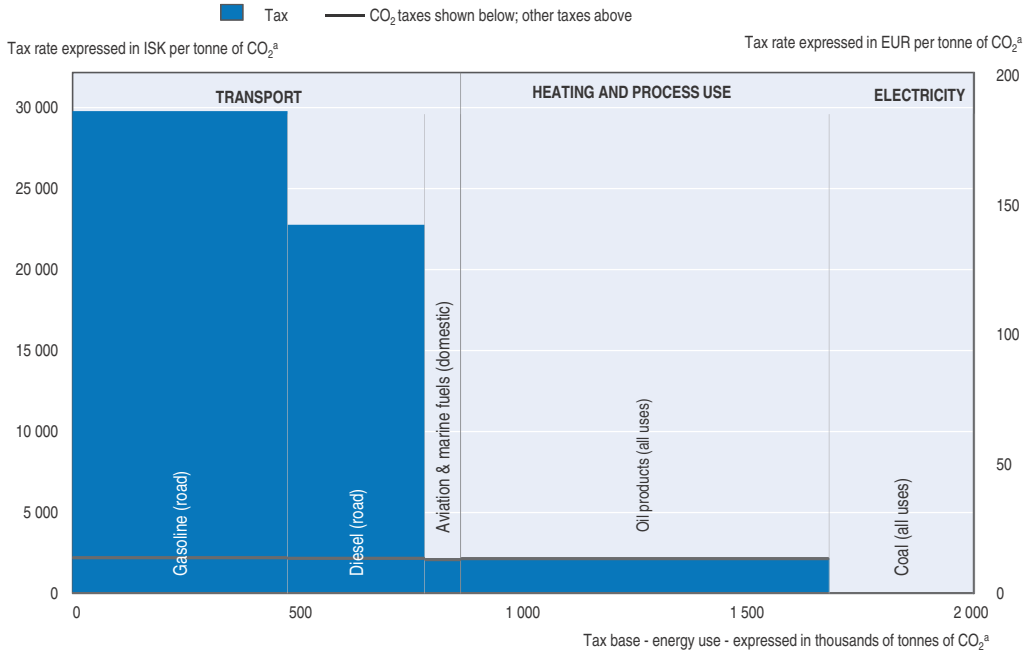
Iceland has an excise tax covering motor vehicle fuels. Up to 2005, diesel use was not taxed directly in Iceland. Instead, diesel vehicles were subject to a separate annual tax, differentiated according to the weight of the vehicle and the distance driven. While such a system could address some of the externalities linked to vehicle use, it did not offer any incentive to reduce fuel consumption per kilometre driven. The introduction of an excise tax on diesel from 2005 was a helpful step in this direction.

Iceland also introduced a carbon tax on most fossil fuels in 2010, with a rate reflecting the price of emission allowances in the EU Emissions Trading System (EU ETS) at the time,

i.e. about EUR 14 per tonne of CO_2. It is laudable that the fishing fleet is also covered by the full tax rate of ISK 7.30 per litre of fuel. In many countries, fuels used in the fishing sector are hardly taxed at all.[2]

Figure 3.3 illustrates total taxes on energy use in Iceland on a carbon content basis, calculated on the basis of 2009 energy data and tax rate as of April 2012. As Chapter 4 explains, the energy generation sector in Iceland is characterised by the almost exclusive use of renewable sources that do not cause carbon emissions. For that reason, electricity generation does not appear among the tax bases in the graph. In 2009, the transport category represented about 6% of total energy use, but accounted for about 40% of total CO_2 emissions from energy use. Petrol accounted for more than 50% of energy use in transport and was taxed at the highest rate (OECD, 2013b).[3] Diesel (which represented about 40% of energy use in the transport sector) was taxed at a significantly lower rate in carbon terms.[4] The CO_2 tax components of both rates are also shown. Only the carbon tax was levied on aviation and marine fuels, which, as a result, were taxed at a much lower rate than road fuels.[5]

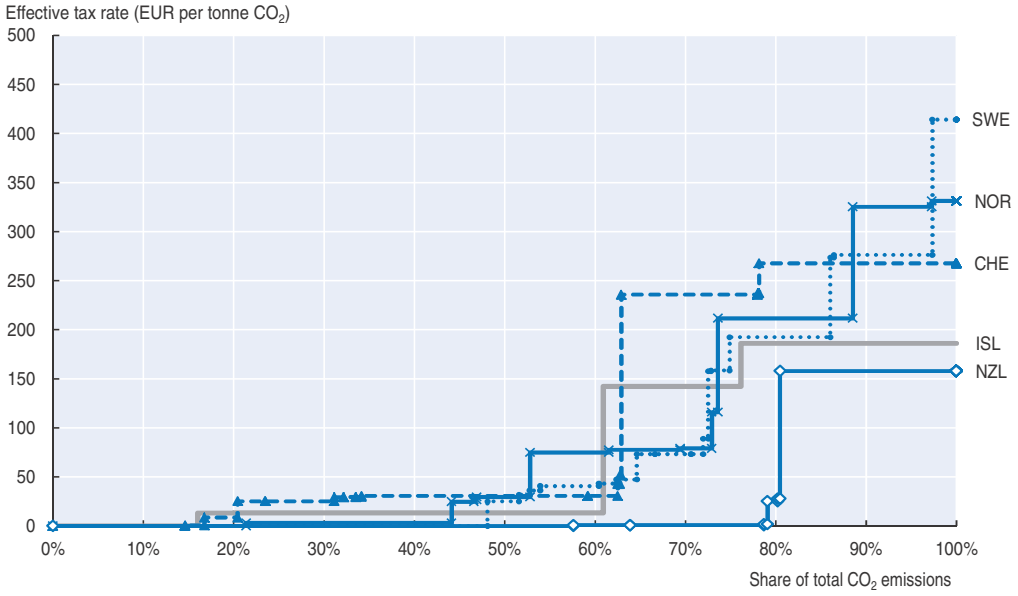
Figure 3.3. **Taxation of energy in Iceland on a carbon content basis**



a) Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.
Source: OECD (2013), *Taxing Energy Use: A Graphical Analysis.*

Figure 3.4 compares the taxation of energy products on a carbon basis in selected countries where electricity generation to a large extent is based on non-fossil fuels. The graph shows that a larger share of total carbon emissions is taxed at a rate above EUR 100 per tonne of CO_2 in Iceland than in the other selected countries. This is chiefly because motor vehicle fuels, which generally are taxed at a much higher rate than most other energy products, account for a larger share of total CO_2 emissions in Iceland. Some of the remaining emissions are taxed at lower rates than in Switzerland, Norway and Sweden. These countries also apply much higher tax rates on petrol and diesel than Iceland.

Figure 3.4. **Taxation of energy on a carbon content basis in selected OECD countries**



Note: The horizontal axis shows the proportion of CO_2 emissions from energy use. The vertical axis shows the corresponding effective tax rate on carbon. Tax rates as of 1 April 2012; energy use is based on IEA data for 2009.
Source: Based on OECD (2013), *Taxing Energy Use: A Graphical Analysis.*

Figure 3.5 illustrates all taxes on fossil fuels for six northern European countries. Each of these countries applies taxes that are explicitly labelled as "carbon taxes", and these taxes are shown as the bottom parts of the vertical bars for each fuel in question, with significant variations within and among most of the countries.[6]

In most cases, countries also apply other sorts of taxes on the same fuels, and the distinction between the "carbon" element and the "other" elements in the total taxes levied on a given fuel cannot be clearly made. In Figure 3.5, these other taxes are shown by the upper parts of most of the vertical bars.

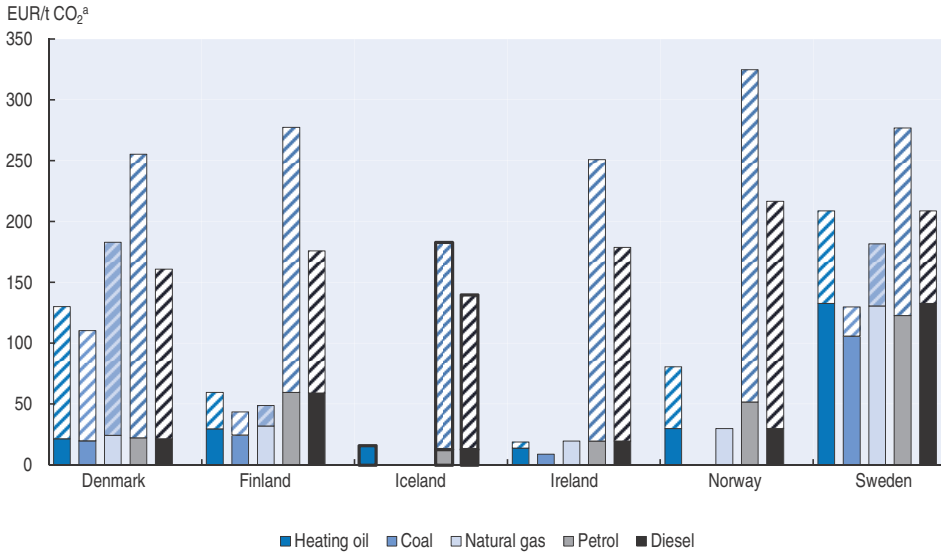
The figure makes it clear that, compared to the other northern European countries with explicit carbon taxes, the total tax rates applied on the selected energy products are relatively low in Iceland. Hence there is scope for increasing some of the tax rates concerned, and for broadening the coverage of energy taxes to include natural gas and coal. There is no use of natural gas in Iceland at present, but including it in the tax could avert tax-motivated use of it in the future. Regarding coal, it should be kept in mind that it is almost exclusively used in sectors covered by the EU ETS (Section 3.1). Taxing coal use in Iceland would not affect greenhouse gas (GHG) emissions for the EU ETS as a whole.

2.2. Taxes on motor vehicles

A CO_2-related differentiation of excise tax rates on vehicle purchases was introduced on 1 January 2011, as was a CO_2-differentiated annual tax on vehicle use.

The first tax is *ad valorem*, with rates that increase with emissions of CO_2 per kilometre driven. Vehicles with emissions below 80 grammes of CO_2/km are exempted. For vehicles emitting more than 80 g CO_2/km, the tax rate rises from 10% up to 65% of the taxable value; the highest value applies to vehicles emitting more than 250 g CO_2/km.

Figure 3.5. **Carbon taxes and fuel taxes in Nordic countries in 2012**



a) For each bar, the solid fill at the bottom of the bar corresponds to the carbon tax component; the shaded fill at the top of the bar corresponds to the other excise duties applied to the fuel.

Source: OECD/EEA (2014), *OECD/EEA Database on Instruments Used for Environmental Policy and Natural Resources Management;* OECD calculations.

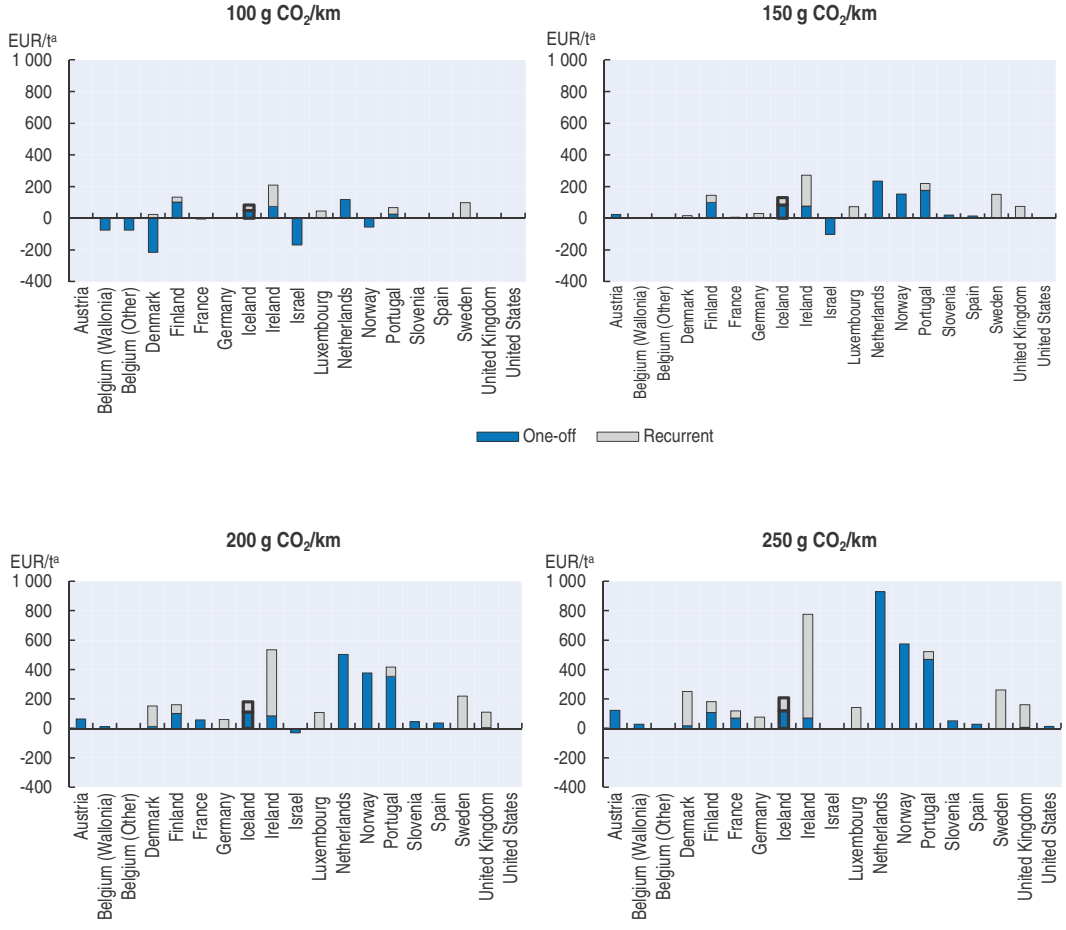
The rate of the road tax on vehicles weighing 3 500 kg or less is ISK 10 860 per year for emissions up to 121 grammes of registered CO_2 emissions per kilometre, plus ISK 260 per gramme of CO_2 emitted per kilometre beyond that level.

Figure 3.6 compares the CO_2 abatement incentives provided via one-off and recurrent taxes on diesel vehicles[7] across the OECD countries that apply CO_2-related differentiation in their vehicle tax rates. It indicates that some countries tax CO_2 emissions from vehicles with high per-kilometre emissions very heavily when measured per tonne of CO_2 emitted over the vehicle lifetime – well over EUR 500 per tonne of CO_2 in some cases. In this connection it should be kept in mind that a given tonne emitted from a vehicle with high emissions does exactly the same environmental damage as a tonne emitted from a low-emission vehicle.[8] Iceland is not among the countries with the highest tax rates – but a rate of about EUR 200 per tonne of the CO_2 that a vehicle is likely to emit over its lifetime is still very high compared to the abatement incentives the country provides to other parts of the economy.

As in most countries with such systems, the CO_2-differentiated vehicle taxes in Iceland tend to promote a shift in the composition of the vehicle fleet, from petrol towards diesel vehicles, since the latter normally cause lower CO_2 emissions per kilometre driven.[9] The disadvantage is that diesel vehicles cause more local air pollution than petrol vehicles. The share of diesel vehicles in all new vehicles sold has increased in recent years and exceeded 50% in 2012. Given the sparse population and windy conditions, however, the contribution to local air pollution from diesel vehicles may be less of a problem in Iceland than in most other OECD countries, since air pollution is not a major problem in Iceland (Chapter 1).[10]

The excise tax rates described above do not apply to all motor vehicles. In particular, rental companies, taxi companies and driving schools pay much lower taxes on the vehicles they buy (Table 3.1), and have the right to resell them after 18 to 24 months, on certain conditions. Thus, these sectors capture a significant part of the forgone taxes in the

Figure 3.6. **CO_2 abatement incentives in motor vehicle taxes in selected countries as of 2013**



a) EUR per tonne of CO_2 emitted by diesel vehicles over the lifetime of the vehicles, for selected emission levels per kilometre driven; 2013 or latest available year.

Source: OECD/EEA (2014), *OECD/EEA Database on Instruments Used for Environmental Policy and Natural Resources Management;* OECD calculations.

StatLink http://dx.doi.org/10.1787/888933087591

Table 3.1. **Rates of excise tax on motor vehicle purchases as of 2013**

Vehicle CO_2 emission level per km driven	Normal rate	Reduced rate
	% of taxable value	
< 80 g	0	0
81-100 g	10	0
101-120 g	15	0
121-140 g	20	0
141-160 g	25	5
161-180 g	35	10
181-200 g	45	15
201-225 g	55	20
226-250 g	60	25
> 250 g	65	30

Source: OECD/EEA (2014), *OECD/EEA Database on Instruments Used for Environmental Policy and Natural Resources Management.*

prices they obtain in the second-hand market. The economic crisis has led to these companies representing a very large share of total vehicle purchases, so the revenue loss due to these tax preferences is sizeable, as Figure 3.2 showed. Moreover, the design of the exemption is such that the companies have an incentive to buy vehicles with as large CO_2 emissions as possible, because that maximises their relative tax advantage. There are, however, some limits on how large a tax reduction the companies can achieve: ISK 1.25 million for taxis and driving-school vehicles, and ISK 0.75 million for rental cars (the latter limit was lowered from ISK 1.25 million at the beginning of 2013).

While the cost of renting a car at a given destination can have some impact on tourists' choice of destination, it seems unlikely that this impact is strong; many other factors are likely to be of much greater significance. The cost of renting a car constitutes a limited part of the total cost of a journey in any case, and the strong depreciation of the króna due to the economic crisis has greatly improved the cost-competitiveness of the tourism sector (Chapter 5). Hence, the justification of the tax preference given to the car rental sector seems weak.

While diesel vehicles weighing more than 10 000 kg now pay a tax on diesel use (like other diesel vehicles), a distance- and weight-differentiated tax is also in place for heavy goods vehicles. It would, however, be possible to link the rates of this tax more closely to vehicles' wear and tear on roads. And if an electronic road-pricing system were introduced, the rates could be varied according to the place and time of driving, as well as according to vehicle environmental standards. As there are few foreign vehicles on the roads, Iceland would largely avoid having to deal with such vehicles not having installed the equipment necessary to be covered by a charging system. For other countries and local areas that apply road pricing systems, administering the use of the roads by such vehicles represents a major share of total operating costs.

2.3. Company car taxation

In most OECD countries, the benefits reaped by individuals who can use a company-owned car are taxed more leniently than other income. Recent OECD studies suggest that the forgone revenue is very substantial (Harding, 2014), and that the cost to society is significantly more than the estimated revenue loss, primarily due to increased traffic accidents and congestion, but also increased air emissions (OECD, 2013c).

In Iceland, two systems for taxing such benefits are in place. Limited use of a company car, for example from home to work and back, is priced at ISK 99 per kilometre driven. That is considered income and taxed as such. For employees who are allowed unlimited use of the vehicle, a share of the car's market value is considered income and taxed as such, regardless of actual use. For cars taken into use in the previous three years, the share is 26%; for cars taken into use in the three years prior to that, it is 21%; and for older cars, it is 18% (Harding, 2014).

Compared to other countries covered by Harding (2014), Iceland's taxation of the capital component at 26% is relatively high; a share of around 18% is more common. However, it is the same as the OECD estimate of the annual cost over the useful life of a vehiclee. This suggests that Iceland is capturing almost the entire benchmark capital component of the benefit. It is among the top five OECD countries as regards the share of taxable benefit captured by the tax system.

However, there is no distance-based component in the Icelandic taxation of company cars. Hence, if employers are paying for the fuel and other operational expenses

(maintenance, insurance, etc.), this distance-based component of the benefit would be entirely untaxed. Taking account of the distance-based component, Iceland taxes around 80% of the total benchmark benefit of company cars, one of the highest shares among the countries examined by Harding (2014). This study estimates that including a distance-based component in Iceland's taxation of company cars could generate additional revenue of up to the equivalent of EUR 3 million per year. In addition, the OECD (2013c) demonstrates that the cost to society of undertaxation of the distance component is particularly large.

2.4. Other environmentally related taxes, fees and charges

A tax on accommodation or lodging, at a rate of ISK 100 per night per room or per tent, has been introduced (Chapter 5). Increasing generation of electricity from geothermal sources contributes to hydrogen sulphide pollution, causing occasional bad smells in some parts of the country, e.g. Reykjavík. Ongoing efforts to address this problem could be stimulated by the introduction of a tax on such emissions (Chapter 4). A tax on air passengers was proposed to the Parliament in 2011, with rates varying by flight distance. The proposal was not adopted, at least partly because of concerns with respect to conformity with the European Economic Area agreement. While it should have been possible to find a solution to that issue, inclusion of intra-European aviation under the EU ETS has since weakened the case for a separate tax on air passengers, and aviation is now exempt from the carbon tax, to which it previously was subject.

2.5. Environmentally motivated tax preferences

Rather than taxing environmental "bads", many countries attempt to adjust relative prices and influence producer and consumer behaviour by providing tax preferences for environmental "goods". Such measures, however, are the preferred instrument only in those cases where positive externalities are involved. For issues involving negative externalities, including pollution and environmental degradation, policies that directly incorporate the cost of damage into market prices, such as environmentally related taxes, are likely to be more cost-effective because they leave actors flexibility in deciding how to best reduce their emissions or other impacts.[11]

Iceland has a number of environmentally motivated tax preferences. There is a discount of ISK 1.25 million (about EUR 7 800) in the excise tax for vehicles that can run on methane. Such cars also incur the minimum rate of the annual vehicle tax (ISK 10 000). Methane is only available as a vehicle fuel in the Reykjavík area, but people from all over the country buy such vehicles and run them on other fuel most of the time. The tax preference thus provides very limited environmental benefits, but entails a certain revenue loss.

There is a VAT exemption for vehicles running on electricity or hydrogen, and for plug-in hybrids emitting less than 50 g CO_2/km. The tax reduction is capped at ISK 1.53 million for electric and hydrogen vehicles, and ISK 1.02 million for plug-in hybrids.

Buses with capacity of 18 persons or more fulfilling the Euro V emission standard can get a refund of two-thirds of the VAT due. Against some opposition, the environmental quality requirement was recently changed: previously buses had to comply with the Euro III standard. As Euro III came into force as early as 2000, and Euro V became compulsory in 2008, the strengthening of the requirement seems reasonable. It is unclear, however, what the argument is for a tax preference for the purchase of a bus that meets a compulsory standard.

As Box 3.1 notes, the Parliamentary Committee on the Strengthening of the Green Economy proposed introducing additional tax preferences on environmental grounds. For example, it proposed reducing the VAT on goods and services that are environmentally and/or organically certified, cancelling customs fees on bicycles and associated products, and exempting renewables used in transport until their share reaches 20% of total energy use in the sector. As pointed out in Section 1, at least for some product categories, the proposals could entail a revenue loss, without much environmental impact.

3. Extending the use of other market-based incentives for environmental policy

3.1. The EU ETS

One of the key market-based instruments applied in Iceland, in addition to environmentally related taxes, fees and charges, is the EU Emissions Trading System for greenhouse gases, which Iceland joined in 2007. The structure of the Icelandic economy, however – for example, zero CO_2 emissions related to electricity generation and no oil refineries – and the fact that the aluminium sector was not covered until 2013 mean that the impact of EU ETS participation so far has been limited.[12] Fishmeal factories are, however, quite energy intensive and they are covered by the EU ETS.

As of February 2014, emission allowance prices were low: around EUR 5 per tonne of CO_2 equivalent, despite a modest increase in response to EU measures to postpone auctioning a number of allowances. There are discussions under way within the EU on how provide a better, more stable incentive for GHG emission reduction within the EU ETS. Once EU countries come out of recession, demand for allowances is likely to increase, and the EU ETS will then be able to provide more important abatement signals in the few sectors concerned, primarily aluminium, the fishmeal sector and intra-European aviation.

3.2. Deposits on beverage containers for recycling

Iceland was the first country in the world to set up a national deposit system for a wide range of containers. The collection company has about 60 return facilities across the country where people can get their deposit of ISK 14 per container paid back. Very good return ratios have been achieved in recent years: 87% in 2011 and 2012, ranging from 82% for glass to 87% for plastic bottles and about 90% for aluminium (Endurvinnslan, 2014).

3.3. Recycling fees on selected products

Fees are also applied to finance recycling programmes for other products. Recycling fees are meant to cover the cost of collecting a given type of waste, transporting it to reception or disposal facilities and recycling or disposing of it. The amount paid is proportional to the volume of the waste. The board of the Recycling Fund, a state-owned fund established by the 2002 Recycling Act (No. 162/2002), is responsible for estimating the cost and proposing fee adjustments to the environment minister. Several fee revisions were made during the review period. All manufacturers and importers of the products subject to the Recycling Act have to pay the fees. The Recycling Fund reimburses facilities which transport, accumulate, recycle or dispose of the products. No cross-funding is allowed.

The Recycling Fund places heavy emphasis on reducing waste generation. For the waste that is generated, it aims to ensure that as much as possible is reused or, as a second option, enters into recovery, with as little as possible landfilled. To this end, it creates economic conditions making materials recovery cheaper than landfilling.

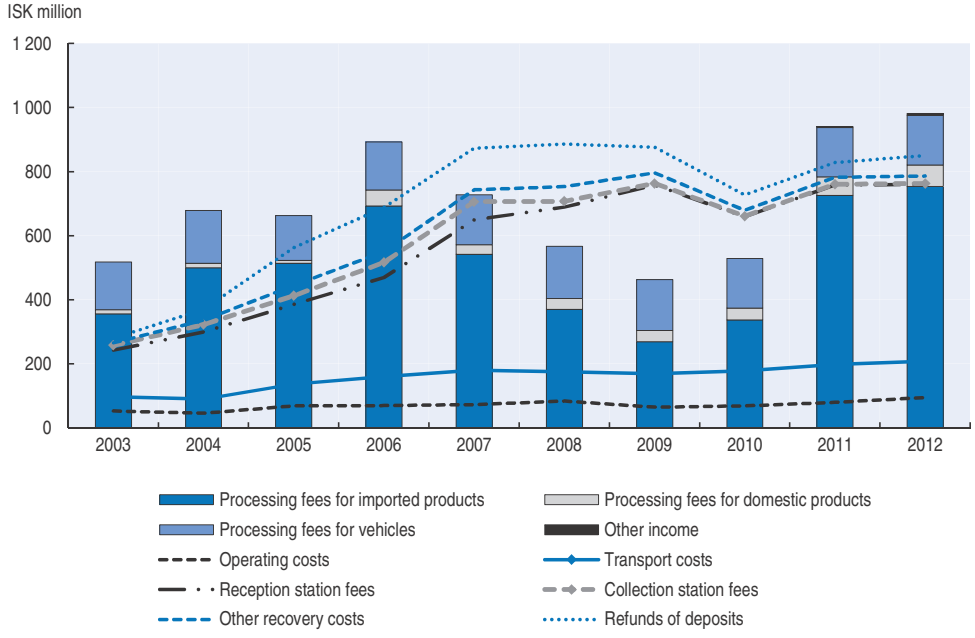
The products covered include cardboard, paper and plastic packaging; plastic hay bale wrap; tyres; fishing gear made of synthetics; and a number of products containing hazardous substances, among them refrigerants, chlorinated compounds, mercury products, organic solvents, photographic materials, paints, pigments, petroleum products and motor vehicles, as well as car batteries and other batteries.

Figure 3.7 illustrates developments in costs and revenue for the Recycling Fund. From 2003 to 2006, revenue was markedly higher than costs. As a result, some recycling fees were reduced as from 1 March 2007, in some cases quite significantly (e.g. by 70% for plastic packaging). The reductions, combined with the economic crisis, which led to lower sales of the products on which the fees are levied, caused significant deficits over 2007-10. In turn, this triggered significant fee increases from 1 July 2010 and again from 1 January 2011.[13] Hence, in 2011 and 2012, the fund showed relatively large surpluses.

Efforts to stimulate and facilitate recycling have had a major impact on the treatment of end-of-life products. In 1995, 79% of all waste was landfilled; by 2011, the share had decreased to 31%, although half the municipal waste generated still went to landfills in 2012 (Chapter 1). The present review is unable to assess in detail whether the benefits to society of these changes in waste treatment are larger than the social costs involved, including those incurred by households in sorting waste and taking it to recycling centres.

In principle, depending on the fee structure used, recycling fees can give producers and importers an incentive to make products easier to recycle. However, as in most extended producer responsibility regimes, the fees that a given producer or importer faces in Iceland are apparently based on average treatment cost rather than the cost of treating a particular product. If this is indeed the case, the incentives for eco-innovation are small.

Figure 3.7. **Costs and revenue of the Recycling Fund in 2003-12**



Source: Úrvinnslusjóður (2014), *Ársskýrslur* [Annual Reports], website.

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3.4. Pricing of water and waste services

Water is not really a scarce resource in Iceland, so the costs of introducing a metering system for cold water supply would most likely be larger than the potential benefits. Instead, each household pays a fee for the use of water that depends on the size of the home, not on the amount used.

Hot water supply, by contrast, is metered, with volumetric fees varying by location. In Reykjavík, the fee is about ISK 130 (EUR 0.80) per cubic metre of hot water for those living in the urban area and about ISK 170 (EUR 1.00) for those in rural areas, where the cost of supplying the water is higher.

Each property pays a waste collection fee that varies with the size and number of its trash bins, as well as frequency of collection. For apartment buildings, the fee is split between apartment owners. Each municipality decides on, and collects, its own fees. In Reykjavík, the fee is ISK 18 600 (about EUR 115) for a 240-litre trash container that is emptied every 10 days, and ISK 9 300 for a 240-litre trash container that is emptied every 20 days. If the container has to be moved 15 metres or more to be emptied, an extra fee of ISK 4 500 per container is due. The fact that these fees vary, at least to some extent, according to the marginal cost of waste collection should help promote an economically efficient collection system.

In addition, each home in Reykjavík is obliged to pay ISK 6 300 (about EUR 40) per year to cover the cost of waste management stations.

3.5. Individual transferable quotas in the fisheries sector

The Icelandic economy is heavily reliant on the fishing industry. Marine products represented more than 25% of total exports of goods and services in 2012 (measured in value), down from around 40% in 2000. This reduction in share was due to, among other factors, a relatively large increase in aluminium production. With a total catch of about 1.5 million tonnes in 2012, Iceland is a major fishing country. The total tonnage has, however, decreased significantly since 2000 (Chapter 1).

The decrease in total fish production is partly linked to Iceland's sustainable and profitable way of managing its fisheries sector. The foundation of this success is the setting of total allowable catches (TACs) based on scientific recommendations of what is biologically sustainable, as well as an individual transferable quota (ITQ) system, which gives each quota holder the right to catch a certain share of the TAC in various species (OECD, 2011). In practice, this means quota owners have a clear incentive to ensure that the TACs are not set too high, as that would undermine the value of the quotas they own. This contrasts with the situation in most other countries, where every fisher has a short-term incentive to argue for the highest possible total quotas.

Originally, ITQs were allocated for free, based on historic fishing activity levels. This and subsequent increased ITQ values linked to improved management of fish stocks have contributed to creating significant income disparity. While several approaches to reduce this problem have been considered, there is nothing the government can do now to undo the initial allocation, which favoured established fishers (OECD, 2011).

Nevertheless, a resource rent tax on extra profits of the fisheries sector was introduced in 2012, in addition to the fishing fee introduced in 2001. The general fishing fee is collected to finance the cost to the government of running the fisheries management system. The rate is ISK 9.5 per cod-equivalent kg, with a minimum of ISK 5 000. Davidsson (2013)

estimates that this fee will raise ISK 4.5 billion per year (0.3% of GDP). The resource rent tax is a special fee meant to capture part of the natural resource rent in fisheries, defined as the difference between the sales value of the output and its extraction and production costs, including a fair rate of return on capital. Once the resource rent is determined in cod-equivalent, the tax rate is set at 65% of that amount, according to the original formulation of the law. Davidsson (2013) estimated that this special fee would raise ISK 9 billion in 2013, or 0.5% of GDP.

The system is currently under review, because the implementation has proven challenging and there are concerns over increased taxation and the way the fee is levied on different fishing sectors. In practice, it proved difficult to calculate the resource rent in 2013, and the government introduced a temporary per-kilogramme proxy for the special fee. It also took several measures that temporarily limited the tax payments, and formed a task force to revise the tax structure. At the beginning of 2014, the special fee was reduced from the 2013 rate of ISK 23.2 to ISK 7.38 per cod-equivalent kg for demersal fisheries, and it was increased from ISK 27.5 to ISK 38.25 per cod-equivalent kg for pelagic fisheries. In this context, it should be kept in mind that a well-designed fisheries resource rent tax has several economic advantages and is likely to be more efficient than most other taxes. However, its level should not be so high as to damage the fisheries management system. Also, a large share of the resource rent has already been capitalised in the increased value of quotas that have been traded since 1984.

4. Removing environmentally harmful subsidies

4.1. *Agricultural support*

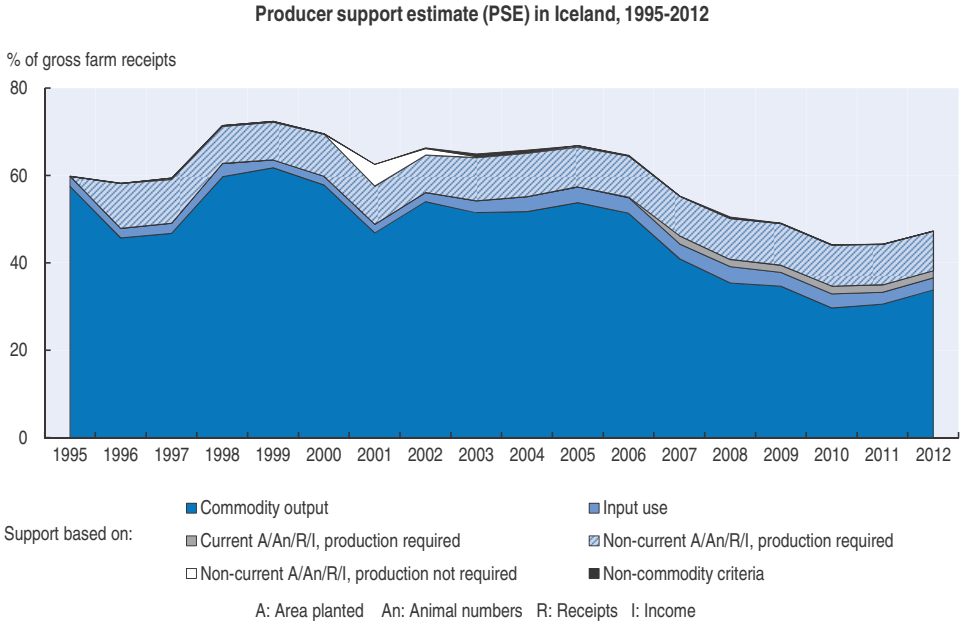
One of the most worrying environmental problems in Iceland is soil erosion and desertification. These are due both to natural causes (volcanic eruptions, strong winds, etc.) and to human activities such as deforestation, grazing and tourism (Box 3.2).[14] The previous *OECD Environmental Performance Review of Iceland* (2001) argued for reducing agricultural subsidies in general and recommended that Iceland "regulate livestock density based on the carrying capacity of soils, as defined by the Soil Conservation Service, for both sheep and horses".

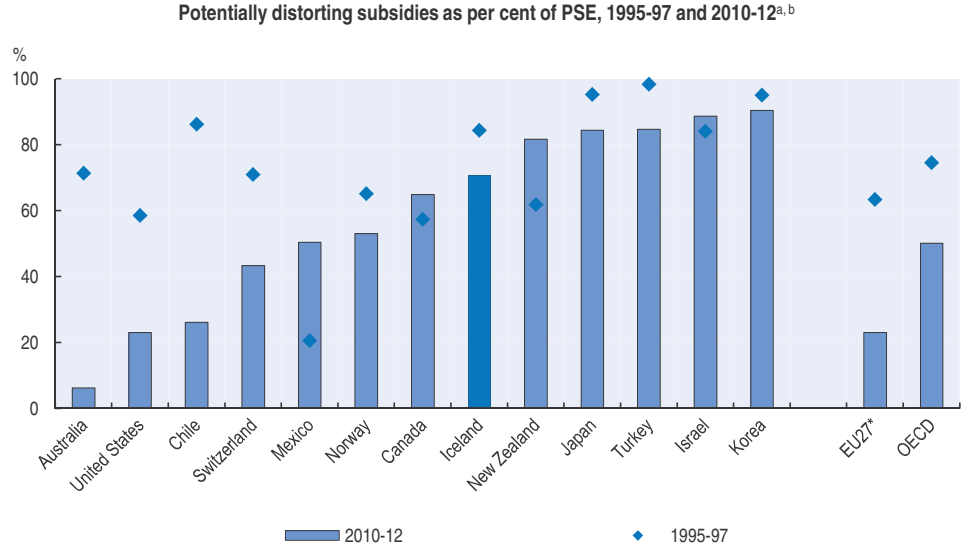
Agriculture in Iceland receives support well above the OECD average, despite a significant decline between 2006 and 2010, as the upper panel of Figure 3.8 shows. The lower panel shows that agricultural policies in Iceland are dominated by production- and trade-distorting measures, even if there has been some shift towards more decoupled forms of support in the sheep meat sector, where payments based on historical animal numbers have replaced output-based payments since 1996. Reception of these payments is, however, conditional on keeping a minimum number of winter-fed sheep on the farm (OECD, 2013d). Payments are only in part tied to environmental cross-compliance requirements, including acceptable rangeland conditions, sustainable grazing management, livestock welfare obligations and sheep flock record keeping (Box 3.2). The support, therefore, is an incentive to maintain a large number of grazing animals, which can have a negative environmental impact, e.g. contributing to soil erosion.

The negative impact of grazing on erosion is to some extent limited by Farmers Heal the Land, a programme of the Soil Conservation Service. This organisation covers 85% of

the cost of seeds and fertilisers if farmers use their machinery, time and skills on land improvement projects. More than 30% of the sheep farmers in Iceland participate, along with many other farmers, according to Arnalds and Thorsson (2012) – but this still means that the large majority of the sheep farmers do not take part.

Figure 3.8. **Agricultural support**





* EU27 for 2010-12 and EU15 for 1995-97.
a) Unweighted averages.
b) Payments based on commodity output and variable input use.
Source: OECD (2013), *Producer and Consumer Support Estimates* (database).

StatLink http://dx.doi.org/10.1787/888933087629

Box 3.2. **Soil erosion**

In 1997 the Soil Conservation Service and the Agricultural Research Institute published a national assessment of soil erosion in Iceland. According to the report, considerable or severe erosion affects about 40% of the country's area (Arnalds et al., 2001). However, this assessment has not been followed up, and monitoring data on land degradation and soil erosions are lacking.

Most rangelands are open to sheep grazing, and horse grazing is common in lowland areas. Current grazing practices, especially in the highlands, are hampering the natural regeneration of degraded ecosystems. The grazing period has been reduced over the past 50 years, from one year to about six months or less in the highlands. Most farmers continue to apply traditional rangeland management practices such as free-range grazing on common land.

A recent voluntary agreement between sheep farmers and the government ties a part of the agricultural production subsidies to quality management requirements, including sustainable land use. However, the criteria are not stringent. Exemptions are granted if land improvement plans are made, although that land often remains unfit for grazing. The lack of monitoring and sustainability indicators weakens policy implementation and enforcement. In turn, this discourages farmers from changing land management practices.

4.2. Support to energy products

Most OECD countries have support mechanisms promoting the production or use of fossil fuels (OECD, 2013e). In Iceland, however, there are few such mechanisms, partly due to the relatively low share of fossil fuels in the energy supply (Chapter 4). Iceland reported only one energy-related tax expenditure to the OECD (2013e): a reduced VAT rate, at 7%, on hot water, electricity and oil used for space heating and swimming pools. Most other goods and services are subject to the standard 25.5% rate.

The full exemption of coal, kerosene and natural gas from excise and carbon taxes could, however, be considered support to fossil fuels. The use of coal – almost all in the iron and steel sector (for ferro-silicon production) – accounts for well over 10% of all CO_2 emissions in the country (Figure 3.3), so removing this exemption could significantly affect Icelandic GHG emissions. However, as ferro-silicon production has been part of the EU ETS since 2013, taxing coal use in this sector would not affect GHG emissions for the EU ETS as a whole.

In addition, there are subsidies for electric heating in parts of the country without geothermal power (Chapter 4). Electricity supplied to greenhouse farmers is also subsidised. Phasing out these subsidies could benefit the environment, though the impact on overall GHG emissions and local air pollution would likely be small.

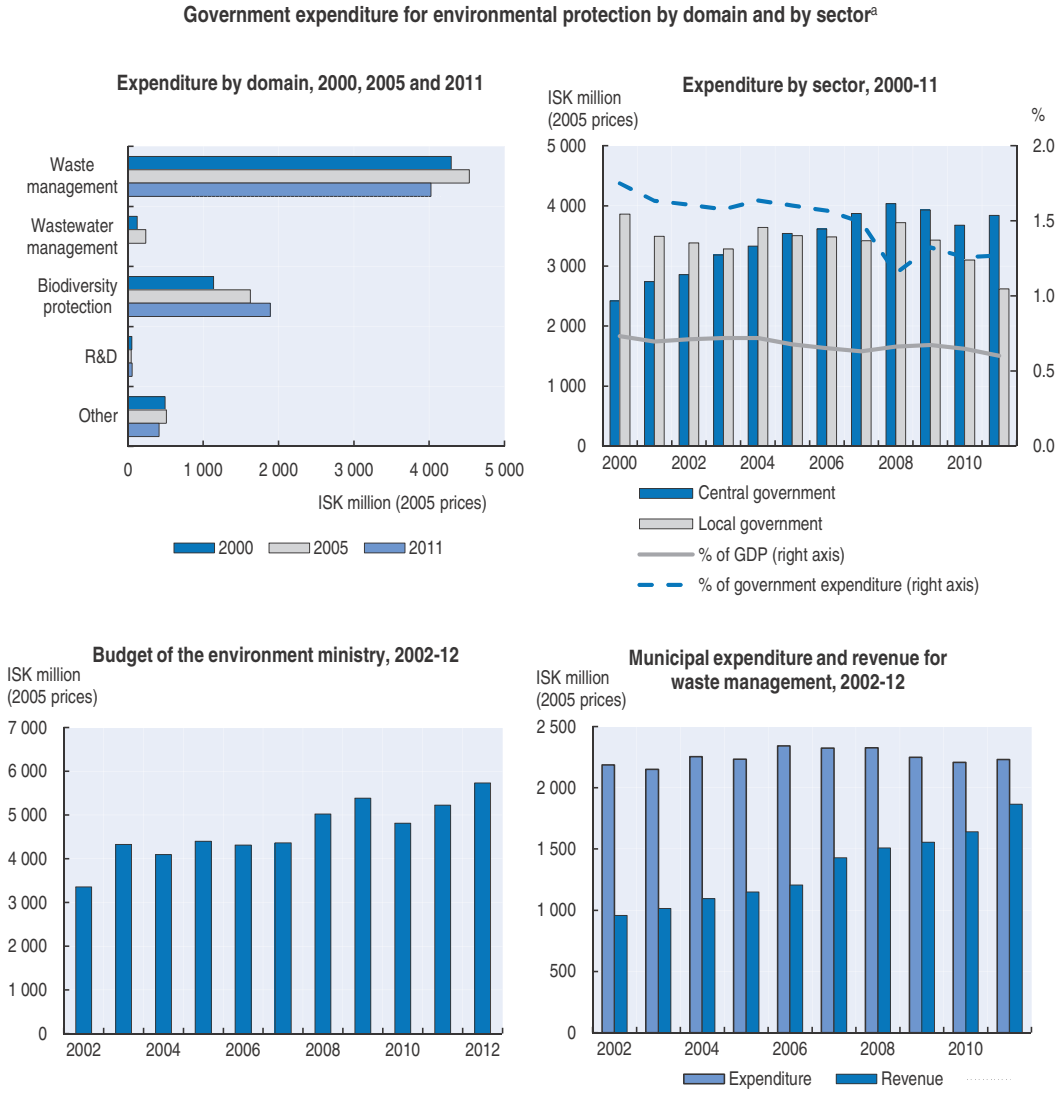
5. The environmental goods and services sector

5.1. The public sector

Since 2000, public environmental expenditure has fallen as a share both of government expenditure and of GDP. The main source of public environmental expenditure shifted from municipal to central government, particularly after 2008

(Figure 3.9). This was probably linked to fiscal consolidation policies, which may have affected the ability of municipalities to meet their responsibility for delivering a wide range of environment-related issues within their boundaries. Despite the economic crisis, the environment ministry budget has tended to increase since 2002, measured in constant prices – except for a marked decrease from 2009 to 2010.

Figure 3.9. **Public expenditure for environmental protection**



a) General government expenditure according to the COFOG classification.
Source: Country submission; OECD (2014), *OECD National Accounts* (database); OECD (2013), *OECD Economic Outlook No. 93* (database).

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Waste management and biodiversity protection are the two main sectors supported by public environmental expenditure. Between 2000 and 2011, expenditure on waste management decreased in real terms. Public expenditure on protection of biodiversity and landscape (for example, management of natural parks), on the other hand, increased in the same period, probably linked to the increase in the tourism activity over the decade

(Chapter 5). Expenditure related to biodiversity and landscape represented almost 30% of total public expenditure on environmental protection in 2011. Only Denmark and Italy devoted as much of public environmental protection expenditure to these activities; in many other OECD countries, the share is well below 10% (OECD, 2014b). These allocations are consistent with Iceland's environmental profile, with biodiversity and landscape protection relatively more important than in many OECD countries, and water and air pollution less so.

5.2. *Green public procurement*

The annual volume of public procurement is estimated at ISK 150 billion (Government of Iceland, 2013). The state thus has considerable influence on the type of products and services that are purchased in the country, including their environmental impact. A new policy on green public procurement and green government was adopted in April 2013. It built on the 2009 Government Policy for Ecological Procurement, which emphasised preparing the ground, readying tools and information, and offering all institutions the option of an introductory presentation and a workshop on green procurement. The policy also aimed to promote the competitiveness of Icelandic enterprises that offer eco-friendly options. A survey of government institutions on green procurement in February 2012 indicated that roughly a third of those surveyed were looking into greening their operations. The survey also indicated that the institutions found tools and education on green procurement and green government useful. Institutions which had received a presentation on green procurement and related tools appeared to have advanced further in this regard than those that had not received such training (Government of Iceland, 2013). By early 2013, more than 140 public institutions (including some secondary schools) had been invited to introductory presentations; 85 had attended one, and more than 50 had attended a workshop.

One goal in the policy is to raise the proportion of green tenders – i.e. tenders with environmental criteria, tenders taking note of life-cycle costs, and tenders otherwise suited to reducing environmental impacts – to 50% by 2016. The means used to achieve this goal include establishing framework agreements between the State Trading Centre, which public institutions are obliged to use when purchasing certain products, and potential suppliers. In many cases, the institutions can choose among several suppliers that have signed such agreements.

5.3. *The private environment-related sector*

Know-how and technology for harnessing geothermal energy represent the basis for several private firms working in what can be considered the environmental goods and services sector. Electricity generation from geothermal plants has increased significantly over the last decade (Chapter 4). There has been significant exporting of know-how in this field, especially as regards harnessing low-temperature geothermal sources for space heating and central heating systems.[15]

Many of the eco-innovating firms mentioned in the next section also belong to the environmental goods and services sector.

6. Eco-innovation

6.1. *Policy framework*

Environmental policies can – to varying degrees, intentionally and unintentionally – stimulate innovations that can benefit the environment and at the same time create market

opportunities for the innovating firms. For example, the OECD (2010) has shown that environmentally related taxes can have a strong impact on innovation activity, compared with many other policy instruments, inducing innovation through more channels.

Like a number of other countries, Iceland provides tax preferences for firms involved in innovation. Positive spillovers to others parts of the economy can provide an economic rationale for such support measures. A firm that carries out research and/or development projects and is certified by the Icelandic Centre for Research (Rannís) has the right to a 20% credit against assessed income tax. The share of the total cost of an R&D project that is covered by the credit decreases with the size of the firm. For enterprises with fewer than 50 employees, the eligible cost may not exceed 70% of the total cost of the project; for enterprises with more than 250 employees, the eligible cost may not exceed 50% of the total cost. There is also a cost ceiling: the credit per enterprise may not exceed ISK 100 million per year.

Innovation in general and eco-innovation in particular can also be stimulated by budgetary expenditure programmes. The key government body in charge of R&D policy is the Science and Technology Policy Council of Iceland (STPC). Chaired by the prime minister, it has 14 members, who represent the science and technology community and the social partners, as well as five ministries.[16]

Rannís and Innovation Centre Iceland (ICI) are the key R&D funding agencies. A key function of Rannís is to operate a competitive public support system for research and technological development. This includes the Research Fund and the Fund for Research Equipment under the Ministry of Education, as well as the Technology Development Fund[17] under the Ministry of Industries and Innovation. Rannís also provides the STPC with information on scientific research and technology developments as a basis for policy making. In addition it monitors R&D resource allocation and performance, evaluates the results of scientific research, technical development and innovation, and participates in international benchmarking of the results.[18]

In December 2007, the STPC selected certain fields in which it considered that Iceland had the potential of achieving international success, and where there were good opportunities for co-operation among businesses, universities, research institutions, public parties and various society groups. In this context, Rannís issued a call for proposals for ideas for centres of excellence or research clusters. One centre selected was the Geothermal Research Group at the University of Iceland, which seeks to create a critical mass of joint resources and efforts to break through scientific and technical barriers to innovation, as well as increasing significantly the number of qualified experts in geothermal research, engineering, design and technical exploitation of the resource.[19]

The ICI aims to advocate and pioneer new ideas in chosen fields of research, development and science; create an infrastructure characterised by simple processes, customer service and a stronger ICI staff; be the first choice for start-up companies looking for a support service and assistance in financing; be a leader in transnational co-operation in R&D projects which create a competitive advantage for participating parties; and take a leadership role in the support and development of creative industries.[20]

Since the economic crisis, the national innovation strategy has been refocused. The New Science and Innovation Strategy 2010-20 places greater emphasis on aspects such as competitive and performance-based funding and better quality assessment. The Iceland 2020 strategy targets eco-innovation as a main growth sector in the next decade (OECD, 2012).

6.2. Innovation performance

Iceland's gross domestic expenditure on R&D (GERD) was 2.4% of GDP in 2011. While this number is not directly comparable to somewhat higher Icelandic figures available for earlier years, it indicates an R&D expenditure level similar to the OECD average, but markedly higher than the EU28 average. Industry is the main funder of GERD, financing nearly half of the total in 2011. This was above the median value across the 30 OECD countries for which 2011 data are available. The government's share in total R&D expenditure (40% in 2011) was relatively high compared to the OECD average (about 30%). Government expenditure on R&D was a bit over 1% of GDP in 2011, the highest among all the OECD countries for which information is available (OECD, 2014c). Overseas funding accounted for 8.2% of total GERD in 2011. In 2001, the share was 18.3%.

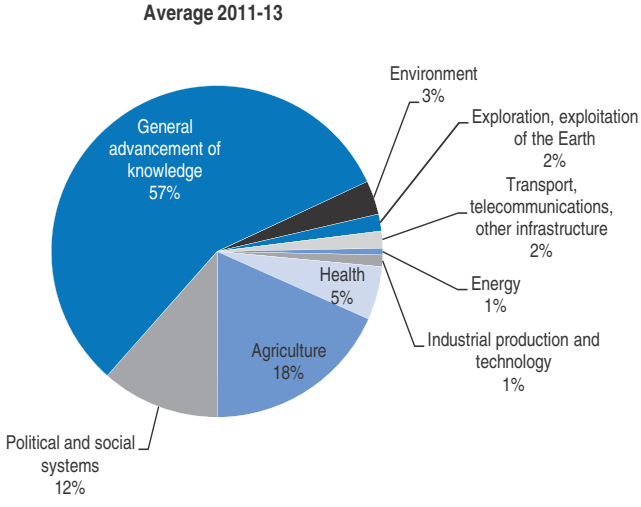
Direct government funding of businesses' R&D in Iceland is the second lowest across OECD countries, and the share decreased from about 1.4% in 2001 to about 1.1% in 2011 (OECD, 2013g). These figures include grants and payments for R&D contracts for procurement, but not R&D tax incentives (which Iceland does apply, as the previous section indicates), repayable loans or equity investments.

Research outputs in total, in terms of patents claimed, are close to the OECD median, and Iceland's performance in terms of non-technological innovation is good, as reflected in trademark counts and strong international publication record (OECD, 2012).

6.3. Environment-related innovation

Industry is the main funder of environment-related R&D activities, in particular energy research. However, in 2011-13, while 3% of the government R&D budget was allocated to environment-related R&D (including research on the control of pollution and on developing monitoring facilities to measure, eliminate and prevent pollution), only 1% was allocated to energy-related R&D, including geothermal energy (Figure 3.10). In 2012, the share of the public R&D budget allocated to the environment was among the highest

Figure 3.10. **Public R&D spending by sector**



Note: Government budget appropriations or outlays for R&D, breakdown according to the NABS 2007 classification.
Source: OECD (2014), *OECD Science, Technology and R&D Statistics* (database).

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for OECD countries, but the energy-related share was the lowest (OECD, 2013g). This seems surprising, given the importance of the energy sector in the Icelandic economy and the potential comparative advantage the country may have in the field of geothermal energy.

Even if patenting activity in general has been on par with what is found in other OECD countries, there were very few Icelandic patent claims in relation to environmentally relevant sectors over 1999-2011. Patent counts are not a perfect indicator of the return on investment in relation to R&D, but it would seem useful to analyse further the reasons for the low patenting activity in this field. It is possible that additional efforts ought to be made to secure property rights to Icelandic innovations in this area.

Nevertheless, a number of Icelandic firms and institutions are innovative in sectors of environmental significance. Box 3.3 provides examples of such firms and projects. In certain cases, firms' innovation activities have been stimulated significantly by policies to promote eco-innovation while in other cases such policies have played less of a role.

Box 3.3. **Examples of environment-related innovation in Iceland**

One Icelandic firm has developed software for fuel management for ships, which has been exported to many cruise liner companies. The firm has received funding from Rannís, and benefited from the R&D tax credit. International Maritime Organization regulations on emission control in shipping have also been important drivers for the innovation activity of the firm.*

Other examples include a firm that has developed sensors that allow the electrical usage and load across circuit breakers in buildings to be measured (ReMake Electric, 2014); a firm that has developed a pilot plant for methanol production from geothermal CO_2 (Carbon Recycling International, 2014); a project led by ICI in co-operation with the Marine Research Institute and a fisheries company that aims at developing a fishing trawl that does not need trawl doors and does not touch the sea bottom, reducing friction and increasing energy savings; and a company that is developing technology for the production of a single-cell protein utilising hydrogen- and sulphur-oxidising bacteria (Prokatin, 2014). This last project aims to use hydrogen, hydrogen sulphide and CO_2 from geothermal power plants as an energy and carbon source. The technology makes it possible to produce protein-rich meal for use in animal and fish feed. The technology can also be used to reduce emissions to the atmosphere.

The Iceland Deep Drilling Project (IDDP) was founded in 2000 by a consortium of three Icelandic energy companies. Its main purpose is to find out if it is economically feasible to derive energy and chemicals from hydrothermal systems at supercritical conditions. IDDP is a long-term R&D project, expected to take a decade or two to conclude. Among the potential benefits are increased power output per geothermal well and production of higher-value, high-pressure, high-temperature steam; development of an environmentally benign, high-enthalpy energy source below currently producing geothermal fields; and extended lifetimes for exploited geothermal reservoirs and power generation facilities (IDDP, 2014).

The 2001-05 Ecological City Transport System project, known as ECTOS, aimed to demonstrate and evaluate a hydrogen-based infrastructure for public transport vehicles. Three hydrogen fuel cell buses were operated in public service in Reykjavík and a fuelling station was established for production and distribution of hydrogen. The buses were originally to be tested for two years, but due to a positive outcome, the test period was extended. The ECTOS project was succeeded by the HyFLEET:CUTE project, with the intent of developing a new generation of buses. The economic turmoil in 2008, however, made this impossible (INE, 2014).

Box 3.3. **Examples of environment-related innovation in Iceland** *(cont.)*

The experience of operating the fuelling station was positive and there was a wish to test hydrogen in passenger vehicles as well. To this end, and to test hydrogen and fuel cells in marine applications, the SMART-H2 project started in 2007, with 35 vehicles from various producers being tested. One aim was to connect the R&D part of the hydrogen work with the potential serial production of fuel cell electric vehicles (FCEVs). However, in 2009, it became clear that serial production of FCEVs could not start for a number of years and it was decided to stop the test period in 2012. One reason was that the vehicles being tested were already three to six years old, which was considered too old for the new technology (INE, 2014).

The Icelandic Biofuels project aims at investigating the possibility of producing fuels from biomass available as waste material from households and industry. Assessment will also be made of the possibility of using energy plants for biofuel production (Icelandic Biofuels, 2014).

* Iceland has not yet signed Annex VI of the International Convention for the Prevention of Pollution from Ships (MARPOL) of the International Maritime Organization. This annex sets limits on SO_x and NO_x emissions from ship exhaust and prohibits deliberate emissions of ozone depleting substances; designated emission control areas set more stringent standards for SO_x, NO_x and particulate matter. One proposal of the Parliamentary Committee on the Strengthening of the Green Economy was to expedite acceptance of the annex.

7. Environment, trade and development

7.1. Official development assistance

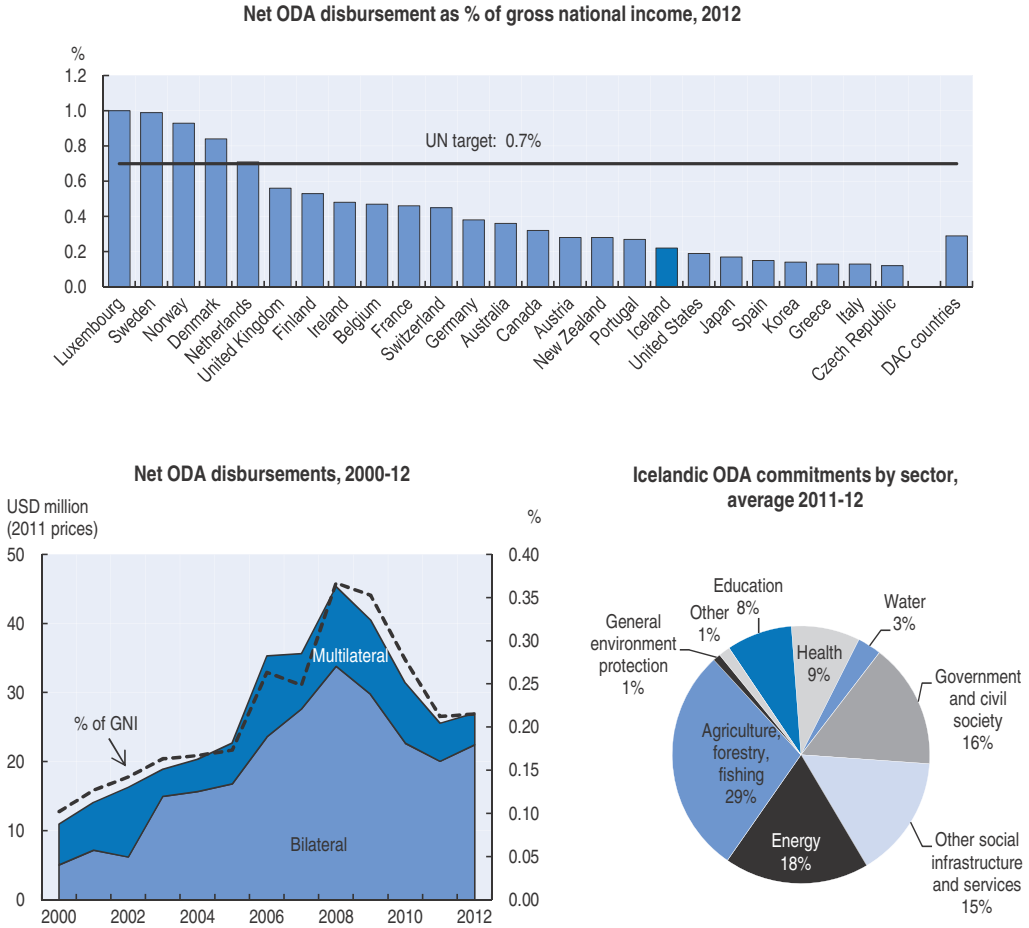
Iceland joined the OECD Development Assistance Committee (DAC) in March 2013, but prior to that it had taken steps to develop its aid policy, for example by endorsing the 2005 Paris Declaration on Aid Effectiveness. Figure 3.11 shows that Iceland provided less official development assistance (ODA) as a share of gross national income (GNI) than the OECD-DAC average in 2012.[21] While the agreed UN target is ODA equivalent to 0.7% of GNI, the OECD-DAC average was 0.29% and Icelandic ODA represented 0.22%. Iceland's priority partner countries – Uganda, Malawi and Mozambique – were the top three recipients in 2010 and 2011, accounting for 38% of Iceland's bilateral aid.

Although the level of Iceland's ODA is low compared to other OECD countries, there was a relatively steady and significant increase – particularly as regards bilateral aid – from 2000 to 2008, when the financial and economic crisis set in (Figure 3.11). The crisis made it very difficult for Iceland to maintain its ODA level, and the share in GNI dropped by more than half from 2008 to 2011 before a minor increase took place from 2011 to 2012.

Only 1% of Iceland's bilateral ODA commitments in 2011-12 went to general environmental protection (Figure 3.11), but several of its ODA activities nevertheless have clear environmental dimensions, drawing on the country's comparative advantages and experiences.

Figure 3.12 shows the share of total ODA going to general environmental protection, water and renewable energy, according to a classification by sector, with Iceland having a lower share than most other OECD countries. In 2012, Iceland began providing information on aid to the OECD Creditor Reporting System, though information on "policy markers" was incomplete. Nevertheless, the available data show that in 2012, for about 37% of the total sector-allocable aid, environment protection was the principal objective, and for more than 40%, it was a significant objective (OECD, 2014d).

Figure 3.11. **Official development assistance of Iceland and OECD-DAC countries**



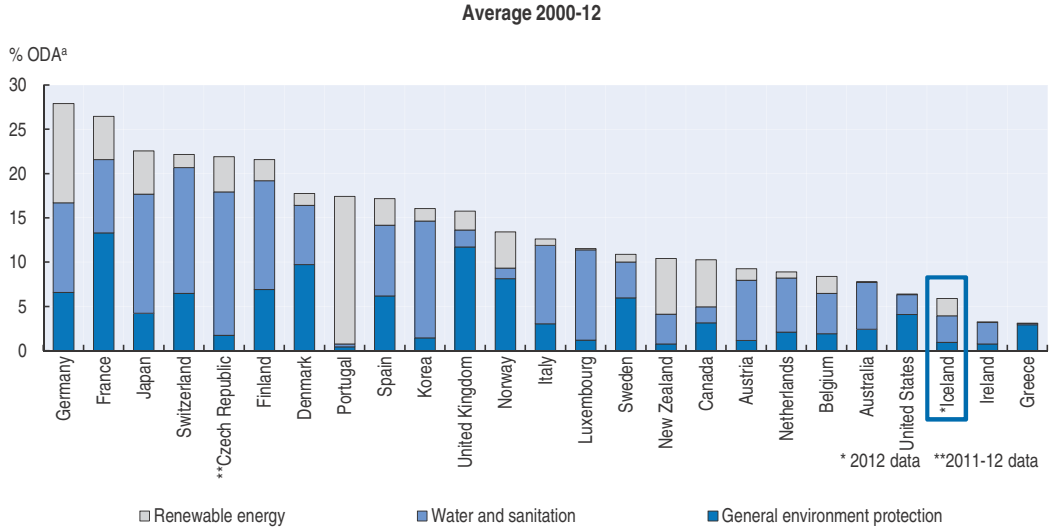
Source: OECD (2014), *OECD International Development Statistics* (database).

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One aid project based on Iceland's comparative advantages is the Geothermal Training Programme of United Nations University (UNU), hosted by the National Energy Authority (Orkustofnun). This is a postgraduate training programme, aiming at assisting developing countries in capacity building within geothermal exploration and development. The programme provides training for six months to professionals from developing and transitional countries with significant geothermal potential, primarily countries where geothermal development is under way.[22]

Another project drawing on Iceland's comparative advantages is the UNU Land Restoration Training Programme.[23] It provides postgraduate training for specialists from developing countries as regards restoration of degraded land and sustainable land management, and aims at assisting developing countries in capacity development in this field. It was founded in 2007 by the Icelandic Ministry for Foreign Affairs, in partnership with the Agricultural University of Iceland and the Soil Conservation Service of Iceland. Its main activity is six months of training in Iceland on land restoration and sustainable land management. The first half of the training focuses on course work, practical training and field trips. In the second half, each student works on an individual project which provides specialisation related to the needs of the individual.

Figure 3.12. **Official development assistance for environment, water and renewables**



a) Bilateral ODA commitments expressed in constant 2011 prices as percentage of total sector-allocable ODA.
Source: OECD (2014), *OECD International Development Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933087705

A third example is the UNU Fisheries Training Programme,[24] again offering six months of postgraduate training in various areas of the fisheries sector for practicing professionals from developing countries. The programme draws expertise from several Icelandic universities and the fishing industry in order to provide participants with a broad perspective on fisheries in their home countries.

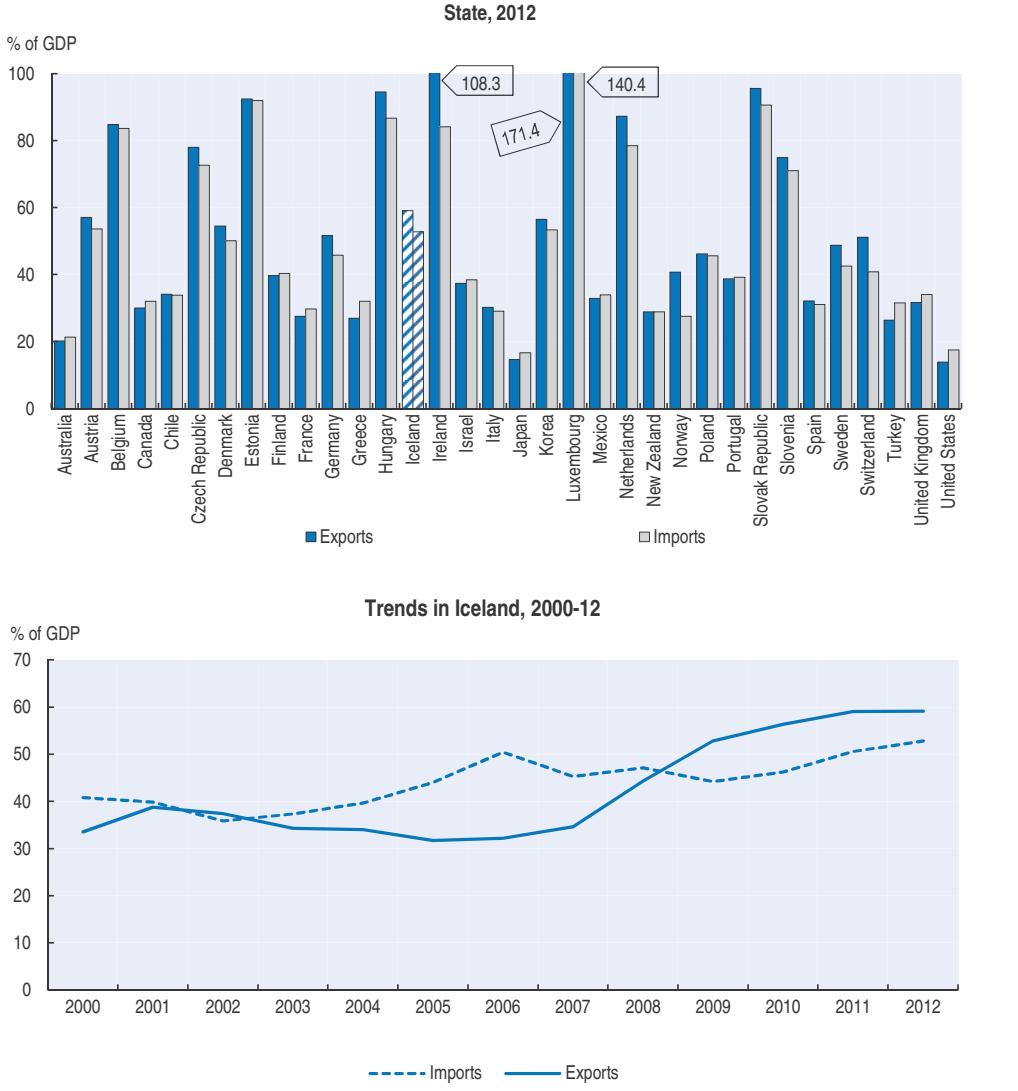
Since 1979 some 730 developing country professionals have attended UNU training programmes in Iceland on international scholarships funded by Iceland's ODA. It cost USD 40 000 in 2011 for a student to undertake one of the programmes. This is a sizeable investment in human capacity development, especially relative to other elements of Iceland's development co-operation. While internal evaluations of the UNU programmes in fisheries and geothermal energy reveal positive effects on students, there has been no external evaluation of the overall impact of the programmes in the countries that have benefited from the training. Nor are there mechanisms to independently ensure the quality of the programmes or to validate them against similar programmes being run by other institutions (OECD, 2013h).

In recent years several DAC members have found their international scholarships not to be cost-effective capacity building. In recognition of this, some DAC members have significantly downsized or abolished such scholarships, focusing instead on in-country training and strengthening the capacity of training institutions in partner countries. Indeed, the current UNU delivery model established by the institution's headquarters promotes a switch to providing training in partner countries, as opposed to international scholarships, and supporting capacity building of developing countries' universities and research institutes through twinning arrangements. Iceland's UNU fisheries and geothermal programmes have begun to provide in-country training in recent years, in addition to the training provided in Iceland, but there are no plans yet to adapt fully to the new UNU model (OECD, 2013h).

7.2. Trade and environment

As Iceland is a small country with a relatively specialised economy, one could assume that it would have higher export and import ratios compared to GDP than most other OECD countries. The upper panel of Figure 3.13 indicates that this in fact was the case in 2012, when imports equalled 52.9% and exports 59.2% of GDP, compared to OECD averages of 29.1% and 28.5%. In European OECD countries, the respective averages were 41.6% and 43.9% of GDP.

Figure 3.13. **Export and import of goods and services in OECD countries and in Iceland**



Source: OECD (2013), *OECD Economic Outlook No. 93* (database).

StatLink http://dx.doi.org/10.1787/888933087724

However, the lower panel of Figure 3.13 indicates that foreign trade shares exceeding 50% of GDP is a relatively recent phenomenon for Iceland, as shares were around 40% in the first years of this century. The figure also highlights the large trade imbalances that developed in the middle of the decade, with a trade deficit equal to 18% of GDP in 2006.

Iceland has concluded 26 free trade agreements (FTAs) with a total of 35 partner countries outside the European Union. For example, in April 2013, it signed an FTA with China, with which trade had increased rapidly in the preceding years.[25] This was the first FTA signed between China and a European country. The aim of the agreement is to promote trade by abolishing tariffs on imports and to further enhance economic ties between the two countries. The agreement is similar to earlier FTAs that Iceland, as a member of European Free Trade Association (EFTA), has concluded.[26] It covers trade in goods and services, rules of origin, trade facilitation, intellectual property rights, competition and investment. It also indicates that the two countries should enhance their co-operation in a number of areas, including the environment, with the parties acknowledging that economic development and environmental protection are interdependent and mutually reinforcing components of sustainable development (Ministry for Foreign Affairs and External Trade, 2013). Compared to the environmental provisions included in some other recent regional trade agreements, the provisions in this agreement do not seem very strong (George, 2013a; 2013b). The agreement will enter into force when legal procedures of acceptance in both countries have been concluded.

Notes

1. As of 1 January 2012, only Poland had a lower tax rate on petrol than Iceland, among the European OECD countries.
2. However, the Icelandic fishing fleet does not pay any other fuel taxes.
3. ISK 25.20 per litre in general excise, ISK 40.70 per litre in special excise and ISK 5.15 per litre in carbon tax; in all, ISK 71.05 per litre as of 1 January 2014.
4. The tax rates per litre as of 1 January 2014 were ISK 40.70 in special excise and ISK 5.90 in carbon tax, for a total of ISK 46.60 per litre.
5. Aviation fuel was subject to the carbon tax in May 2012, the date reflected in Figure 3.3, but such fuel has been exempt from the carbon tax since 1 January 2013. The inclusion of intra-European aviation in the EU ETS weakens the environmental arguments for taxing aviation fuel.
6. The graph shows the main tax rates applied to the different fuels, but in several countries there are (normally) lower rates for products used in certain sectors. The rates shown regarding heating oils are those that apply to the household sector.
7. Taxes for diesel vehicles are used as an example. For Iceland, the tax rates for petrol and diesel vehicles are the same, but in some of the countries shown, the tax rates differ for the two vehicle types.
8. Note that the CO_2 abatement incentive provided via the motor vehicle taxes comes on top of the more direct and effective abatement incentives provided via the taxes on petrol and diesel.
9. Drivers benefit directly from this advantage with respect to CO_2 emissions due to the higher energy efficiency of diesel engines compared to petrol engines. There is thus no argument for providing a tax stimulus to promote the purchase of diesel vehicles.
10. According to the OECD (2014a), only Norway, Australia and New Zealand have lower per capita mortality from ambient air pollution, from all sources. The same report estimates the annual social cost of air pollution in Iceland at USD 115 million.
11. For example, the OECD (2013f) demonstrates that emission trading systems and taxes that place an explicit or implicit price on carbon emissions are much more cost-effective than other policy instruments, including various tax preferences and other subsidies, in combating climate change.

12. Also, perfluorocarbons (PFCs) stemming from aluminium production are now covered by the EU ETS, in addition to the related CO_2 emissions (European Commission, 2014).
13. For example, the rate for plastic packaging as from 1 January 2011 is 20% higher than what it was prior to the rate reductions of 1 March 2007. The minimum rate for vehicle tyres was ISK 30 000 from 1 January 2005, ISK 20 000 from 1 January 2006 and ISK 15 000 from 1 March 2007, but increased to ISK 40 000 (about EUR 250) as from 1 January 2011 (Recycling Fund, 2013).
14. It has been estimated that when the first settlers arrived in Iceland in the 9th century, some 25% of the island was covered by birch woodland. The share stands today at about 1% (Croft, 2011).
15. See *www.nea.is/the-national-energy-authority/export-of-know-how* for more information.
16. See *www.m-era.net/iceland* for further information.
17. The fund supports emerging technologies in geothermal research, genetics, artificial intelligence and eco-technologies (OECD, 2012).
18. See *www.m-era.net/iceland* for further information.
19. See *http://georg.hi.is/efni/georg_geothermal_research_group* for further information.
20. See *www.nmi.is/about-us/policy-and-organization-chart/* for further information.
21. The average is calculated across the countries taking part in the OECD Development Assistance Committee.
22. See *www.unugtp.is* for further information.
23. See *www.unulrt.is/en/home* for further information.
24. See *www.unuftp.is/en/home* for further information.
25. Iceland's exports to China (mostly seafood) reached ISK 7.65 billion (USD 61.2 million) in 2012, up 41% from 2011. Its imports from China reached ISK 42.6 billion (USD 340.8 million), up 21% from 2011 (Ministry for Foreign Affairs and External Trade, 2013).
26. For example, the FTA between EFTA and Canada, which entered into force in July 2009, included the following wording in its preamble: "RECOGNISING the need for mutually supportive trade and environmental policies in order to achieve the objective of sustainable development". It also included a reference to the environment among the exceptions to obligations under the agreement, stating: "The Parties understand that the measures referred to in Article XX(b) of the GATT 1994 include environmental measures necessary to protect human, animal or plant life or health, and that Article XX(g) of the GATT 1994 applies to measures relating to the conservation of living and non-living exhaustible natural resources" (Gallagher and Serret, 2010).

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PART II

Progress towards selected environmental objectives

PART II

Chapter 4

Energy and environment

Iceland has by far the highest share of renewables in energy supply among OECD countries. After an overview of the country's energy mix, this chapter examines the environmental impact of the energy sector, including on landscape, water, biodiversity and emissions of greenhouse gases and air pollutants. The energy market and prices, as well as the role of energy-intensive industry, are also discussed. This chapter studies the institutional and policy framework for integrating energy and environment, with a focus on the planning of renewable energy infrastructure. Finally, it reviews the opportunities and obstacles to improve energy efficiency in residential heating, transport and the fishing industry.

Assessment and recommendations

Among OECD countries, Iceland has by far the highest share of renewables in the energy supply: all electricity and 95% of heat are generated from hydro and geothermal power. As these sources can be produced at relatively low cost in Iceland, there has been no need for support measures such as those often used in many other countries.

The abundant supply of cheap energy has attracted energy-intensive industries, notably aluminium smelting. To meet industry demand, electricity production has more than doubled since 2000, and is now five times the amount needed by the population alone. As a result, Iceland's energy intensity has grown, and it is the highest in the OECD. While power generation emits virtually no greenhouse gas (GHG) emissions, the expansion of aluminium production has resulted in growing GHG emissions.

Over many years, the expansion of Iceland's power capacity and electricity transmission and transport infrastructure has generated intense debate about environmental and social impacts. Many areas with potential for hydropower or geothermal development are sites of exceptional beauty and unique biodiversity, and they are often major tourist attractions. Geothermal power plants also discharge wastewater containing chemicals and nutrients, and they emit hydrogen sulphide (H_2S). This gas has an unpleasant odour and is toxic and corrosive in high concentrations; the health and environmental impact of long-term exposure to low concentrations of H_2S are not yet known. Emissions of H_2S have more than doubled since 2000, and concentrations in ambient air, especially in the area around Reykjavík, have often exceeded ambient standards. In 2010, the environment ministry introduced a daily H_2S limit that is three times as strict as the World Health Organization's guideline value.

Iceland is effectively locked into providing energy-intensive industries with low-price energy through long-term contracts. Electricity is generally provided at below average commercial rates, and it is not clear if the rate of return earned by public utilities is sufficient to cover all costs, including environmental costs. Further expansion of the aluminium sector would exacerbate the vulnerability of the economy to the fortunes of the aluminium industry and further reduce diversity in the energy market. There appears to be scope for Iceland to leverage its low-cost renewables without significantly increasing production capacity by developing smaller energy-intensive industries that exert less pressure on the environment, e.g. greenhouses and data treatment centres.

Another option under discussion is the potential for constructing an undersea cable to Scotland to export excess electricity. Such a project could result in significantly higher electricity prices, which would benefit electricity generators at the expense of Iceland's consumers, although the overall effect on prices is difficult to predict. Introducing a resource rent tax would capture part of generators' excess profits and generate revenue to compensate the consumers most affected by higher prices. More recently, two areas off the coast have been identified as having potential for commercial extraction of oil and gas. Work is still exploratory, but if it were to go ahead, there could be significant environmental

risks, particularly associated with deep-sea drilling. Given the low level of oil consumption in Iceland and the absence of refineries, oil and gas extraction would not materially affect energy security, but would generate additional revenue.

Conflicts over energy-related developments prompted the Icelandic government to change its approach to decision making in this area. In the late 1990s, it launched an initiative to develop the Master Plan for Hydro and Geothermal Energy Resources. The development of the master plan involved many features of strategic environmental assessment, and was based on scientific analysis and wide public participation. The plan, adopted by the Parliament in 2013, classifies some 80 areas with potential for hydro or geothermal development as suitable for development, not suitable, or needing further research. Final decisions on whether to issue a licence will be based on environmental impact assessment. The master plan provides a valuable model for building consensus on complex energy-environment issues. The next phase and the four-year review of the master plan should further reinforce the independence and quality of the scientific assessment, strengthen the economic analysis of options and broaden the scope of activities covered (to include, for example, power lines).

Iceland's energy-related legislation is generally in line with that of the EU, except in the area of energy efficiency. The government claims that EU energy efficiency policies would not sufficiently benefit Iceland's consumers or the environment due to the cheap and abundant geothermal heating. Reflecting the low cost of energy and relatively poor insulation, consumption of heat in residential buildings grew by about 12% over 2000-11. However, evidence from other countries suggests that geothermal energy is not inexhaustible. Thus a prudent policy would be to implement cost-effective measures promoting energy efficiency. Iceland could consider tightening energy efficiency requirements in the building code on the basis of those applied in other Nordic countries.

About 10% of the population does not have access to geothermal heat, using electricity or oil instead. The price for the latter is aligned with the price of geothermal heat through a subsidy, and these customers benefit from favourable tax treatment. Removing these support measures could strengthen incentives for energy efficiency and for connection to the geothermal heat supply, even if the impact on overall energy use and emissions of GHGs and air pollutants is likely to be small.

Transport and fishing are the main consumers of fossil fuels, together accounting for about 17% of total final energy consumption in 2011. While there has been considerable progress in improving energy efficiency and reducing fossil fuel use in the fishing sector, transport energy use has continued to rise. Iceland has one of the highest per capita vehicle ownership levels in the OECD. It introduced a CO_2-based vehicle tax, but average fuel efficiency is low and CO_2 emissions from new cars are well above those in other European countries. These features are linked to the low population density, limited transport mode alternatives and frequently difficult driving conditions. The government expects to achieve the 2020 target of 10% renewables in transport mostly by using biogas and other biofuels, but this seems neither feasible nor cost-effective. The use of electric vehicles in Iceland is in its infancy, but increasing it is technically feasible within the current electricity system. However, costs would need to be reduced and other obstacles addressed to boost demand for this mode of transport.

Recommendations

- Ensure that decisions on future energy developments (e.g. expansion of power capacity, connecting the Icelandic electricity system to Europe, exploration of offshore oil reserves) are based on independent scientific advice, are subject to cost-benefit analysis and involve open public dialogue.
- Ensure that electricity prices are adequate to cover the long-term costs of power installation projects, including the environmental costs.
- Reinforce the independence of scientific assessment, make better use of economic analysis and integrate power lines into the next phase of the Master Plan for Hydro and Geothermal Energy Resources.
- Develop a better understanding of the sustainability of geothermal fields and development limits.
- Consider how the combination of a tax and an air quality standard for hydrogen sulphide could accelerate the development of low- or no-emissions technology.
- Review the energy efficiency requirements in the building code, and consider introducing a maximum total energy need for residential buildings; complement energy efficiency regulations with information and awareness-raising campaigns.
- Review the cost and benefits of heating subsidies with a view to removing those that encourage geothermal energy waste and that conflict with improved home insulation and geothermal space heating development.
- Strengthen co-ordination among municipalities in the Reykjavík area in urban planning and infrastructure development to reduce urban sprawl and private car use; promote alternatives to private car use, including public transport; assess opportunities for, and obstacles to, the wider use of electric vehicles.

1. Introduction

Iceland is an island of volcanic origin; it is geologically active, with considerable geothermal development potential. The large glaciers and numerous rivers flowing from the highlands to the sea also provide major potential for hydropower development. The energy sector is unique because of its isolation from other European networks, the very high share of renewable sources in the energy supply, the absence of natural gas and refinery infrastructure, and the full dependence on imports for the supply of refined oil products. The cold climate and sparse population necessitate high energy use for space heating and transport, and key export industries such as fishmeal and metal production are energy intensive.

Since the oil price crisis in the 1970s, energy policy has focused on replacing oil with geothermal and hydropower to meet Iceland's energy needs. Currently, the vast majority of energy supply is from renewables: Iceland is the only OECD country where energy for electricity and heat generation is almost fully based on renewables.

In the last decade Iceland embarked on a major expansion of generation capacity to provide power for energy-intensive industries such as aluminium smelting. These industries were attracted to the country largely because of its comparatively cheap, low-emission energy. The government's goal has been to diversify the export base by reducing its reliance on fisheries while at the same time taking advantage of its wealth of renewable

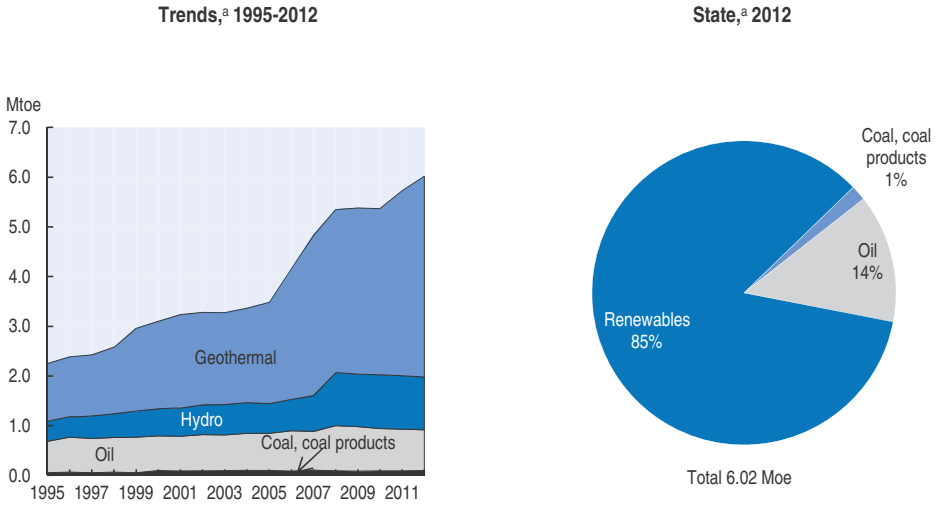
energy resources. While these industries provided a significant stimulus to the economy, the development of the associated power plants and infrastructure has had an impact on the environment.

2. Key energy trends

2.1. *The energy mix*

While the economy grew by 30% between 2000 and 2012, Iceland's total primary energy supply (TPES) almost doubled. This mainly reflects booming energy demand associated with the installation of heavy industrial plants (Figure 4.1). The primary energy sources are hydropower and geothermal for electricity generation and heat production. The contribution of renewables to TPES increased from 74% in 2000 to 85% in 2012, a share significantly higher than in any other OECD country (Annex I.A; Figure 1.3). Geothermal power accounted for more than two-thirds of TPES (Figure 4.1). Iceland is the only Nordic country having geothermal as its main energy source. Iceland is dependent on imported fossil fuels, which accounted for the remaining 15% of TPES in 2012. Fossil fuels are used primarily in transport and fishing, and to a minor extent to produce electricity and heat in remote locations and as a backup power source.

Figure 4.1. **Energy supply by source**



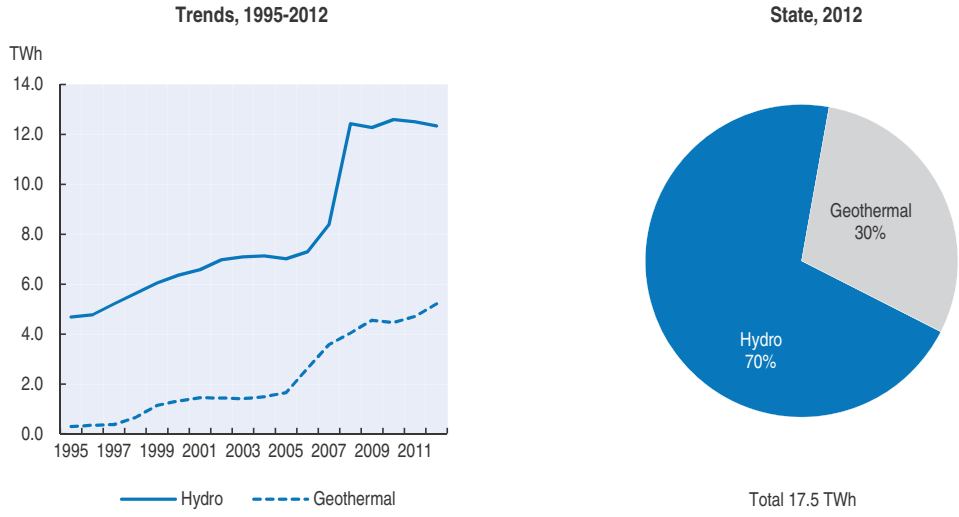
a) Total primary energy supply, excluding trade of electricity and heat.
Source: IEA (2013), *IEA World Energy Statistics and Balances* (database).

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Over the last decade, net hydroelectric capacity nearly doubled and geothermal capacity more than trebled. The significant growth of the aluminium industry is the main factor underlying this increase of power generation capacity and the corresponding expansion of the transmission grid. As a result, electricity production has more than doubled. After steep growth in 2006-09, hydroelectric power production levelled off to reach 70% of total power generation in Iceland in 2012. Geothermal electricity generation, which accounted for the remaining 30%, has grown steadily since the mid-2000s (Figure 4.2).

Geothermal power is primarily used to produce heat for several purposes, including heating homes, swimming pools and greenhouses (Figure 4.3). Since the 1970s, Iceland has

Figure 4.2. **Electricity generation by source**

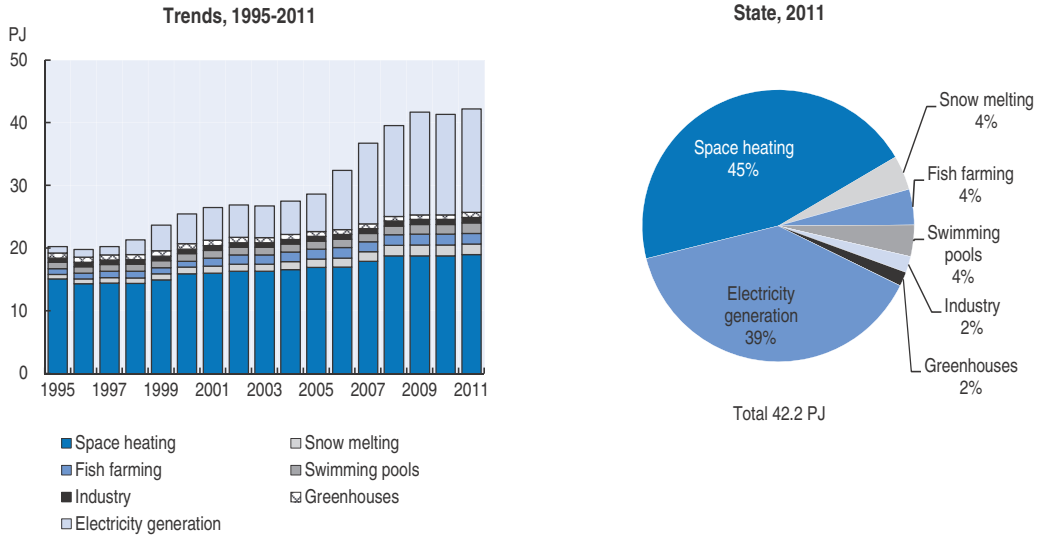


Source: IEA (2013), *IEA World Energy Statistics and Balances* (database).

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heavily invested in expanding geothermal space heating, which accounted for 45% of geothermal use in 2011. Geothermal energy met 90% of space heating needs that year, and electricity about 9% (one-third via district heating systems). The share of oil in heating fell to about 1% (Orkustofnun, 2012). Geothermal water is also used for industrial and commercial purposes.[1] Geothermal heating of swimming pools has a long tradition in Iceland, which has more than 160 geothermal swimming pools with a total surface area of about 37 550 m^2.

Figure 4.3. **Use of geothermal energy**



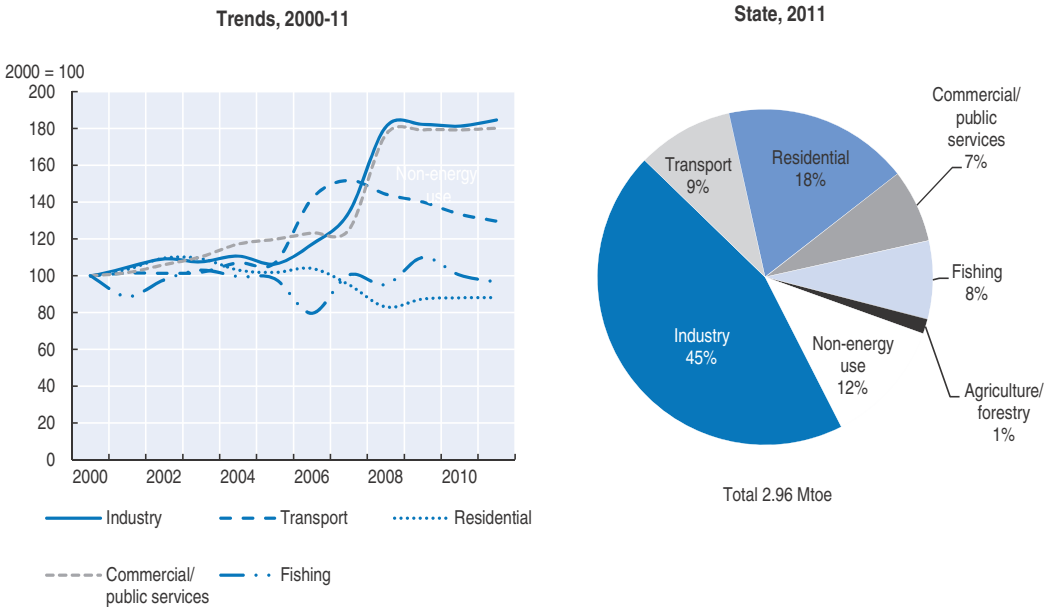
Source: Orkustofnun (2014), "Geothermal Utilisation", Iceland Energy Portal.

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2.2. *Energy use and intensity*

Between 2000 and 2011, total final consumption of energy (TFC) increased by 40%, driven by massive growth in electricity consumption. It has stabilised since the 2008 economic crisis. In 2011, industry was the largest consumer of energy, using 45% of all energy and 87% of electricity, the latter mostly for aluminium smelting (Figures 4.4 and 4.5). The residential sector was the next largest end-use sector, accounting for 18%, followed by transport (9%) and fishing (8%). Residential consumption decreased by 12% relative to 2000, mainly in the second half of the 2000s as a result of the impact of the recession on household income. Energy consumption from transport also declined with the recession, but by 2011 it still was 30% above the 2000 level (Figure 4.4; Section 7.2).

Figure 4.4. **Final energy consumption by sector**



Source: IEA (2013), *IEA World Energy Statistics and Balances* (database).

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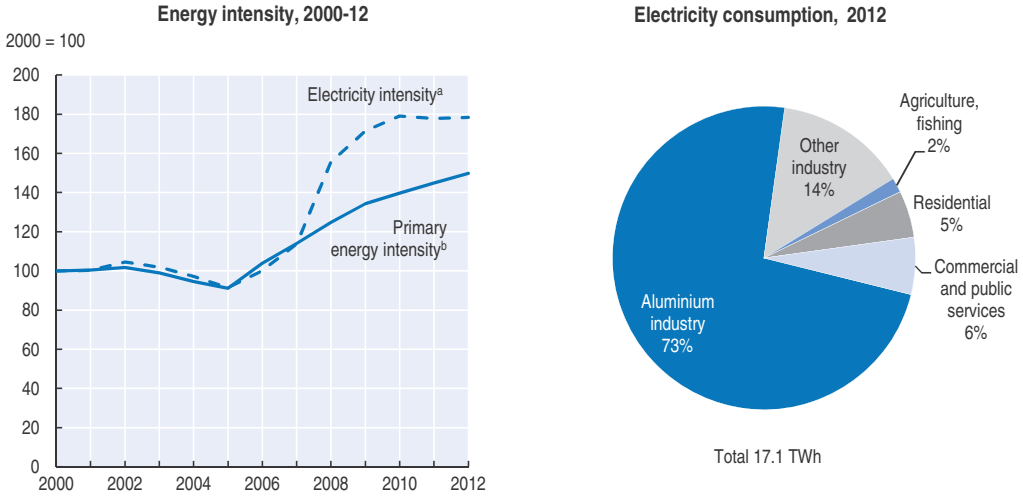
The consequence of the concentration of electricity-intensive industry has been a steep rise in energy and electricity intensity (Figure 4.5). Energy intensity (TPES per unit of GDP) increased by 50% over 2000-12 to nearly four times the OECD average (Annex I.A). Iceland has 3.5 times the energy intensity of the United States, and also of New Zealand, another hydro- and geothermal-reliant island country.

3. Environmental impact of the energy sector

3.1. *Impact on landscape, water and biodiversity*

Development of large hydropower and geothermal power capacity has a potentially significant environmental impact. Both types of plant affect Iceland's landscape and wilderness areas. In addition, the installation of pipes, transmission lines, roads and other infrastructure can affect a much wider area than the locations of the plants themselves.

Figure 4.5. **Energy intensity and electricity consumption**



a) Electricity consumption per unit of GDP at 2005 prices and purchasing power parities.
b) Total primary energy supply per unit of GDP at 2005 prices and purchasing power parities.
Source: IEA (2013), *IEA World Energy Statistics and Balances* (database); OECD (2013), *OECD Economic Outlook No. 93* (database); Orkustofnun (2014), Iceland Energy Portal.

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Iceland's high-temperature geothermal fields are restricted to active volcanic zones, which often have little organic soil and biodiversity. Yet the environmental impact of geothermal plants may be high. Many geothermal areas are distinctive and exceptionally scenic landscapes, with hot springs, lava, glaciers and some of the main tourist destinations and hiking trails (Thórhallsdóttir, 2007a). In addition, operating the plants can cause minor land subsidence in neighbouring areas. Wastewater from geothermal installations contains substances such as heavy metals and nutrients. Wastewater discharges into surface waters can thus affect the ecosystem and are subject to pollution limits indicated in the plant licence. Some power plants operated by the National Power Company pump the wastewater back into the geothermal reservoir to reduce environmental contamination (Landsvirkjun, 2013).

Hydropower is generally considered as having greater environmental impact than geothermal in Iceland, primarily because it is associated with potentially irreversible biodiversity, landscape and cultural loss. Hydropower plant capacity is dependent on the river flow rate and the elevation from which water falls (hydraulic head). Significant storage and hydraulic head are usually associated with lakes and waterfalls, both of which are likely to have high scenic value. Large water reservoirs generally provide habitats for wildlife and water for irrigation. Flooding to form large reservoirs poses considerable problems in an ecologically fragile environment where less than 2.5% of the land area is arable (Figure 1.10). For example, in the central highlands, potential sites for hydro storage reservoirs are located in depressions where vegetation, organic soils and the bulk of the biodiversity are concentrated, while the surrounding flats and hills are mostly barren with very low vegetation cover and negligible organic soil (Thórhallsdóttir, 2007a). Regulating river flows may have consequences for flora and fauna and alter conditions for fish migration; part of the young salmon (smolt) population going downriver can be lost in hydropower plant turbines.

Landscape and nature are the main features attracting foreign visitors and Icelanders alike to the highlands (Chapter 5). Many Icelanders consider landscape their most important national symbol (Thórhallsdóttir, 2007a). Concerns over the potential impact of energy development have often led to heated public debate, prompting the government to revise the decision-making processes for power plants (Section 6).

3.2. Emissions from energy production and use

Greenhouse gas emissions

With the highest share of renewables in energy supply among OECD countries, Iceland has also the lowest carbon intensity in electricity and heat generation (0.154 g CO_2/kWh in 2011). Electricity and heat production generate virtually no greenhouse gas (GHG) emissions: geothermal processing emits an insignificant amount of carbon dioxide (CO_2) from boreholes; hydropower generates even lower CO_2 emissions from reservoirs, due to loss in vegetated areas when reservoirs are filled (Landsvirkjun, 2013).

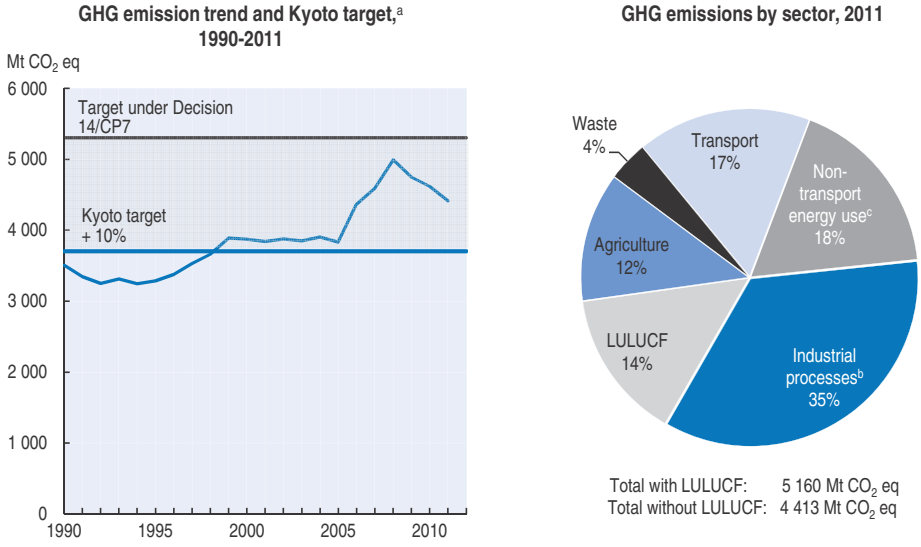
Overall, GHG emissions (excluding emissions and removals from land use, land-use change and forestry) have increased by 14% since 2000, although at a lower rate than GDP (Figure 1.2). As of 2011, Iceland was on track to reach its Kyoto Protocol target to keep the increase in GHG emissions within 10% from the 1990 level in 2008-12, excluding CO_2 emissions from new heavy industry that complies with Decision 14/CP.7 (Figure 4.6; Section 5.3).[2]

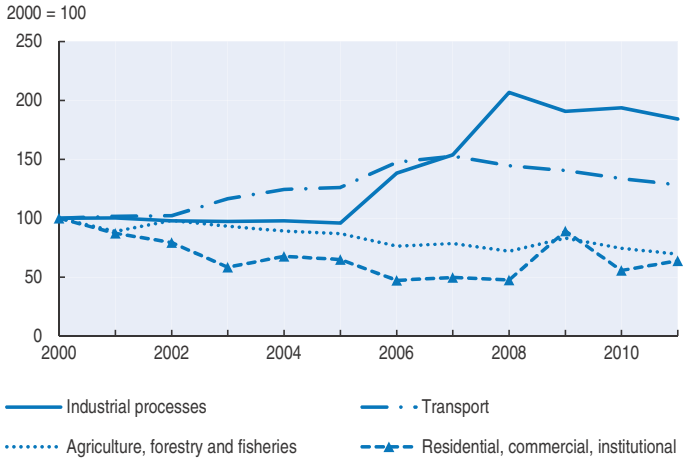
Industrial processes, mainly three aluminium smelters and a ferrosilicon plant, form the largest source of GHG emissions (35%), which is unique in the OECD (Figure 4.6). Aluminium production mainly emits CO_2 and perfluorocarbons (PFCs).[3] Aluminium smelters in Iceland are among the least GHG-intensive in the world thanks to the use of renewables-based electricity: for example, the Alcan smelter in Straumsvík and the Norðurál smelter at Grundartangi emit 1.4 to 1.7 t CO_2 eq per tonne of aluminium produced, compared to an international average of 10-12 t CO_2 eq per tonne of aluminium produced (Institute of Economic Studies, 2009). However, capacity growth has led to an increase in industrial process emissions, especially since 2005 (EAI, 2013). GHG emissions from industrial processes grew by 83% between 2000 and 2011 and were the main driver of total GHG emission growth. Reducing process-related emissions in the aluminium industry would require radical changes in the production process (IEA, 2013).

Energy use in transport, mainly by road, is the second largest single GHG emission source (17% of total emissions). Energy consumption and GHG emissions from road transport increased dramatically between 2000 and 2007 owing to increases in the number of cars per capita, in the number of larger, more powerful vehicles and in mileage driven. Despite a decline since 2007, with the crisis and higher fuel prices, in 2011 transport emissions were 28% above the 2000 levels. In recent years more fuel-efficient vehicles have been imported (EAI, 2013). Emissions from energy in the residential and service sectors declined by 36%, reflecting progress in replacing oil with geothermal power in space heating (Figure 4.6). Space heating contributes only 0.5% of GHG emissions in Iceland, compared to 36% in the EU (MII, 2012). GHG emissions from agriculture, forestry and fisheries declined by over 30% from 2000 to 2011. In particular, CO_2 emissions from fuel use in fishing fell by 24%, reflecting a reduction in the fishing effort and improved efficiency (Section 7.3).

A corrigendum has been issued for this page. See http://www.oecd.org/about/publishing/Corrigendum-Iceland2014.pdf

Figure 4.6. **Greenhouse gas emissions**





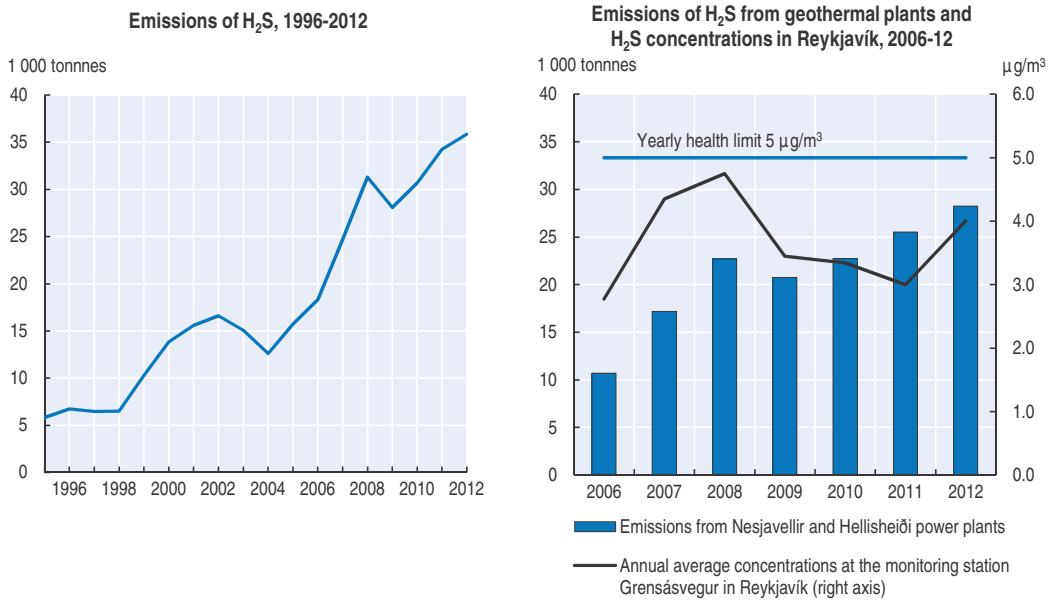
a) Excluding emissions/removals from land use, land-use change and forestry (LULUCF).
b) Includes solvents.
c) Includes emissions from energy use in the following sectors: manufacturing and construction; agriculture forestry and fisheries; and residential, commercial and institutional.
Source: OECD (2013), *OECD Economic Outlook No. 93* (database); UNFCCC (2013), *Greenhouse Gas Inventory Data* (database).

StatLink http://dx.doi.org/10.1787/888933087838

Hydrogen sulphide

Hydrogen sulphide (H_2S) is a potential air pollutant from geothermal power plants. It is a colourless gas with the characteristic foul odour of rotten eggs. In low concentrations it is mainly an irritant to eyes and respiratory systems. In high concentrations H_2S can be corrosive, flammable and explosive, and can affect respiratory organs. The impact on human health and the environment of continuous exposure to low concentrations of H_2S over the medium and long term is still unknown. As Figure 4.7 shows, emissions of H_2S have more than doubled since 2000 with the increase in geothermal power capacity.

Figure 4.7. **Emissions and concentrations of H_2S**



Source: Country submission; Orkustofnun (2014), Iceland Energy Portal.

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The concentration of H_2S has risen significantly in the Reykjavík area since construction of the Hellisheiði power station, the largest geothermal plant in the world, with capacity of 303 MW of electricity and 400 MW of hot water.[4] Emissions of H_2S from the plant are estimated at 16 000 tonnes per year, nearly half the total H_2S emissions from all Icelandic geothermal plants.

Since Hellisheiði started operating in 2006, the Ministry for the Environment and Natural Resources (MENR) has received many complaints from the public about emissions of H_2S. Ambient monitoring in the vicinity of the plant showed concentration levels persistently above the WHO guideline value for occupational exposure of 150 µg/m^3 (reaching 170 µg/m^3). An examination of vegetation in the Hellisheiði area showed that H_2S was damaging moss. A study in 2011 showed a link between the plant's emissions and increased purchase of asthma medicines in the greater Reykjavík area (Saving Iceland, 2012). Local media have reported on damage to electronic equipment linked to H_2S. To respond to these concerns, the MENR tightened regulations on H_2S, and the energy companies are looking at possible ways to reduce the emissions (Box 4.1). The introduction of a tax on H_2S emissions could encourage energy companies to further reduce emissions, provided that they can be accurately measured.

4. The energy market and prices

Iceland has liberalised its electricity market in line with EU policy but has not established a wholesale electricity trading system (Box 4.2). All major producers sell electricity through bilateral contracts with power-intensive industrial and retail companies under fixed agreements running one to twelve years. The electricity prices are among the lowest in Europe, reflecting the renewable nature of power generation, which is capital intensive but entails no fuel costs.

Box 4.1. **Standards limiting concentrations of hydrogen sulphide in ambient air**

In 2010 the Ministry of the Environment and Natural Resources announced a regulation to limit the concentration levels of H_2S in the atmosphere at 50 µg/m^3, measured as an average over 24 hours. The daily limit is three times stricter than the WHO guideline value of 150 µg/m^3. The limit for the maximum annual average is 5 µg/m^3. According to the WHO guidelines, H_2S concentrations should not exceed 7 µg/m^3 on average over 30 minutes to avoid substantial odour annoyance.

The regulation allows levels higher than 50 µg/m^3 five times a year until July 2014. Icelandic energy companies have asked for the stricter rules to be delayed until 2020 to allow them to develop a cost-effective and environment-friendly way to reduce H_2S emissions. As from July 2014, exceedances of the ambient standards trigger financial penalties, and the authorities will be obliged to inform the public each time the pollution exceeds the limit.

Reykjavík Energy, which operates the Hellisheiði power plant, is currently exploring emission reduction options, including dissolving H_2S in condensate water and injecting it back into the high-temperature geothermal reservoir, allowing its mineralisation. This technology is more environment-friendly than the current method of surface-processing H_2S gas into sulphur powder, which then needs to be disposed of (Reykjavík Energy, 2012). A pilot project due to start in 2014 will allow 15-30% of the gas from the Hellisheiði power plant to be dissolved in water for reinjection, and it is hoped that zero emissions can be achieved by 2020. The trials have been successful, but increased seismic activity in the area has been reported.

4.1. Electricity contracts with aluminium smelters

Nearly 80% of the electricity generated in Iceland is sold to energy-intensive industry, notably three aluminium smelters – Alcoa in Reyðarfjörður, Norðurál in Grundartangi and Rio Tinto Alcan in Straumsvík. As with similar contracts in other countries, electricity for power-intensive projects is sold via long-term contracts, frequently for 20 years or more, and renewable. The price is generally below average commercial rates and special transmission tariffs apply. New supply contracts index the electricity price to the US consumer price index, while older ones were indexed to the global price of aluminium, exposing the National Power Company and its owner, the state, to the aluminium price risk (OECD, 2013a). In line with common international practice, the contracts are frequently "take or pay", obliging the customer to either take electricity from the supplier or pay a penalty. This, combined with the below-market price, may discourage efficient energy use. While energy prices for power-intensive industry are not publicly available, the European Free Trade Association (EFTA) Surveillance Authority has verified that the contracts do not involve state aid.

The very high share of energy-intensive industry in total consumption has prompted local criticism that these customers receive a disproportionate benefit from cheap power prices, to the detriment of other consumers. A study by the Institute of Economic Studies (2009) indicated that high electricity demand by the aluminium industry has not resulted in a massive price increase for households (Section 4.2), and that the overall economy has gained net benefits from the smelters. However, the study did not take environmental costs and risks into account. Current contracts between public utilities and the foreign aluminium companies make it difficult to evaluate how profitable the related energy

Box 4.2. **The liberalisation of Iceland's electricity market**

Iceland's energy system has no connection to other countries' networks. The 2003 Electricity Act implemented the EU Electricity Directive (2003/54/EC) concerning common rules for the internal market in electricity. The act consolidates various laws into comprehensive legislation on generation, transmission, distribution and sale of electricity. It liberalised the electricity market and defined the generation and sale of electricity as competitive activities subject to public licensing. Licences can only be given for power plants that run on renewable energy sources.

Most of the energy sector is publicly owned and subject to foreign ownership restrictions. There are three major producers of electricity. The state-owned National Power Company (Landsvirkjun) is the dominant producer, with a 73% market share. It and two other large companies, Orkuveita Reykjavíkur/Reykjavík Energy and HS Orka, generate 97% of the country's electricity. There are also companies with limited generation capacity, including small private hydropower producers. The introduction of wholesale electricity trading would allow small generators to participate in the market without having to commit their entire output to long-term bilateral contracts. It would also facilitate implementation of demand-response systems. However, the small size of Iceland's energy market – with a limited number of wholesale sellers and purchasers – lack of interconnection with other markets, and low price of electricity are barriers to a fully competitive and transparent market in the near term.

The transmission system operator owns and manages the power transmission system. Six distribution system operators manage the regional electricity grids, and most also provide hot and cold water distribution. All but one are owned by either the state or one or more municipalities. There are eight retail companies, and the electricity market was opened to all customers in 2006. Reykjavík Energy is the largest; it is almost fully owned by the municipality of Reykjavík and supplies the greater capital area with electricity, heat and water.

Source: Ólafsson et al. (2011), *Report on Regulation and the Electricity Market 2010 Iceland*.

investments are. It is unclear whether the public utilities earn an appropriate return on the use of natural resources including the environmental costs and risks. As energy companies are mostly in public hands, this means taxpayers may be subsidising and bearing the risks of insufficiently profitable investment by power companies (OECD, 2006; Krater and Rose, 2009).

Further expansion of the aluminium sector would make the economy overly dependent on export earnings from a single sector and reduce diversity in the energy market (OECD, 2006). The large size of the aluminium industry, compared to domestic electricity demand, means that if industry demand were to decline, there would be no alternative uses for the current electricity production. While Iceland has been exploring the development of sectors such as data centres and greenhouse expansion, these are expected to lead to comparatively low growth in electricity demand. Thus Iceland would be quite vulnerable to future change in the aluminium industry's situation, should the smelters seek to renegotiate contract prices. Renegotiations of this type, seeking more favourable terms, are not unknown internationally.[5]

The OECD (2013a) concluded that the net benefits to Icelanders from energy-intensive industry may not be maximised. It recommended that future expansion of electricity generation for powering such industry should be evaluated on the basis of a broad, transparent cost-benefit framework. Such analysis should ensure that electricity

prices are adequate to cover the long-term costs of the projects, including the environmental costs.

4.2. Household energy prices

Iceland has the lowest household electricity prices in the OECD. Table 4.1 tabulates EU electricity prices against a representative tariff for Icelandic households. It shows that the latter, expressed in euros, is lower than those of major EU countries. Commercial and industrial prices follow a similar pattern. The decline in prices expressed in euros is partly the result of the strong depreciation of the króna due to the financial crisis; expressed in krónur, nominal prices for domestic users rose.

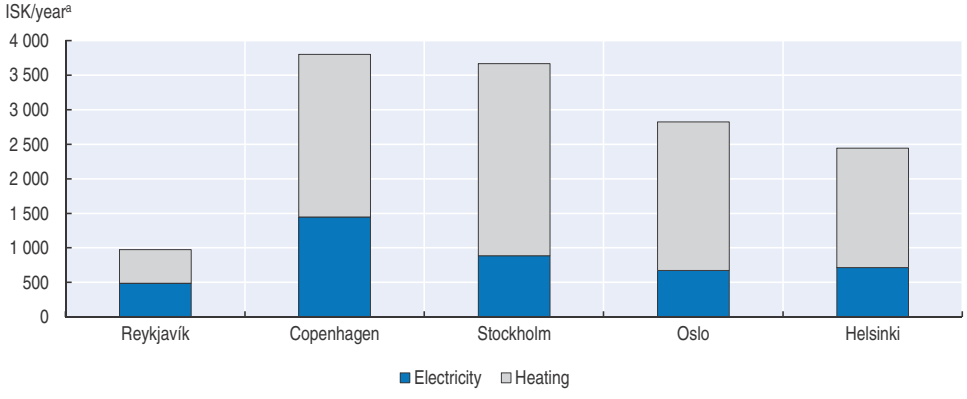
Table 4.1. **Household electricity prices in selected OECD countries in 2012-13**

Country	2012	2013
	EUR/kWh	
France	0.099	0.101
Germany	0.144	0.149
Iceland	0.088	0.083
Norway	0.136	0.137
Sweden	0.131	0.136
United Kingdom	0.160	0.166
EU27	0.134	0.137

Note: Average national price in EUR per kWh without taxes applicable for the first semester of each year for medium size household consumers (with annual consumption between 2 500 and 5 000 kWh).
Source: Eurostat (2014), *Energy Statistics* (database).

Geothermal space heating is used throughout the country. Municipalities operate district heating systems under concession agreements, often through municipal utilities. They distribute and sell hot water and steam from geothermal fields or heating stations within their area, at tariffs approved by the industry minister. The low cost of geothermal heating means Icelandic households incur much lower total energy costs than their Nordic neighbours. As Figure 4.8 shows, Iceland's electricity cost for a typical home is similar to (though cheaper than) those of Norway and Finland, but with much cheaper space heating.

Figure 4.8. **Annual home energy costs in Nordic capitals as of April 2013**



a) For annual consumption of 4 800 kWh of electricity and 495 cubic metres of hot water.
Source: Reykjavík Energy, August 2013.

StatLink http://dx.doi.org/10.1787/888933087876

5. Institutional and policy framework for integrating energy and environment

5.1. *Institutional framework*

As in other OECD countries, the institutions responsible for developing and implementing energy policy include line ministries and supporting agencies. The Ministry of Industries and Innovation (MII) is responsible for energy policies and the MENR for environmental policies (Chapter 2). In particular, the MENR has overall responsibility for climate policy and works in close co-operation with the industry ministry. The Environment Agency of Iceland and the Agricultural University estimate GHG emissions. An interministerial committee oversees implementation of the action plan for climate change mitigation (Section 5.3), reports on progress and provide advice to the MENR.[6]

The Competition Authority oversees electricity generation and sales. The Orkustofnun, or National Energy Authority, is the energy market regulator; it issues and monitors operating licences of competing firms and regulates transmission and distribution companies, especially as concerns revenue caps, tariffs and service quality. It also licenses exploration for, and use of, energy and mineral resources. The National Planning Agency (NPA) is responsible for assessing the quality of environmental impact assessment (EIA), including for power plant and energy infrastructure projects (Chapter 2).

Municipal authorities play a strong role in various areas related to energy and climate policies, including physical plans, public transport and construction permits for energy infrastructure (subject to favourable assessment by the planning agency). Local authorities also oversee industry licensing and other issues under the Health and Pollution Control Act (Chapter 2).

5.2. *Energy policy framework*

Energy policy is grounded in the Comprehensive Energy Strategy for Iceland, a document based on a report presented and discussed in the Parliament in 2012. The main objectives of the strategy include reducing fossil fuel imports by fostering renewables; developing hydroelectric and geothermal sources with a precautionary and protection approach; supporting diversified, sustainable and eco-conscious industry; encouraging better energy use and energy efficiency; and examining the possibility of connecting the Icelandic and EU electricity grids (Box 4.3) (MII, 2012).

Much of the EU legislation on energy policy is part of the agreement on the European Economic Area, which Iceland joined in 1994 (Chapter 2). Iceland's energy-related legislation is thus broadly in line with EU law. However, some differences exist due to Iceland's unique energy mix and isolated market. Its energy efficiency policy is not fully consistent with the EU legislation, as the country requested derogation from some related directives (Section 7.1).

In 2013, Iceland adopted a national renewable energy action plan in compliance with the Renewables Directive (2009/28/EC). The objective of the plan is to increase renewables' share in gross final consumption to 72% by 2020, a target Iceland has already exceeded (Table 4.2).

There is no room for further improvement in electricity, and only minimal room in heating and cooling, which are close to saturation in gross final energy from renewables. Unlike most OECD countries, Iceland needs no support measures in this regard, given the magnitude of its renewables potential and the absence of domestic fossil fuel reserves. Its

Box 4.3. **Connecting Iceland's electricity system to Europe?**

Studies carried out by the National Power Company indicate that a submarine cable between Iceland and Scotland is technically feasible and financially expedient, although it would be challenging as it would be the longest and deepest interconnector in the world (Landsvirkjun, 2012a).

The MII co-ordinated a committee to review the social, environmental and macroeconomic impact on Iceland of a submarine cable. Its report, released in June 2013, reached no firm conclusions; the issue will require further debate and analysis as the technology and economic conditions develop.

A potential effect of any connection of Iceland to the EU electricity market would be to link Iceland to the electricity prices prevailing in the EU. Given Iceland's low energy production cost and delivered energy price, this could result in a rise in electricity prices for local domestic and commercial consumers, and a corresponding decline in real income. At the same time, the electricity generators would likely benefit from significantly higher prices per kilowatt-hour generated. The overall effect would be, however, difficult to predict.

One way to address such a potential outcome would be through a resource rent tax on windfall profits to capture a large part of generators' excess gains for the benefit of society.* Part of the revenue from such a tax could be used to compensate the consumers most affected by higher electricity prices. With a cable connection, real-time electricity trading would probably become necessary.

* Taxes on resource rents are levied on the extra profit, beyond a normal rate of return on capital, which the exploitation of certain natural resources can entail. They fall outside a strict definition of environmentally related taxes since the tax base (profit) has no particular environmental impact as such (Chapter 3). These taxes can, nevertheless, be important from a resource management point of view.

Table 4.2. **Progress towards the 2020 target for the share of energy from renewable sources**

	2005 baseline	2010 actual	2020 target
Heating and cooling	89.9	95.2	96.1
Electricity	100.0	100.0	100.0
Transport	0.1	0.35	9.9
Total	63.4	75.2	72.0

Source: MII (2012), *The Icelandic National Renewable Energy Action Plan*.

situation is similar to that of New Zealand, another island country with large geothermal potential.

Yet Iceland is far from reaching the target of 10% renewables in transport, which includes the fishing fleet (Table 4.2). Hence the government's policy effort is focused on reducing fossil fuel dependency in transport and fishing. In early 2013, Iceland approved a bill to promote the use of renewables in transport and to introduce sustainability criteria for biofuels and other renewables-based fuels (Section 7.2). Reaching these renewables-based targets is expected to help Iceland achieve its climate mitigation targets as well.

5.3. Climate policy framework

Climate change policy is largely shaped by the United Nations Framework Convention on Climate Change and the Kyoto Protocol, which Iceland ratified in 2002. For the first commitment period (2008-12), Iceland agreed not to increase its GHG emissions by more

than 10% from 1990 levels, excluding emissions from heavy industry that use renewables and best available technology and were established after 1990 (Decision 14/CP.7).[7] For the second period (2013-20), it committed to a quantified GHG emission reduction of 20% from the 1990 level, a target based on the understanding that it will be fulfilled jointly with the European Union and its member states.

To meet these objectives, Iceland adopted a national climate change strategy in 2002, which was revised in 2007. The 2002 strategy aimed at curbing emissions in conformity with the country's obligations under the Kyoto Protocol and increasing the level of carbon sequestration through afforestation and revegetation programmes (Ministry for the Environment, 2010). Under the 2007 strategy, Iceland is committed to the long-term goal of reducing GHG emissions by 50-75% by 2050, compared to the 1990 level.

In 2010, the government adopted an action plan for climate change mitigation. It set a target of reducing emissions from sectors outside the EU Emissions Trading System (EU ETS) by 30% from 2005 to 2020. Almost half this reduction would come from afforestation and reforestation. Iceland's energy and industrial mix gives it limited abatement potential in sectors outside the EU ETS, except road transport. For example, unlike many OECD countries, it has little scope to reduce emissions from buildings (Section 3.2). The plan sets the basis for adopting the EU Effort Sharing Decision on GHG emission mitigation targets. In June 2012, the Parliament passed a law on climate change (Act No. 70/2012), aimed at tackling reduction of GHGs efficiently and effectively, increasing carbon sequestration, promoting mitigation and creating conditions for the government to fulfil its international obligations (EAI, 2013).

5.4. *Key energy and climate policy measures*

Table 4.3 presents an overview of measures to achieve the renewables targets, improve energy efficiency and reduce GHG emissions. In recent years Iceland has implemented several economic instruments to encourage energy savings and reduce GHG emissions, especially in industry and transport (MII, 2012).

Iceland has been part of the EU ETS for GHGs since 2007. Its participation in the trading mechanisms has been very limited so far because of the absence of fossil fuel-based power generation and refineries and the exclusion of the aluminium sector, fishmeal production and aviation until 2013.[8] With these sectors now included, the EU ETS covers about 40% of Iceland's GHG emissions. Emissions of PFCs from aluminium smelters are also regulated in environmental licences, which set emission limits per tonne of industrial output (0.14 tonne of CO_2 eq per tonne of aluminium).

In 2010, Iceland introduced a carbon tax and CO_2-based vehicle taxes (Section 7.2). Most of the GHG emissions excluded from the EU ETS are subject to the carbon tax. It applies to fossil fuels used in sectors not participating in the EU ETS, including those used to power fishing vessels, which is uncommon among OECD countries. However, the effective tax rate on CO_2 emissions (the combination of energy and carbon taxes) is lower in Iceland than in other countries that also apply a carbon tax (Chapter 3). The OECD (2013a) judged the carbon pricing to be too weak to meet future goals. In addition, the use of coal is fully exempt from energy and carbon taxation, and oil products used in sectors other than road transport (including home heating and fishing) are exempt from the energy excise duty. As the OECD (2013a) recommended, Iceland should broaden the base for the carbon tax and raise its rate to increase cost-effective abatement of GHG emissions.

Table 4.3. **Key energy and climate policy measures**

Sector	Price instruments	Subsidies	Others
General	CO_2 tax on fossil fuels used in sectors outside the EU ETS Excise duty on energy products		
Energy supply		Grants and loans to find usable geothermal water for heating in areas where resources have not yet been found Subsidy for the construction of district heating systems	Master Plan for Hydro and Geothermal Energy Resources
Industry	EU ETS		Limit on emissions of PFCs from aluminium smelters (included in the licence)
Transport	CO_2-based semi-annual road tax on passenger cars CO_2-based excise duty on motor vehicles	Exemption from excise and CO_2 tax for CO_2 neutral fuels (biodiesel, methane, methanol) Discount from excise duty for methane cars (1 000-car limit) VAT exemption on zero-emission vehicles, hydrogen and electricity, with a cap (2012-13) Parking benefits for zero-emission cars (2007-12)	Procurement of environment-friendly vehicles by the central government (2009-12) and municipalities (2006-15) Investment plan to expand public transport and cycling (2012-22)
Buildings		Lump-sum grants for switching from fossil-fuel or electric heating to heat pumps (when geothermal district heating is unavailable)	Energy efficiency requirements in building codes.

Source: Adapted from MII (2012), *The Icelandic National Renewable Energy Action Plan*.

Iceland is engaged in research and development on climate-friendly technology and renewables. Notable examples include deep drilling for superheated geothermal fluid; carbon capture and storage by mineralisation in basaltic rock; production of methanol from CO_2 in geothermal steam; information technology to reduce emissions from ships; and use of hydrogen as fuel in cars and ships (Ministry of Environment, 2010). The National Energy Fund promotes research on geothermal energy in cold areas and supports research projects in the energy sector with the primary focus on alternative fuels, renewables to replace fossil fuels, and energy conservation.

While emissions have declined since the economic crisis, a stronger economic recovery and new energy-intensive projects could result in new emission increases. In the aftermath of the crisis, and in light of the high government debt, public resources to finance GHG mitigation projects are limited. Phasing out the exemption from energy and carbon taxes and the subsidy for electric and oil heating (Section 7.1) would help improve public finances. Companies and households are also heavily indebted, which reduces their ability to invest in low-carbon technology such as more climate-friendly vehicles.

6. Planning and permitting for renewable energy infrastructure

6.1. Master Plan for Hydro and Geothermal Energy Resources

Long-term investment needs in the electricity sector are primarily based on developments in power-intensive industry. Total electricity production is already five times the level needed for a society of comparable size without large energy-intensive industries. Annual growth in electricity demand excluding power-intensive industry is expected to be about 1.5%, requiring investment in energy generation and infrastructure of ISK 1 billion to ISK 2 billion per year in the medium and long term. But investment needs due to increased demand from power-intensive industry in the medium and long term, although uncertain, could amount to ISK 10 billion to ISK 20 billion (Ólafsson et al., 2011).

However, as Section 3 indicated, power-intensive investment projects and the associated expansion in electricity generation capacity have a significant, often long-term impact on the environment. Some possible problems, e.g. affecting flora and fauna, would become apparent only over time, with possible impact on landscape, nature and cultural heritage. As natural areas are Iceland's key resource for tourism, there are also potential land-use conflicts between the power and tourism industries (Chapter 5). Energy generation development projects have often prompted heated public debates, such as that occasioned by Kárahnjukar, a major hydro project (Box 4.4). If Iceland aims to develop its economy based on both power-intensive industry and nature-based tourism, these conflicts have to be addressed and the location of new power plants and infrastructure needs to be carefully planned (Sæþórsdóttir, 2012).

In response to such concerns, in the late 1990s the government decided to develop a Master Plan for Hydro and Geothermal Energy Resources. Its purpose was to evaluate and categorise all potential areas for hydro and geothermal development on the basis of energy and technical potential, economic profitability, implications for employment and regional development, and environmental impact.[9]

The MENR is responsible for the plan, in co-operation with the MII. The plan was developed in two phases (1999-2003 and 2004-10),[10] and was partly based on the example of the Norwegian master plan for water resources (Einarsson, 2011). In both phases, the ministries appointed a steering committee to co-ordinate the work of expert groups.[11] The committees included representatives of various central and local institutions, as well as environmental NGOs and the tourism industry. The results of both phases were made available to the public and public hearings were conducted (Steingrímsson et al., 2007). The plan development process is an example of application of the key elements of strategic environmental assessment (SEA), even though SEA only became mandatory in Iceland in 2006 (Chapter 2).

After more than a decade of analysis and debate, the draft parliamentary resolution approving the plan was submitted to SEA and public consultation. More than 200 comments were received from individuals, NGOs and power companies. The master plan was approved as a parliamentary resolution in 2013 and became binding on all municipalities, which must incorporate its provisions in their land-use plans.

The approved plan classifies some 80 areas for potential hydro and geothermal power plant development into three categories: "green" or suitable for development, i.e. the projects face no obstacles and can apply for licences (8.5 TWh); "yellow" or pending further research on feasibility and environmental impact (12.5 TWh); and "red" or "protection", which does not allow development (11.3 TWh). Building all the "green" capacity and half the "yellow" would nearly double Iceland's current power generation. The MII and MENR decided to move six power plant proposals from the "green" to the "yellow" category in response to comments received in the SEA consultation. Most projects in the "green" category are geothermal power projects, which were generally found to have a lower environmental impact (Thórhallsdóttir, 2007a).

The Master Plan for Hydro and Geothermal Energy Resources is a major step towards broad consensus about future energy development. It is an example of complex decision making and consensus building based on an independent scientific assessment, which is an approach not commonly used (Sæþórsdóttir, 2012). The final ranking of projects was mainly based on scientific assessment of environmental and tourism-related impact

Box 4.4. **Public concerns about energy-related projects**

Iceland witnessed controversies over construction of hydropower projects as early as the 1970s. More than 100 farmers officially claimed responsibility for an explosion on 25 August 1970 that destroyed a small dam on the Laxá River near Lake Mývatn in the north. Locals were determined to prevent the construction of a bigger dam that, according to the farmers involved, would have destroyed a vast natural area as well as most of the surrounding farmlands. A number of other attempts to use rivers for hydropower production, especially in the eastern highlands, failed because of public opposition (Jónsson Úlfhildarson, 2013).

In 2002, the government, Landsvirkjun and the multinational Alcoa agreed to build an aluminium smelter in the eastern town of Reyðarfjörður; the associated 690 MW Kárahnjukar hydropower plant generated much of the public debate. The government argued that development of a clean renewable energy source would offer great marketing opportunities that could form the basis for increased exports and a stronger image of the country, while the industrial plant would provide much needed tax revenue and create jobs. Environmentalists argued that creation of a new reservoir would affect the second largest unspoilt wilderness in Europe, hurt the flows and ecosystems of rivers from Europe's largest glacier, Vatnajökull, and expose the surroundings to accelerated soil erosion. Concerns were also expressed about air and soil pollution, especially by fluorides, which can lead to serious health effects (Del Giudice, 2008).

The NPA first rejected the EIA of the hydropower plant because of the considerable environmental damage involved and insufficient information provided about the construction and its environmental effects. Following extensive analyses, however, despite protests by NGOs, the EIA and permits were given. The conditions set by the environment ministry are estimated to have increased the cost of construction by 2-3% and reduced the amount of energy generated by 4% (OECD, 2005). In particular, several river diversions could not be carried out, and the design and arrangement of the largest dam had to be changed so as to avoid damage that would result from an overflow. Water from the hydroelectric dams is diverted through tunnels to the underground Fljótsdals power station. Power is then sent through high-voltage transmission lines to the Fjarðaál aluminium smelter.

The Fjarðaál smelter was completed in 2007 and reached its full operational capacity of 346 000 tonnes of aluminium per year in 2008. The hydropower project development was completed in 2009. To address environmental impact concerns, the smelter employed a group of Icelandic and foreign scientists to analyse the baseline state of the environment and develop an extensive monitoring process to evaluate and reduce the impact on human health and natural resources. Nearly all lowland area near the smelter is monitored, including air, water and soil. Among the substances measured are gaseous fluoride, particulate matter and sulphur dioxide. The best available technology was used in designing the smelter to minimise pollution and protect the air, water and soil.

In 2006, Alcoa began planning another aluminium smelter in Bakki, near Húsavík in the north. After a six-year process its plans to build a 250 000 tonne smelter were abandoned in 2012 following a negative EIA and negative power supply prospects. The EIA stated that the project's impact would be high and could not be mitigated; its GHG emissions would constitute 14% of Iceland's total and 17 000 ha of pristine wilderness would be affected.

because of the strong correlation between them (Jóhannesson, 2012). Nevertheless, some effects were inadequately considered due to methodological constraints and lack of data. They included groundwater contamination from geothermal wastewater and downstream

impact of hydropower projects as well as potential indirect and cumulative effects (Thórhallsdóttir, 2007a; 2007b). In addition, the plan did not assess the environmental impact of power lines.

No compromise will please everyone, however, and Icelandic generators have expressed concerns that some sites they believe could be developed were excluded. Some claim that the steering committees were not independent and that politics should not have been involved at the last stage of the process to change the ranking, which should have been based purely on the scientific work (Sæþórsdóttir, 2012). Environmentalists argued, meanwhile, that the plan listed some areas or projects inappropriately as "exploitable". These include the glacial Þjórsá River and a dam proposed above the Urriðafoss waterfall, which they claim would disrupt salmon spawning and breeding grounds.

Current development, especially for electricity generation, is putting increased pressure on geothermal resources. Iceland needs to consider the long-term sustainability of geothermal development. International experience has shown that geothermal resources are not inexhaustible and some countries have depleted fields faster than their natural replenishment rate, or have subsequently found that geothermal plant could not operate at design capacity due to pressure limitations. Recent reports of diminishing yields at the geothermal plant at Hellisheiði would indicate that Iceland is not immune to this risk.[12] More generally, it seems Iceland has insufficiently explored ways to limit the amount of new capacity and infrastructure it may need in the future by increasing efficiency in energy use and improving demand management (Sections 4.1 and 7.1).

The 2011 Act on a Master Plan for Protection and Development of Energy Resources (No. 48/2011) institutionalised the master plan preparation process, requiring that the plan be reviewed and re-voted by the Parliament every four years. The act also requires that the master plan take the river basin management plan into account (Einarsson, 2011). A third phase of the plan was launched in 2013, and a new steering committee appointed, to assess the areas classified as yellow and needing additional analysis, as well as additional sites (Rammaáætlun, 2014). The third phase and the review of the master plan should further strengthen the scientific assessment methodology and the independence of the steering committee. It is important to develop some cost-benefit analysis process which gives appropriate consideration to all dimensions of power development (environment, tourism, social and regional development, project profitability). The power lines should also be integrated in the reviewed master plan.

6.2. Environmental impact assessment and permitting

The plan does not replace the need for full environmental impact assessment. The Orkustofnun is responsible for licensing new power plants (over MW 1 of capacity) and transmission lines. A licence can be granted only if the plant or infrastructure is in accordance with the relevant master plan for the area, and has undergone EIA (if required). The authority has to take EIA results into consideration in granting the licence. It can place conditions on power development licences to ensure that the use of the renewable energy resources is efficient from a macroeconomic and environmental perspective. The draft licence is made available to the public, which has four weeks for comments.

To facilitate energy plant and infrastructure development and respond to public concerns over the environment, Iceland has improved its EIA procedures. In particular, the decision point was shifted to local level, though municipalities must take into account the

opinion of the NPA (Chapter 2). The design of power plants and aluminium smelters has been changed, sometimes significantly, following EIAs (OECD, 2006). Before EIA, generators need to undertake a number of investigation and consultation stages to, for example, gain permission for exploratory site investigations and drilling (in the case of geothermal development). Oil and gas exploration are also subject to licensing and to SEA (Box 4.5).

Box 4.5. **Oil exploration and development**

Iceland imports all fossil fuels and has no domestic oil refineries. However, two areas on its continental shelf are thought to have potential for commercial accumulations of oil and gas: Dreki, 200-400 km north-east of Iceland, and Gammur on the northern insular shelf. In early 2013, the government issued exploration licences for the Dreki area, which is in deep waters (between 800 and 2000 metres) and therefore technically challenging to explore and develop.

Exploration and production are regulated by the 2001 Hydrocarbons Act, which prescribes that "exploitation shall take into consideration environmental aspects" but does not include specific provisions for environmental protection. Since the adoption of the SEA Act in 2006, oil exploration and development plans have been subject to SEA. Licences for the Dreki area followed the positive outcome of the SEA. No SEA has yet been made of the Gammur area.

The development of this resource, if it proves technically and economically feasible, would bring Iceland additional revenue through royalties. Without development of indigenous refining capability, it would not in itself materially affect Iceland's oil security and therefore would only be a source of additional government revenue.

As initial exploratory work has only just begun, development (if it occurs) is likely to be many years away. Furthermore, any such development is likely to be controversial and opposed by significant portions of the community on environmental grounds due to the risks of deep sea oil drilling and development.

Some generators claim that these preliminary regulatory steps, when considered along with the EIA process, are too complex and time consuming, as they require multiple consultations, often with the same agencies or groups (e.g. municipalities, MII, MENR, EAI, NPA and other stakeholders). Similarly, they claim that EIA and permitting procedures duplicate each other and lead time is too long. For example, the authorisation process for new transmission lines can take from two to four years (MII, 2012). The EAI has no mandatory deadline for processing the application (Chapter 2).

7. Improving efficiency of final energy use

7.1. Energy efficiency in the residential sector

Iceland has implemented, or is implementing, the EU Regulation (EC) No. 106/2008 on energy efficiency labelling for office equipment, the eco-design directive (2009/125/EC) and the energy labelling directive (2010/30/EU) (MII, 2012). It requested derogations on the directives on energy performance of buildings (2010/31/EU) and on energy end-use efficiency and energy services (2006/32/EC), citing the special features of the country's energy supply as grounds. The Icelandic authorities have maintained that implementing

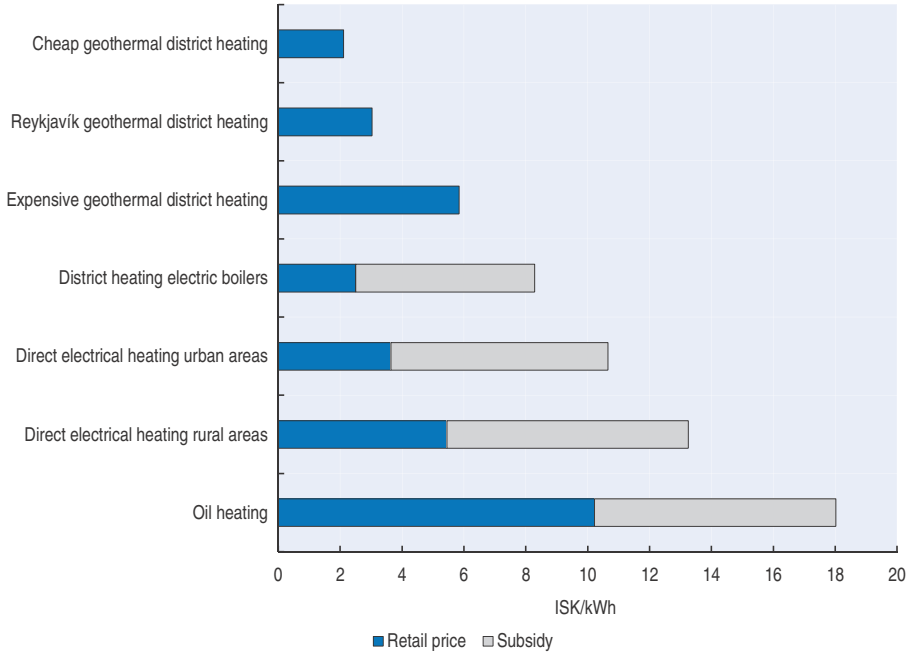
these directives would be insufficiently beneficial for consumers and the environment, given the abundant, low-priced renewable energy (IEA, 2013).

Energy efficiency requirements for new buildings and renovations in the Icelandic building code have been changed repeatedly in the last years. They now include, among other things, standards on ventilation and airtightness. Despite being less stringent than elsewhere, the code is believed to require more energy efficiency than cost minimisation would determine optimal (IEA, 2013). Partly as a result, the level of building insulation is generally lower than in other Nordic countries. Open window ventilation is still common in new buildings, with no restrictions on design.[13] There is little private economic benefit from improved insulation in existing houses because it is generally cheaper to heat houses than to insulate them to the level employed in other Nordic countries.

As a result, consumption of heat in residential buildings grew by 12.5% between 2000 and 2011, although it stabilised after 2007 because of the economic crisis. Encouraging building energy efficiency, via stricter building standards and information campaigns, would help keep downward pressure on overall energy demand. This would help save geothermal reservoirs for future generations, as some reservoirs may have limited capacity (Section 6).

Around 10% of the population cannot use geothermal space heating, depending largely on electric heating. For these people there is a more obvious economic benefit in improving home insulation, installing heat pumps, etc. Electric and oil home heating in communities lacking geothermal water is subsidised so that affected homeowners effectively pay a similar price to those using geothermal heating, as Figure 4.9 shows.

Figure 4.9. **Energy prices for residential heating in mid-2013**



Source: Orkustofnun (2013), *Energy Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933087895

In 2011, this subsidy amounted to ISK 1.14 billion. A similar subsidy is provided to greenhouse farmers; it amounted to about ISK 0.22 billion per year in 2011-13. Iceland also applies reduced VAT (7%, compared to the standard 25.5%) to sales of hot water, electricity and oil used for space heating and swimming pools, and heating oil is exempt from the general excise duty on energy products and the carbon tax (European Commission, 2011). These subsidies can decrease interest in searching for new geothermal resources and thus work against the transition to geothermal space heating. Subsidised electricity prices also reduce incentives to improve energy efficiency. Phasing out the subsidies could benefit the environment, although the impact on overall energy use and emissions of GHGs and air pollutants is likely to be small in the short term.

The MII also subsidises switching from fossil-fuel or electric heating to heat pumps when geothermal district heating is unavailable, providing lump-sum grants determined by the cost and estimated energy savings. In addition, it subsidises insulation and connections to district heating when available, as well as construction of district heating systems. The government gives grants to various projects with emphasis on finding usable geothermal water for heating in areas where resources have not yet been found.

The Energy Agency provides information on energy, creates educational materials for schools and consumers, and helps small and medium-sized companies and municipalities plan strategies to improve energy efficiency. Online calculators allow homeowners to calculate the possible energy savings, energy costs and payback time for investments. Reykjavík Energy also offers information and education on energy use and ways to reduce it (IEA, 2013).

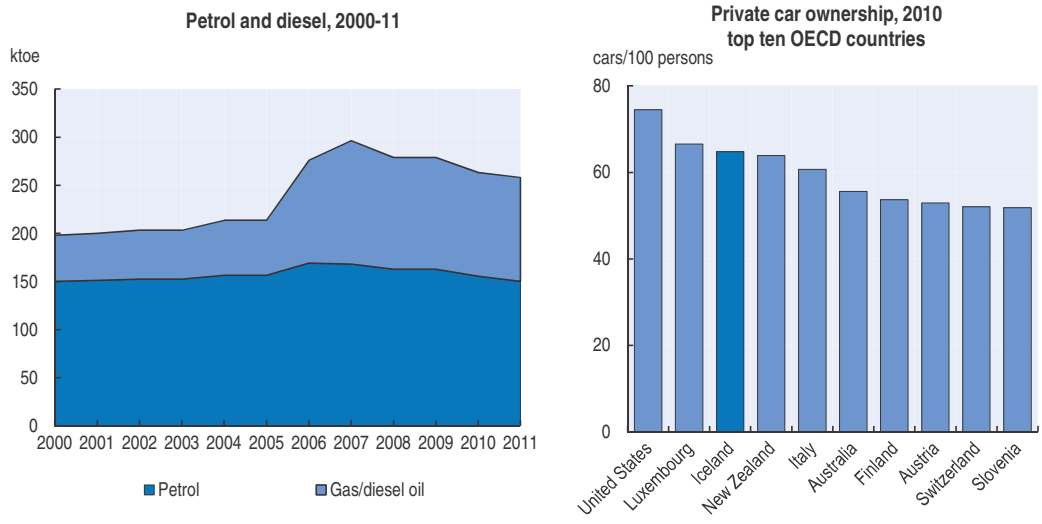
7.2. Reducing fossil fuel use in transport

Road transport

Road is the dominant transport mode in Iceland. There is no rail network because the country's geographic characteristics and sparse population have made investment in railways economically unsustainable (Ministry for the Environment, 2010). Iceland has one of the highest levels of private car ownership in the OECD, as Figure 4.10 shows. Road transport accounts for more than 95% of energy use and GHG emissions in domestic transport. Energy use for transport has grown by 32% since 2000, with a sharp rise in diesel consumption since 2005. That year a special tax on diesel vehicles was replaced by an excise duty on diesel fuel, stimulating diesel vehicle sales (Speck et al., 2006). Fuel consumption started to decline due to the economic crisis, króna depreciation and higher fuel prices. GHG emissions followed the same pattern (Figure 4.6).

With such high per capita vehicle ownership and limited transport alternatives, improved urban public transport networks in major municipalities and vehicle efficiency could deliver significant energy savings in the sector. The government and the Reykjavík municipality have introduced environmental requirements in vehicle procurement policy and undertaken an investment plan to expand the public transport network in the capital region, with an annual budget of ISK 1 billion between 2013 and 2022. The capital's government has also invested in expanding the bicycle network. Transport emissions could be reduced by strengthening co-ordination among municipalities in the Reykjavík area in urban planning and infrastructure development, to reduce urban sprawl and commuting in private motor vehicles (OECD, 2013a).

Figure 4.10. **Road fuel consumption and private car ownership**



Source: IEA (2013), *IEA World Energy Statistics and Balances* (database); OECD (2014), *OECD Environment Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933087914

Vehicle taxes to improve fuel efficiency in the fleet

Average CO_2 emissions from new cars sold in 2009-11 came to 168 grammes of CO_2/km (Harding, 2014), well above the EU average of 140.5 g CO_2/km (EEA, 2013). This is partly because sport utility vehicles (SUVs) are needed to drive in many parts of the country for most of the year. As Chapter 3 notes, in 2011 the government amended vehicle taxation and linked it to CO_2 emissions to encourage the purchase of more fuel- and carbon-efficient cars. However, rental car companies, which account for a large share of the fleet, benefit from reduced vehicle taxes, which encourages them to buy high-emission vehicles (Chapter 3). CO_2-differentiated taxation has had a significant impact on consumer choice in other Nordic countries. In Finland and Denmark, changing tax systems to reflect CO_2 emissions helped reduce average emissions from new cars by 8% in the year following the reform. Similarly, in Norway, the share of cars emitting less than 120 g CO_2/km in new cars sold doubled after the introduction of a tax deduction for such vehicles (IEA, 2013).

Renewable transport fuels

Iceland has encouraged the use of alternative fuels in its vehicle fleet. In its national renewable energy action plan (Section 4.2), the MII aims to raise renewables use in transport to 23.7 ktoe by 2020 from less than 1 ktoe in 2010. The increase will mostly take the form of biogas and vegetable oil (75%). Biodiesel (internally produced) is expected to contribute some 15% and renewable electricity the remaining 10% (MII, 2012). A public-private committee, EcoEnergy, was established by the government in 2010 to develop a policy for promoting use of renewables in transport.

Use of biogas from landfills for transport commenced in 2007. This is the only renewable transport fuel used, representing less than 0.5% of energy use in the sector, a share comparable to that in Denmark but considerably lower than in other Nordic countries, such as Norway (4%) and Sweden (8%). Among the reasons for the slow development are lack of supporting infrastructure and a relatively slow pace of vehicle fleet renewal since the economic crisis (MII, 2012). Recent legislation obliges fuel distributors to

guarantee that at least 3.5% of fuels sold for transport are of renewable origin by 2015, rising to 5% by 2016. Fuels must comply with sustainability criteria.

Given Iceland's scarcity of biomass, however, large-scale biofuel deployment using current technology (which relies on large quantities of animal or vegetal material) is unlikely to be feasible and cost-effective. A demonstration project is under way in Akureyri in northern Iceland, where waste vegetable oil and animal fat are used as biodiesel in local public transport. Subsidies are available for the conversion of motor vehicles to use methane from waste landfills and a number of conversions have been undertaken. Use of methane is promoted through favourable taxation on the fuel and vehicles (Chapter 3). However, because methane is available only around the capital, many owners of subsidised methane-powered vehicles use standard petroleum products, defeating the environmental purpose of the subsidy.

Electric vehicles

Iceland is an ideal location for widespread electric vehicle (EV) deployment: it has comparatively cheap electricity that is 100% renewable, reliable nationwide transmission and distribution systems, high imported fuel prices and generally short commutes. As most Icelanders live within a short distance of Reykjavík, the use of EVs, which are best suited for city driving, could make a significant difference to transport emissions. Analyses indicate that expanding the EV fleet is technically feasible with little additional investment in power infrastructure and generation capacity (Box 4.6). This is a medium-term strategy, which depends on more economic EVs coming on the mass market.

Box 4.6. **Impact of electric vehicles on the power system**

Analysis by Reykjavík Energy indicates that the power system could cope with a major shift to EVs. The analysis estimates that 50 000 EVs could be charged within the company's distribution area by 2030 (i.e. up to 15% of the forecast national fleet). While the system would need reinforcement, in some areas it could meet the additional distribution needs of an all-EV fleet. The annual power generation required to service 50 000 EVs would be 112 GWh, or less than 10% of the company's production in 2010, and just 0.56% of the forecast total Icelandic production for 2030. If the cars were charged cyclically, 60 MW of additional capacity would be needed in the Reykjavík Energy system, i.e. a minor addition to the 2011 capacity of 2 668 MW and well within the expansion capacity envisaged in the master plan (Section 6). If charging took place in off-peak hours, no further power plants would be needed. Even if the whole fleet went electric by 2030, annual demand would be about 750 GWh, not quite 4% of the power generation forecast for 2030. According to the national transmission system operator, a fully electric car stock would not require any changes in the transmission network.

Source: IEA (2013), *Nordic Energy Technology Perspective*.

A few companies have formed the Icelandic Electric Vehicle Association to promote the use of EVs. Projects launched to promote EVs include a partnership between the Landsvirkjun and Icelandic New Energy to test EV performance (Landsvirkjun, 2012b). EV deployment is still in its infancy, with some 30 EVs in Iceland in 2013. Icelanders appear reluctant to switch to EVs because of the high upfront cost, lack of charging stations, higher electricity requirement in cold weather and the fact that most EVs on the market are small

cars unsuited to frequently difficult driving conditions (Kelly, 2013). A complete charging solution would mean sufficient charging stations to meet public demand. This may not be too great a challenge, as around 75% of the population lives within 60 km of Reykjavík. Financing infrastructure development for EVs in the aftermath of the crisis remains an issue (MII, 2012).

In 2012, Iceland introduced a two-year VAT exemption for electric and hydrogen-powered vehicles (Chapter 3). This should bring electric SUVs closer to price parity with their fossil fuel counterparts. SUVs make up 35% of new car sales in Iceland, where they are popular for recreational driving in the interior. This tax change is a step in helping establish more widespread EV use, and could be combined with higher taxes on high CO_2-emission vehicles. A comparison of energy consumption in electric and standard vehicles at current energy prices indicates that the energy cost per kilometre of EV use in Iceland is about 80% below that of an energy-efficient fossil-fuel car.[14] Estimates indicate that for a consumer driving the average distance per year, lower energy costs would completely offset the higher EV price in six to seven years (IEA, 2013).[15]

Aviation and shipping

Due to its isolation from the rest of Europe, Iceland relies almost entirely on aviation for international passenger transport and on sea shipping for freight haulage to Europe and North America. The number of passengers travelling through Keflavík International Airport grew by 63% between 2000 and 2012.

In 2011, GHG emissions linked to international aviation accounted for two-thirds of emissions from international bunkers and sea shipping for the remaining third. As a comparison, international aviation emissions amounted to about half the emissions from domestic road transport and 20 times those from domestic flights.[16] They grew rapidly to 2007, after which the economic crisis damped Icelanders' air travel abroad, along with emissions, which in 2011 were only 3.5% above their 2000 level (EAI, 2013). More recently, energy consumption and emissions from international aviation have been rising again. Energy use in the sector is forecast to grow by some 60% between 2011 to 2020, not least because of growth in tourism (MII, 2012) (Chapter 5).

Aviation is used also for longer-distance domestic travel. Domestic aviation and shipping account for less than 5% of energy use and GHG emissions from the transport sector. Energy use in domestic aviation declined by 33% in 2000-11 and GHG emissions by 27%, partly as a result of the crisis. Energy and emission trends in domestic navigation do not show a clear pattern.

The key policy measure to tackle fuel use and GHG emissions in aviation is Iceland's participation in the EU ETS. The carbon tax on aviation fuel was lifted after emissions from intra-European aviation were included in the trading system (Chapter 3). A tax on air passengers, at rates varying with flight distance, was unsuccessfully proposed to the Parliament in 2011. With aviation emissions included in the EU ETS, there is little case for introducing such a tax from a GHG mitigation perspective.

Shipping and aviation are the most difficult sectors to decarbonise. Aside from efficiency gains and the use of biofuels, breakthrough technologies are needed to overcome the barriers that limit the share of biofuels: cost, availability and concerns about sustainability. Co-operation with other countries would be necessary in order, for example, to build infrastructure for refuelling (IEA, 2013).

7.3. Improving fuel efficiency of the fishing industry

Fishing accounts for 8% of final energy consumption. Fuel use in this sector decreased by 3% between 2000 and 2011, reflecting a reduction in fishing and improved efficiency of vessels and processes. A 30% drop in the number of fishers and vessels between 2000 and 2009 contributed to a decrease in fishing capacity through an improved fisheries management system based on transferable quotas (Chapter 3). The government did not provide any subsidy or decommissioning programme (OECD, 2013b).[17]

Rising oil prices in the 2000s led Icelandic fishing firms to focus increasingly on fuel efficiency and fuel switch. There was a substantial renewal of the fishing fleet with more fuel-efficient vessels. Energy-saving devices based on information technology have been developed through experimental projects supported by the government. In addition, the Marine Research Institute has set up an energy-saving system in the research vessel Árni Fridriksson, and the Ministry of Justice has agreed to install such a system in the Coast Guard's newest cruiser. Another measure involves equipping harbours with land-based electricity, which would allow engines and independent internal power sources to be switched off in harbour. There was no use of land-based electricity and heat in 2000; in 2010, this accounted for about 21% of energy used in the fishing industry for powering vessels in harbours (of which geothermal represented 60%). This measure is expected to reduce emissions by some 16 000 tonnes of CO_2 per year (Ministry for the Environment, 2010).

The MENR estimates that the fishing industry can contribute considerably to reductions in energy use and GHG emissions. Emissions from fishmeal factories could be almost eliminated by using electricity rather than burning fuel. Similarly, emissions of the fishing fleet could be reduced by 75% through increased use of biofuels and energy saving measures. Considerable costs would be involved in such a transformation, especially in securing reliable electricity for fishmeal plants, which would call for significant investment in power plants and infrastructure (OECD, 2011).

Renewables-based fuels for fishing are being researched. The Maritime Administration and other agencies have been working on pilot projects aimed at developing biofuels to power ships. The uptake of biofuels in fishing depends on many factors, including oil prices. Icelandic New Energy, in co-operation with foreign partners, as well as the European Union and the Icelandic government, is working on a project aimed at determining the economic and technological feasibility of using hydrogen as an energy carrier for fishing vessels. The results of this project could apply to the transport sector as well.

The fishing sector faces a carbon price in Iceland. Fishmeal factories, which are energy intensive, are covered by the EU ETS. Unlike many other OECD countries, Iceland imposes a carbon tax on fuel used to power vessels. Higher oil prices have led vessel owners to replace standard fuel with less refined oil, thus increasing emissions. Iceland should look into the effects of fuel prices and taxation on substitutability between fuels and the effect on fuel use and GHG emissions (OECD, 2011).

Notes

1. Industrial use of geothermal heat includes a seaweed processing plant at Reykhólar in western Iceland, using about 250 TJ per year for drying; and a plant commercially producing liquid CO_2 that has operated at Haeðarendi in the south-west since 1986.
2. Iceland is authorised to emit an additional 1.6 Mt of CO_2 eq per year from new heavy industry units (mainly aluminium smelters) established after 1990, if the units meet conditions set by Decision 14/CP.7 on using renewables and best available technology.
3. The production technology in all aluminium plants is based on prebaked anode cells. The main energy source is electricity. Industrial process CO_2 emissions are mainly due to the anodes that are consumed during electrolysis (EAI, 2013).
4. The Hellisheiði plant is located about 30 km from Reykjavík. Operated by Reykjavík Energy, a publicly owned utility company, it generates electricity almost entirely for aluminium production at the Grundartangi smelter. A 90 MW expansion is planned near Hverahlíð, south of the Hellisheiði plant, to generate energy for a smelter in Helguvík, near Keflavík International Airport.
5. Recent examples include settlements in 2012 between Australia's government and the Bell Bay and Point Henry smelter operators and in August 2013 between Rio Tinto and the New Zealand government.
6. The MENR leads the committee, which includes representatives from the Prime Minister's Office, the MII, the Ministry of the Interior, the Ministry of Finance and Economic Affairs, and the Association of Local Authorities.
7. These industries can emit an additional 1.6 Mt CO_2 eq per year.
8. Perfluorocarbons (PFCs) from aluminium production are now covered by the EU ETS, in addition to the related CO_2 emissions.
9. The environmental impacts of hydropower development considered in developing the plan included loss of vegetation, habitats and organic soil due to reservoir submergence. For geothermal development, they included visual landscape and wilderness intrusion of infrastructure, noise pollution, reduction of some surface manifestations of geothermal activity (e.g. drying up of springs) and land subsidence. The environmental impact of each potential project was assessed and ranked using multi-criteria analysis (Thórhallsdóttir, 2007a).
10. Phase 1 (1999-2003) concluded with a preliminary assessment due to limited availability of scientific evidence and data. The expert groups and steering committee continued with the analysis during Phase 2 (2004-10), and concluded with suggestions for a categorisation of possible power plant developments.
11. There were four working groups: 1) nature, environment and cultural heritage; 2) recreation, fishing, hunting and agriculture; 3) social and economic impact and regional development; and 4) economic aspects.
12. In the first half of 2013, production fell at the Hellisheiði power plant by around 30 MW, representing a decline of over 2% of annual energy production. This decline is expected to be permanent and could increase if field pressure continues to decline (Hansen, 2013; Hávarðsson, 2013).
13. Many Icelanders even open windows instead of turning down the heat when the inside temperature is too high (IEA, 2013).
14. In 2010, EV energy use averaged about 150 watt hours per kilometre (Wh/km), or 195 Wh/km in bad weather. At the 2012 electricity price, the energy cost of using an EV in Iceland was USD 0.0183/km. At the 2012 fossil fuel price of around USD 1.93/L, owners of diesel and petrol vehicles using 5 L/100 km had an energy cost of USD 0.0966/km (IEA, 2013).
15. Assuming a 6.36% interest rate and similar maintenance costs and fixed energy prices for electric and standard vehicles (IEA, 2013).
16. As almost all international flights depart and arrive from Keflavík, oil products sold to the Keflavík airport are reported as being for international use. However, domestic flights sometimes depart from Keflavík and some international flights from Reykjavík airport. The EAI is developing a methodology to calculate the fuel split between international and domestic aviation now that Iceland is part of the EU ETS for aviation (EAI, 2013).
17. Decommissioning programmes are government programmes to purchase vessels, permits, licences and other entitlements from participants in the fishing sector.

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PART II

Chapter 5

Tourism and environment

Tourism is one of Iceland's fastest growing sectors. Millions of international tourists have visited the country in recent years, many of them drawn by its unique but highly sensitive natural environment. After an overview of the key trends and features of tourism in Iceland, this chapter describes the environmental impact of tourism, including on landscape, flora and fauna. It reviews the institutions and the policy responses put in place to ensure that tourism promotion adequately takes account of environmental concerns. These include financing environment-related infrastructure, promoting green innovation and strengthening the quality of tourism operators.

Assessment and recommendations

Tourism is one of Iceland's fastest growing sectors. It is largely based on the country's unique combination of environmental assets (e.g. areas of pristine wilderness, natural hot springs, geothermal activity, lava fields, glaciers, northern lights). The number of visitors more than doubled over 2000-12 to reach 673 000. Some estimates suggest that over 1 million international tourists could visit Iceland each year by 2020, significantly more than the population of about 320 000.

After the financial crisis, the government recognised tourism's potential to contribute to a more diverse pattern of economic development. In 2010, tourism's contribution to GDP reached 6%, higher than the OECD average of 4.7%. In 2011, the sector employed 6.5% of the labour force. Its share of export revenue exceeded that of fisheries in 2013. The projected increase in tourism, as well as improvement of the relatively low value added of tourism products and services, should result in tourism accounting for a greater share of Iceland's economic activity.

Increased international arrivals and high seasonality place growing pressure on fragile ecosystems and on local ways of life and traditions. There is continuous pressure to locate large tourism developments in pristine areas. Receiving increased numbers of tourists also requires the construction of additional accommodation, as well as transport and environmental infrastructure. This intensifies a range of impacts, notably soil erosion, and damage to vegetation and biodiversity. Successive governments have recognised that unless adequate account is taken of such environmental impacts, the sustainability of tourism will be undermined. The continued rapid expansion of the sector makes this challenge all the more urgent.

Tourism strategies were developed for 2006-15 and 2011-20. While they considered environmental issues, they tended to be declarative rather than providing a framework for action. The 2011 parliamentary report on the strengthening of the green economy called for actions to stimulate an environmentally sustainable tourism industry. The report could provide a framework for co-ordinating tourism-related strategies and plans into a comprehensive action plan.

Development of such a plan should be accompanied by a simplified and better co-ordinated institutional framework for promoting environmentally sustainable tourism. Representation could also be improved: one of the key advisory councils for tourism policy does not include any environmental representative. A 2013 study for the Icelandic tourism sector provides a good basis for considering how these shortcomings could be addressed. It recommends establishing a tourism strategy task force, involving all stakeholders, to oversee a comprehensive tourism strategy. The study also recommends forming a tourism ministers committee, ideally chaired by the prime minister and bringing together ministers with tourism responsibilities, to agree on the required reforms and oversee implementation.

A key requirement for better integrating tourism and environmental policies is a clearly defined land-use policy. Given the importance of national parks – Vatnajökull National Park, the country's largest, occupies 14% of the land area – nature conservation should be fully integrated into land-use policy. Outside national parks, there is a need to establish a clearer framework for decisions about the location of economic activities, particularly tourism and energy production, as conflicts between these sectors have been the source of considerable tension.

Better integration of tourism and environmental policies also requires a strengthened information base. A comprehensive set of tourism accounts was established in 2008, but information on the environmental impact of tourism is not included in official tourism statistics and indicators. While some gaps have been filled by independent research, information has remained partial and scattered. Research by the Environment Agency of Iceland to develop an action plan to protect the most damaged tourist sites could form one of the building blocks of a more comprehensive information base. The agency classified sites according to their degree of environmental vulnerability, and the Icelandic Tourist Board used this analysis in financing investment in infrastructure to help limit environmental damage.

In some areas, environmental impacts have reached such a level that public access is banned or severely restricted. It is not unusual for national parks to close trails for extended periods due to significant erosion and vegetation damage resulting from hiking. Off-road motoring has been banned since 1999, yet there is evidence that it still takes place. In 2010, a three-year action plan was prepared to strengthen enforcement.

A shortfall in financing infrastructure at tourist sites has existed for many years, and has become more acute with the sharp increase in tourist numbers. Access fees have been used to finance some infrastructure investment since 1994. To meet the new demand, an accommodation tax on lodging was introduced in 2011. In its first two years, the tax proved difficult to administer and raised less revenue than expected, in part because of design flaws and difficulties in collecting it from private homeowners. Beyond the needs related to infrastructure at tourist sites, further consideration should be given to how the much larger investment in hotels, transport and environment-related infrastructure will be financed. Facilitating private sector investment will be important in this regard.

Part of the revenue from the accommodation tax is used to finance the Tourist Site Protection Fund. In addition to helping finance infrastructure, the fund is used to increase the number of tourist sites so as to reduce pressure on the most frequently visited tourist destinations. In this connection, developing a multi-access "nature pass" has been considered, drawing on successful experience in other countries. Such a pass could provide access to a set of sites, both popular and less well known, again with a view to reducing pressures on the most visited sites.

The government has sought to improve the environmental performance of tourism operators. The VAKINN certification system, introduced in 2011, is a voluntary, fee-based quality assessment system that rates various aspects of tourism services, including environmental protection and sustainability. The VAKINN accommodation star rating is expected to be introduced in 2014. Only nine companies were participating in VAKINN as of August 2013, but the system has potential for growth and could help improve the environmental performance of tourism operators. Iceland took part in a 2011 OECD-Nordic Innovation project on green business model innovation in tourism.

Recommendations

- Develop a comprehensive action plan for sustainable tourism development that is closely co-ordinated with policies for land use, infrastructure development and nature conservation, and that contributes to the government-wide initiative on sustainable development.
- Develop a comprehensive information base to help increase integration of tourism and environmental policies; strengthen co-operation with the research community; integrate environment into official tourism statistics and indicators; strengthen analysis of environmental impacts related to tourism, including carrying capacity limits; develop more effective ways of communicating information to tourists with a view to minimising the environmental impact of their behaviour.
- Consider establishing a body involving all relevant stakeholders to oversee the development and implementation of a comprehensive sustainable tourism policy; strengthen co-operation among ministries with responsibilities related to tourism and environment to ensure that measures are taken to support implementation of the tourism strategy.
- Consolidate national park and protected area management within a single authority under the ministry responsible for the environment to enable better integration of nature conservation and tourism development objectives.
- Conduct a comprehensive review of mechanisms that could be used to close the funding gap for infrastructure at tourist sites, including a revised accommodation tax, arrival/departure taxes, entrance fees and a "nature pass"; consider how such mechanisms could help reduce pressures at the most visited sites.
- Promote the adoption of the VAKINN certification system with a view to improving the environmental performance of tourism operators, and, as experience develops, consider how its environmental provisions could be strengthened; continue to support green innovation in tourism.

1. Key tourism trends

1.1. Visitor trends

Since 2000 Iceland has been remarkably successful at attracting tourists, many of them drawn by the country's unique but highly sensitive natural environment. The number of visitors more than doubled from 303 000 in 2000 to 673 000 in 2012. The growth was particularly strong in 2011 (16.6%) and 2012 (18.9%) (Figure 5.1). Other key trends and features of tourism in Iceland are presented in Box 5.1.

If the current trends continue, Iceland can expect over 1 million international visitors a year by 2020 (ITB, 2013a). This is a significant figure for a country with a population of just over 320 000. Analysis indicates that if Iceland puts in place a range of measures to attract a wider spectrum of visitors, the annual number of tourists could reach about 1.5 million by 2023 (BCG, 2013).

The increase in visitor numbers has in large part been due to the success of the hub-and-spoke model that the national air carrier, Icelandair, introduced in 1998 (PKF, 2013). It uses Iceland's main airport, Keflavík, as its main hub for transatlantic flights. More recently the growth has been underpinned by the significant devaluation of the Icelandic króna following the financial crisis in 2008, along with new "budget" airline connections between Iceland and continental Europe. These developments made visits to Iceland affordable to a much wider range of visitors.

Figure 5.1. **Total international visitor arrivals and cruise passengers in 2000-12**



* Accounts for approximately 96% of cruise ship passengers visiting Iceland.
Source: ITB (2013), *Tourism in Iceland in Figures, April 2013.*

StatLink http://dx.doi.org/10.1787/888933087933

Iceland's attractiveness as a tourist destination was reinforced after Eyjafjallajökull volcano erupted in 2010, creating ash clouds that severely disrupted European air travel for several weeks. Iceland turned this negative event into a success story via an international campaign, "Inspired by Iceland".[1] The volcanic activity and the campaign raised awareness of the country and stimulated interest in visiting. The number of visitors was 17% higher in the winter of 2011 than in the winter of 2010, and Iceland was ranked a top destination for 2012 by many leading travel publishers, including National Geographic and Lonely Planet.

1.2. Tourism and the economy

Tourism has become an important sector of the Icelandic economy. In 2010, its contribution to GDP reached 6% (from 5.2% in 2000 and 4.6% in 2008), a higher share than the OECD average of 4.7% (Figure 5.3). When the activities of Icelandic tourism companies outside Iceland are included (e.g. the overseas operations of Icelandair), the real value of tourism exports grew 136% in the first decade of the century, from ISK 33 billion to ISK 78 billion. As a proportion of total export revenue, tourism increased from 18.8% in 2010 to 23.5% in 2012 (ITB, 2013a). Its share of export revenue exceeded that of fisheries in 2013. It is estimated that in 2013 tourists paid ISK 17 billion in direct taxes (ISK 27 billion including indirect contributions), equal to ISK 120 000 for every household in the country (BCG, 2013).

Employment in the tourism sector increased by 21% between 2000 and 2008, although it accounted for a stable 5.1-5.2% of total employment during that period. Despite an initial drop, employment in the sector increased by 13% between 2008 – the start of the recession – and 2011, while the decrease in total employment during the same period was 6.3%. In 2011 the sector included some 1 370 enterprises and employed about 12 000 people, or 6.5% of the total labour force (Júlíusdóttir, 2012). Over 60% of tourism jobs are in accommodation and catering, passenger transport or travel agencies, with the remainder in tourism-related sectors such as retail, entertainment, culture and leisure activities, as well as shops and services relating to passenger transport (ITB, 2012b).

Box 5.1. **Key characteristics of tourism in Iceland**

In 2010, total travel consumption in Iceland amounted to some ISK 199 billion, with international visitors accounting for ISK 118 billion, or 59%. Of the remainder, Icelandic households accounted for 36% and Icelandic companies and public bodies for 5% (ITB, 2013a). The major overseas markets for Iceland are the Nordic countries (22%), North America (17.3%), the UK (14.4%), Germany (10.6%) and France (6.4%). These five markets accounted for over three-quarters of all overseas visitors in 2012 (OECD, 2012).

In 2012, Keflavík International Airport was by far the most common entry point, accounting for more than 96% of total international visitor arrivals (647 000).* In line with increases in total international visitor arrivals since 2000, international cruise ship passenger numbers have also experienced significant growth, more than trebling, albeit from a relatively low base of 27 000 in 2000 to 95 000 in 2012. Of the latter figure, about 96%, or nearly 92 000 passengers, passed through Reykjavík, where 81 cruise vessels docked in 2012 (Figure 5.1).

Tourism in Iceland is highly seasonal. In 2012, 47% of all foreign visitors arrived in the summer months of June to August, while 30% came in the spring or autumn. The remainder (23%) arrived between November and March. Organised tour coaches are the most commonly used mode of transport in the winter (58.8%), while rented cars are the most popular mode in the summer (46%).

There were 3.7 million nights spent in all types of accommodation in 2012 (Figure 5.2), 48.3% of them spent in the capital area. Foreign visitors spent 2.9 million guest nights, representing 77% of the total for the year (up from 66% in 2000). Growth in the number of nights spent in all types of accommodation between 2000 and 2012 was approximately 8% for international and 3% for domestic tourists. The Icelandic Tourist Board (ITB), in its survey of international visitors for 2011/12, noted that, on average, foreign visitors stayed 10.2 nights in the summer of 2011 and 6.6 nights in the winter of 2011/12 (ITB, 2012a).

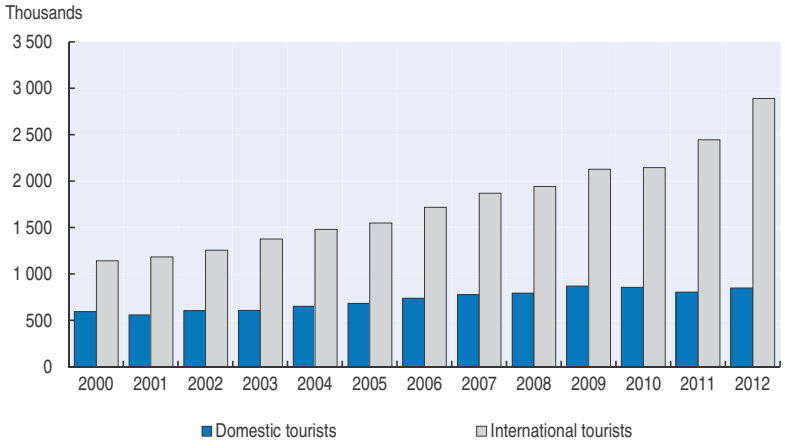
The proximity of many major attractions to Reykjavík gives visitors the option of staying in the capital and taking day trips to popular attractions. Recent surveys show that around 95% of visitors spend time in Reykjavík, with fewer than half visiting the north and only around a third making it to the east. This is largely due to the presence of Keflavík International Airport in the capital region and the concentration of accessible, high-quality attractions on the Golden Circle route (about 300 km), including Þingvellir National Park, Gullfoss waterfall and the Geysir geothermal area.

* Just over 2% entered at the Seyðisfjörður seaport and less than 2% arrived by air through the Reykjavík, Akureyri and Egilsstaðir airports.

Source: ITB (2013a), *Tourism in Iceland in Figures*, April 2013.

In the aftermath of the crisis, the government recognised that tourism could create jobs, attract foreign investment and foreign currency, and stimulate national, regional and local economic growth. The projected rise in incoming visitors could more than double tourism's direct contribution to the economy to ISK 215 billion by 2023, with an indirect contribution of ISK 400 billion (BCG, 2013).

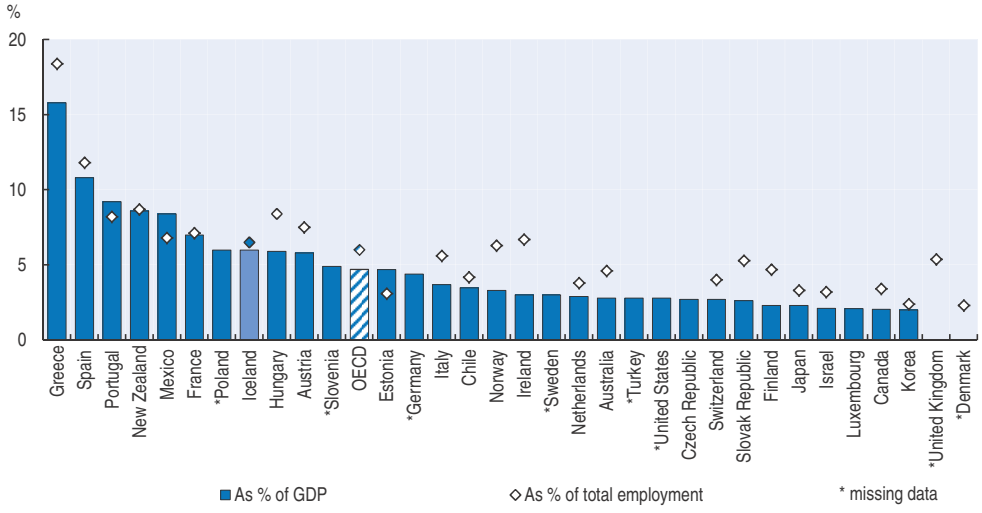
Figure 5.2. **Total nights spent in all types of accommodation in 2000-12**



Source: ITB (2013), *Tourism in Iceland in Figures, April 2013.*

StatLink http://dx.doi.org/10.1787/888933087952

Figure 5.3. **Direct contribution of tourism to OECD economies in 2012**



Note: 2012 or latest available year. Iceland: 2010 (% of GDP) and 2011 (% of total employment). Greece, New Zealand, Poland and Spain: data include indirect impacts.
Source: ITB (2013), *Tourism in Iceland in Figures, April 2013*; Júlíusdóttir, V. H. (2012), "Iceland's Tourism Satellite Account: The inconsistency between balance of payments statistics and tourism statistics"; OECD (2014), *OECD Tourism Trends and Policies 2014.*

StatLink http://dx.doi.org/10.1787/888933087971

2. Role of environmental assets in tourism development

Tourism in Iceland is based largely on a unique combination of environmental assets (e.g. areas of pristine wilderness, natural hot springs, picturesque lava fields and glaciers, "white nights" and the northern lights) and its reputation as a destination for adventurous outdoor activities (e.g. hiking, mountain biking, white water rafting, whale, seal and bird watching, and fishing) (Box 5.2).

Box 5.2. **Selected natural attractions**

Hiking and trekking

Silfra, a feature of Lake Þingvallavatn in Þingvellir National Park, south-west Iceland, is part of the rift between the North American and Eurasian tectonic plates. Its clear, cold water has led scuba divers to rank it among the world's top 50 diving destinations. Silfra is on the country's most famous tourist route, the Golden Circle, along with the spectacular waterfall Gullfoss, the spouting hot springs of Geysir and Strokkur (erupting every 5 to 10 minutes), and Þingvellir, a designated UNESCO World Heritage Site, where the Icelandic Parliament met from its founding in 930 until 1798.

The Diamond Circle is another popular tourist route, around the town of Húsavík and Lake Mývatn in the north. It covers an area rich in volcanic and geothermal features. The main stops are Dettifoss and Goðafoss waterfalls (the first is Europe's largest in terms of volume discharge), the "dark castles" of the Dimmuborgir lava fields (characterised by large hollow chambers and dramatic pillars), Ásbyrgi canyon (with cliffs up to 100 metres) and Lake Mývatn (surrounded by wetlands with an exceptionally rich diversity of water birds).

Vatnajökull National Park covers 14 200 km^2 or 14% of Iceland, making it Europe's largest national park. It offers a great variety of trekking and hiking opportunities through unspoilt landscapes, including Vatnajökull, Europe's largest glacier extending over 8 100 km^2. Skaftafell, the jewel in the crown of the park, includes an impressive area of peaks and glaciers.

Jökulsárlón is a large glacial lake on the southeast border of Vatnajökull National Park. A host of spectacular, luminous blue icebergs that calve from the tongue of the Breiðamerkurjökull glacier is a major attraction.

Þórsmörk, in the south, is one of Iceland's most spectacular wilderness areas, sealed off by three glaciers, surging rivers and steep mountain slopes. Hiking on the glaciers is popular, as is trekking in Stakkholtsgjá canyon, with its waterfall, or to the summits of surrounding peaks, which offer rewarding views.

Bird, whale and seal watching

Many places in Iceland are of great interest for birdwatchers. Látrabjarg in the West Fjords is the world's largest bird cliff and hosts the largest razorbill colony in the world. The Westman Islands are home to Iceland's largest puffin population, and there is a major colony of great skua on the sandy coast of southern Iceland. Lake Mývatn in the north has more species of breeding ducks than any other place in Europe. Eiders, Arctic terns, waders and passerine birds can be observed in many spots.

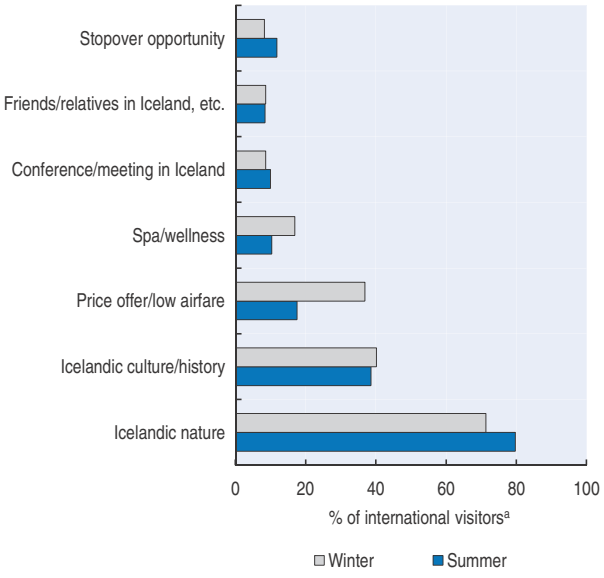
Iceland is one of the most popular places for whale watching in Europe, attracting approximately 150 000 visitors each year. The clear North Atlantic waters encircling Iceland teem with minke and humpback whales as well as harbour porpoises and white-beaked dolphins. There are whale watching ports around the coastline. Harbour and common seals can be also observed in their natural habitat in several spots.

Northern lights and "white nights"

Iceland's northern latitude and limited urban light pollution make September to March an excellent time to view the aurora borealis and enjoy outdoor spas. At the height of summer, daylight lasting over twenty hours provides opportunities for extended touring and outdoor recreation.

The 2011 summer survey of international visitors pointed out that for 79.7% of visitors in the summer and 71.3% in the winter, an interest in nature affected their choice of destination (Figure 5.4). While in Iceland, 75.2% participated in one or more nature-related recreational activities, and 23.8% undertook five or more (ITB, 2012a).

Figure 5.4. **Factors influencing decision to travel to Iceland in 2011/12**



a) Internet survey among international visitors who arrived at Keflavík airport and Seyðisfjörður seaport between June 2011 and May 2012.
Source: ITB (2013), *Tourism in Iceland in Figures, April 2013.*

StatLink http://dx.doi.org/10.1787/888933087990

A few figures show what high interest the most popular natural attractions generate. For example, the Gullfoss waterfall near Reykjavík attracts around 200 000 visitors a year. About 40% of all foreign summer visitors travel to the most popular tourist destinations in the central highlands and the number of overnights in the central highlands almost doubled between 1985 and 2009, from a little less than 48 000 to over 120 000 (Sæþórsdóttir, 2012).

3. Key issues in interaction between environment and tourism

3.1. Degradation of soil and vegetation

Recent growth in visitor numbers has placed significant pressure on natural attractions, leading to environmental degradation at sensitive sites, including national parks and other protected areas. Research identifies trampling as one critical factor in the alteration and degradation of ecosystems. The most common indicators include trail widening and deepening, multiple tread formations, root exposure and damage, and soil erosion. Some studies reveal that in the southern highlands, severely deteriorated segments may account for 30% or more of trail systems (Ólafsdóttir and Runnström, 2013). It is not unusual for national parks to close trails for extended periods due to significant erosion and vegetation damage resulting from hiking (Vatnajökull National Park, 2013).

In the most vulnerable areas, relatively minor damage to the vegetation cover is enough to expose the underlying soil bank to wind and water. Trail deterioration usually leads to soil erosion that may trigger land degradation affecting larger areas. Reduction in species cover and density may occur at low trampling intensity, affecting visual quality and leading to lower perceived environmental value (Ólafsdóttir and Runnström, 2011).

Many trails in the central highlands have become popular for other types of recreation, which have had an even larger environmental impact. These include mountain biking, mountain marathon racing and off-road motoring. Although banned throughout Iceland since 1999, off-road motoring has been frequently reported. The increasing use of vehicles to and within sensitive sites damages vegetation cover and leads to soil erosion. Degradation by hikers and vehicles not only places considerable pressure on the natural environment, but also poses a threat to visitor safety and has the potential to generate negative visitor perceptions. Littering is also a problem in many tourist sites, especially as decomposition of waste is slow, leaving waste remains visible atop the permafrost.

3.2. Threats to fauna

Many visitors come to Iceland to watch bird colonies. Because there are relatively few places where such sights are accessible and reliable, this tourist traffic is often concentrated. Colonies chosen for visits, including by cruise ships, tend to be large and spectacular. During a colony visit, passengers typically board smaller boats from the larger ships and cruise by colonies observing the seabirds and taking pictures. Occasionally passengers land at suitable sites and view the seabirds from above or below cliffs, which may cause local disturbance.

To prevent disturbance, especially during nesting periods, environmental authorities impose site restrictions or closures. This helps reduce negative impacts but upsets tour operators. Closure decisions have usually been taken by environmental authorities in the spring, for instance, impeding local operators' tour planning and making it hard to inform visitors about access in advance. Responding to complaints, the Environment Agency of Iceland (EAI) is now aiming to make closure decisions public five years in advance.

3.3. Degradation of landscapes

As the value for recreation and tourism in parts of Iceland, such as the central highlands, lies in areas of pristine nature and primitive wilderness, the construction of access roads and tourist facilities, not to mention industrial facilities, power plants, pylons and transmission lines, reduces the value. Although the conflict between tourism and infrastructure is not insurmountable, as such construction may not spoil the wilderness experience for all visitors, the anticipated experience of wilderness may be significantly reduced, possibly affecting demand (Sæþórsdóttir, 2011). There is continuous pressure to introduce large-scale tourism development in pristine areas. Recent attempts include a project to convert more than 250 km^2 of wilderness area in the north into a resort comprising a luxury hotel and golf courses. The plan, involving a foreign investment of USD 160 million and reported creation of up to 600 jobs, was rejected in 2011, but the government is now reconsidering it (Eudes, 2013).

3.4. Tourism infrastructure

The need to provide tourism infrastructure at popular tourist sites, to ensure traveller safety and environmental conservation while enhancing the visitor experience, is widely accepted. Examples of basic types of infrastructure include sign-posted and paved access roads, designated parking areas, sealed, wooden or raised footpaths (boardwalks), fences and signage/interpretation. The more heavily visited sites also provide visitor information services, concession stands, food and toilets.

The unprecedented growth in international and domestic tourism has had a twofold effect on tourism infrastructure. First, pressure on facilities as a result of increased visitor traffic at popular sites has led to infrastructure deterioration. For example, in 2012 a tarmac road leading to the site of the first Icelandic parliament in Þingvellir National Park buckled and almost collapsed because of the steadily growing stream of visitors. One study showed that 60% of Icelandic tourism industry stakeholders rated infrastructure at popular sites as "bad" and 65% considered infrastructure at tourist sites to be the key priority for improvement, above roads, airports and seaports (BCG, 2013). Land ownership issues are sometimes a barrier to the development of adequate infrastructure. This is true at Landmannalaugar, a popular tourist destination and hiking hub in the central highlands, where poorly designed and laid out visitor facilities detract from the quality of the natural environment (PKF, 2013).

Second, limited funding has meant that opportunities to develop infrastructure at new sites, promoting the geographical distribution of visitors, have not been fully acted on. One study revealed that tourism operators considered the West Fjords particularly attractive, but did not feature the area in their offers due to poor access and lack of visitor infrastructure (PKF, 2013). At a more basic level, there is a need to invest in facilities such as parking, signage and toilets. The cost of these facilities is typically not very high. The greater challenge is ensuring that they are maintained.

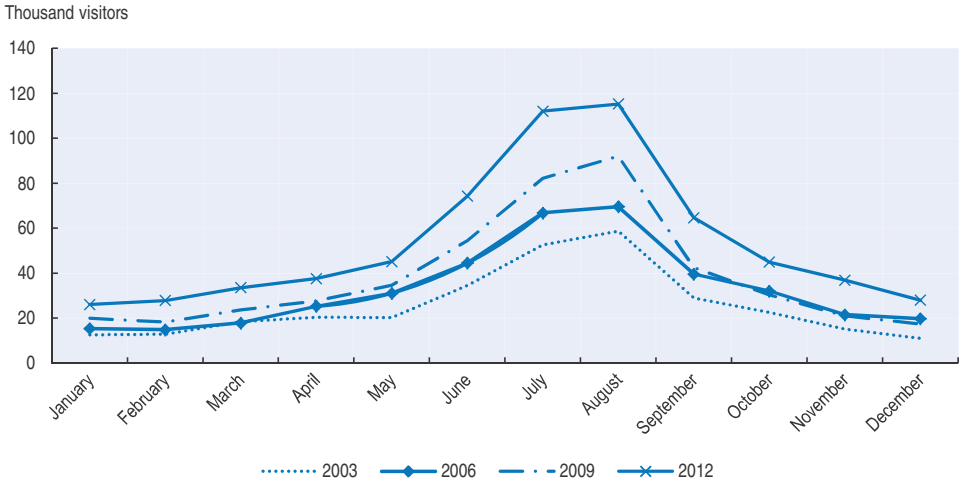
3.5. Seasonality and distribution of visitors

Tourism in Iceland is highly seasonal, with an increasing number of arrivals concentrated in the summer (Figure 5.5). In 2012, 58% of the 3.7 million visitor nights occurred from June to August, and 75.9% of nights spent outside the capital area were concentrated in these months. On any given day in July 2012, there were up to 35 000 international visitors in Iceland, which represented an increase in the population of around 6% (BCG, 2013). Icelandic tourism is also concentrated around Reykjavík and the south-west (Box 5.1).

Excessive concentration of visitors at peak periods results in congestion at tourist sites and damage to their quality, reducing their ability to attract future visitors. Most popular destinations on the Golden Circle, such as Gullfoss waterfall and the Geysir and Strokkur hot springs, suffer from such problems. Increased concentrations of visitors can also reduce the quality of experiences at sites renowned for tranquillity and isolation, such as the central highlands.

High seasonality also puts significant pressure on environment-related infrastructure, such as that for waste collection and treatment, water supply and wastewater treatment. In July 2012, hotel room occupancy in the capital region reached 91%, compared with occupancy rates around 60% in the shoulder seasons, from March to May and September to November. The difference is higher in other regions: for example peak month occupancy is

Figure 5.5. **Visitors to Iceland through Keflavík airport by month**



Source: ITB (2013), *Visitor Departure Statistics.*

StatLink http://dx.doi.org/10.1787/888933088009

56% in the north-west while in March it is as low as 7%. Based on forecasts of visitor numbers, regional distribution and seasonality, around 5 700 new hotel rooms will need to be built, half as many again as exist today, of which around 60% will be needed in the capital region and south-west (BCG, 2013).

Because of the abundance of clean water and relatively large assimilative capacity of land and sea, there is still potential to increase water use and discharges during peak periods. But the accumulation of impacts, especially in areas with vulnerable ecosystems, can result in significant and irreversible damage. There is a need for strengthening monitoring systems in such areas to guard against contamination of fragile water supplies, as well as to provide regular maintenance of sewerage and waste collection services. Tourism strategies, at the national and regional levels, include plans for road development and hotel infrastructure, but say little or nothing about plans and financing concerning expansion and maintenance of environment-related infrastructure.

Despite efforts to address the issue of seasonality, the variation in international arrivals has remained largely consistent in recent years. Therefore, any steps to reduce seasonality and/or increase the geographical distribution of visitors through greater product diversification (e.g. a greater focus on history, culture and creative industries) could reduce environmental impact at existing sites and on supporting infrastructure, as well as increase opportunities for further development of tourism enterprises.

4. Environmental and tourism policies and institutions

4.1. *Policies and objectives*

Unspoiled wilderness was recognised as one of the most important resources of Icelandic tourism as early as 1990 in the Parliamentary Resolution on National Tourism Policy. Subsequent tourism strategies, including the most recent ones, for 2006-15 and 2011-20, reiterated the importance of natural assets for tourism development (Box 5.3). They also acknowledged the need to address the growing environmental impact of tourism and called for inclusion of broad environment-related objectives in each aspect of tourism development.

Box 5.3. **Environmental objectives of tourism strategies**

The 2006-15 tourism strategy, then the responsibility of the minister of communications, included the following objectives:

- Nature and wilderness shall prevail in the development of tourism.
- The impact of tourism shall be distributed evenly and remain within tolerance limits defined by research.

The most recent strategy, for 2011-20, developed by the Ministry of Industry, Energy and Tourism in collaboration with the Icelandic Tourist Board, industry associations and other stakeholders, aims to:

- Maintain Iceland's unique nature with focused and strong emphasis on strengthening destinations.
- Improve the quality, professionalism and environmental consciousness of the tourism industry.
- Promote increased profitability and respect for the industry.
- Extend the tourist season, decrease seasonal fluctuations and promote better distribution of tourists around the country.

The strategy notes that meeting the objectives depends on actions in four key areas: i) infrastructure, ii) research and forecasting, iii) product development and innovation, and iv) marketing. Most notably, under the heading of infrastructure, it states that:

- Iceland's natural surroundings are a natural resource for the tourism sector. It is important to develop, protect, and maintain tourist sites nationwide. The authorities and other stakeholders must join forces in finding the means to finance such improvements.
- The development of tourism infrastructure shall aim at protecting nature, and the tourism strategy shall aim at incorporating the concepts of sustainability and responsibility for Iceland's culture and natural surroundings.

Source: PKF (2013), "Promote Iceland: Long-term strategy for the Icelandic tourism industry".

However, the national strategies (which the Icelandic Tourist Board is responsible for implementing) lack the detailed action plans, executive regulations and clearly defined responsibilities necessary for implementation, evaluation of progress and measurement of success against stated objectives. One survey of Icelandic tourism stakeholders highlighted tourism policy and regulation as an area for significant improvement: 54% of respondents rated national laws and regulation as "bad" or "very bad" in terms of their supportiveness to the tourism sector; 56% rated government policy negatively in the same terms (BCG, 2013). A key challenge in this regard is the lack of a clearly defined land-use planning policy. One has been under development since 2003, but has yet to be adopted. This lack has hampered more coherent and co-ordinated spatial and economic development, including in the area of tourism development. As a result it has created uncertainties in policy-making processes and has been a source of conflict between the national and local authorities (Chapter 2).

The tourism-related priorities of the Ministry for the Environment and Natural Resources (MENR), developed under the national strategy for sustainable development 2002-2020, Welfare for the Future, have been more concrete and operational (Chapter 2).

For example, a key priority for 2010-13 was to introduce a tourism-related environmental levy that would help fund land protection and infrastructure improvement at popular destinations. Another priority, for 2006-09, was to carry out a systematic assessment of natural sites that required special measures due to intensive traffic. Special attention was placed on designing measures to prevent off-road motoring, including completing the mapping of highland roads and trails in 2012.

The relationship between tourism and nature was also prominent in the nature conservation strategies for 2004-08 and 2009-13, which resulted in increasing the number and coverage of protected areas, all of which attract growing numbers of local and international visitors. Some regional tourism strategies, such as that for the north-east for 2009-14, provide clearer directions for development and insights into the desired results. They also help build consensus among residents (John S. Hull Associates, 2008).

The role of nature in economic development has featured high in the context of recent discussions on the green economy. The 2011 report of the Parliamentary Committee on the Strengthening of the Green Economy identified tourism as one of the country's fastest growing sectors (Chapter 3). It called for actions to stimulate a green or sustainable travel industry, which should have an obvious interest in maintaining the resources that the industry first and foremost builds its income on.

That report, and the oversight of its implementation by the Prime Minister's Office, could serve as an important driver in the transition to a green economy. Its implementation should be used to better co-ordinate tourism-related strategies and plans, including nature conservation planning and management, which so far has not been fully integrated in tourism policy making. This can be facilitated by development of a sustainable tourism action plan that would guide urgent action and provide a longer term perspective. Such a plan should include measurable numeric targets that would allow assessment to be published in regular progress reports.

4.2. Institutional framework

The 2005 Tourism Administration Act (No. 7324/2005) redefined the administrative framework for tourism management. The act gave overall responsibility for defining tourism policy to the Ministry of Industry, Energy and Tourism (which in 2012 was subsumed under the new Ministry of Industries and Innovation)[2] and made the Icelandic Tourist Board (ITB), an independent authority under the MII, responsible for policy implementation. Other important changes brought about by the act were the definition of criteria for tour operators and travel agencies, and the laying down of procedures for obtaining and revoking certification and licences and ensuring secure operations.

The ITB acquired a range of responsibilities, including issuing licences, registering and monitoring compliance by tourism operators, and implementing the tourism quality and environmental assurance system, VAKINN. It also has stewardship of the Tourist Site Protection Fund for infrastructure, safety and the preservation of natural sites; and collects data on tourist numbers, expectations and experiences.[3] The ITB has since played an active role in developing the regulatory framework for tourism, interacting with legislators and government agencies such as the EAI and the Innovation Centre Iceland.

The MENR has long overseen the use and management of key natural tourism sites linked to protected areas. The 1999 Nature Conservation Act established a strategic approach to nature conservation, based on scientific assessment (MENR, 2013). The MENR,

together with the EAI and specialised bodies, is responsible for expanding and managing protected areas, including national parks (Box 5.4).

Reforms introduced by the 2005 Tourism Administration Act strengthened operational aspects of tourism management, such as registration, licensing and tourism promotion. However, tourism-related policies are still not well co-ordinated across ministries. Related plans and programmes are developed in isolation, primarily under the MII, but also by the Prime Minister's Office, the MENR, the Ministry of Finance and Economic Affairs and the Ministry for Foreign Affairs. In addition, government agencies including the ITB, Promote Iceland and the EAI carry out actions in parallel, with suboptimal co-operation with local authorities and the private sector.

Box 5.4. **Combining nature conservation and tourism in Vatnajökull National Park**

In 2008, Iceland embarked on Europe's single largest nature conservation project to date, establishing Vatnajökull National Park. Initially covering 12 000 km^2, the park offers a mixture of dynamic ice caps and outlet glaciers, geothermal energy sites and frequent subglacial volcanic activity, coupled with outburst floods.

The park incorporated areas already under protection, including Skaftafell and Jökulsárgljúfur national parks, the Lónsöræfi wilderness and Vatnajökull glacier, which is larger than all other glaciers in Europe combined. The park originally occupied about 12% of national territory, and has since been expanded to 14% (14 200 km^2). It offers a unique opportunity to observe the wide-ranging impact of Vatnajökull glacier on its surroundings, in which ice and fire play leading and often complementary roles.

The creation of the park was one of the largest economic and rural development projects the government had ever undertaken. Tourists visiting this protected area can observe the culture and history of the communities dotted around the glacier, which have learned to live with and utilise their volatile surroundings. The proximity to nature's land-sculpting elements opens up a wide range of possibilities for research and study visits, and for experiencing the wilderness.

Visitor centres are the park's core service facilities. They contain exhibitions and displays, provide information and host cultural events, and house the park wardens. Wardens offer guided nature interpretation tours and children's activities, providing insight into such natural phenomena as volcanic eruptions and catastrophic floods, at the grander end of the scale, as well as the delicate world of Iceland's fragile flora and fauna.

Vatnajökull National Park is overseen by a board of seven members, including the four heads of the area committees involved, one member nominated by environmental NGOs and two appointed by the environment minister, who serve as the chairperson and vice chairperson. Outdoor activity associations are entitled to have an observer present at board meetings. The board formulates policies relating to the park, manages the preparation of proposals for a conservation plan and regulations, prepares the budget, allocates funds, approves individual operating plans, monitors implementation of park rules and the conservation plan, and ensures co-operation with other public bodies, local authorities and stakeholders.

The lack of co-ordination with environmental policies is particularly vivid in advising on tourism policies and related funding. The 2005 reforms included establishing the Icelandic Tourism Council, a consultative body under the MII, to make recommendations on tourism planning, marketing and promotion activities. However, none of its ten representatives (from central government, industry and local authorities)[4] represents the environmental authorities. Given the role of natural assets in tourism policy, the council's advice on tourism-related matters is partial and contributes to overlaps or gaps in policy responses. Similarly, the managing board of the Tourist Site Protection Fund (Section 5.2) includes no formal representatives of the environmental authorities, although it is stated that they are consulted in the fund's decision making.

Planning and governance of tourism and environment are also not aligned in managing environmentally sensitive areas. For example, while responsibility for tourism policy development lies with the MII, responsibility for managing Iceland's three national parks (Snæfellsjökull, Vatnajökull and Þingvellir) is allocated to three authorities under two separate bodies – the MENR and the Prime Minister's Office. This situation complicates efforts to develop policy responses in a timely, co-ordinated and strategic manner.

A 2013 study commissioned by a consortium of private companies (including Icelandair Group and Blue Lagoon) on strengthening tourism strategy implementation recommended establishing a tourism strategy task force, chaired by the minister for industries and innovation, which would include representatives from relevant ministries and agencies, and private sector organisations (BCG, 2013). Such a body, in which the environmental administration should be strongly represented, would greatly increase co-ordination and overall engagement in the tourism strategy. Overall, there seems to be a need to considerably reduce the number of entities involved in tourism governance. Some entities' functions could be assigned to the tourism strategy task force.

The task force would be responsible for overall strategy: defining the vision and targets, co-ordinating activities across governance bodies, tracking progress and resolving conflicts. However, the study also recommended establishing a tourism ministers committee made up of ministers with tourism responsibilities (and ideally chaired by the prime minister), whose function would be to agree required reforms and oversee implementation (for example, in relation to targeted development of tourism products and services in new areas). It would also co-ordinate new infrastructure required to support expected visitor growth. The concept of such a committee is based on similar bodies in Australia and New Zealand, which have been credited with successfully co-ordinating the countries' approach to tourism expansion (BCG, 2013).

5. Selected policy responses

5.1. *Initiatives to address the environmental impact of tourism*

Policy makers and the tourism industry generally acknowledge that the environmental impact of increased visitor numbers could affect future growth in the industry. This recognition has stimulated a number of actions. For example, as stipulated in Welfare for the Future: Iceland's National Strategy for Sustainable Development-Priorities 2006-2009, the EAI conducted research on tolerance limits of the most visited tourist destinations and in 2010 developed an action plan to protect those most affected. The plan identified, for the first time, the nine areas most heavily affected (classified as the Red List) and eight areas of concern (the Orange List). In these areas, tourism was deemed responsible for exceeding tolerance limits for off-trail walking and off-road motoring,

mostly due to lack of infrastructure (MENR, 2010a; EAI, 2010). The lists provided important guidance to the ITB, which funded improvements. Revision of the lists in 2013 showed seven areas on the Red List and 14 on the Orange List: four Red List areas were shifted to the Orange List, two Orange List areas to the Red list; and four new areas were added to the Orange List (EAI, 2010; 2013).

After the ban on off-road motoring in 1999, the EAI website began providing information about the potential impact of this activity on ecosystems and implications of non-compliance. As part of these educational efforts, a team from the environment and transport ministries issued a map of roads and tracks not subject to the ban (EAI, 2013). Despite enforcement efforts by national park rangers and the police, information collected by the EAI shows several cases of environmental damage from off-road motoring, especially in the central highlands. To address the issue, in 2010 the EAI issued a three year action plan envisaging stronger enforcement, wider dissemination of official maps of approved roads and tracks, and education efforts in co-operation with tourism and recreation groups (MENR, 2010b).

5.2. Financing of environment-related infrastructure

Since 1995, the Icelandic tourism industry has spent about ISK 700 million on grants and projects in over 300 locations around the country (ITB, 2013a). However, it has been long acknowledged that funding is insufficient to address the infrastructure requirements to maintain and rehabilitate tourist sites of high environmental significance and ensure visitor safety. Various instruments to address the funding shortfall have been considered, including arrival/departure taxes, entrance and service fees at attractions, and a "nature pass" for access to national parks and other protected areas.

The instrument chosen was a tax on lodging, the so-called accommodation tax, introduced in 2011. With a rate of ISK 100 per night, the tax is levied per accommodation unit.[5] It is earmarked, with 40% of the revenue used to support environmental protection measures by the EAI and 60% going to the Tourist Site Protection Fund for the development, maintenance and protection of popular tourist attractions (Box 5.5).

Early experience indicates that, in its present form (on a per night and per unit basis), the accommodation tax does not appear to be fulfilling its intended purpose. In its first two years, the tax raised less revenue than expected and proved difficult to administer, especially in cases of households renting out rooms or second homes. A further issue is that the tax does not capture the growing cruise ship market. These combined factors suggest that tax base and rate urgently need to be reconsidered in order to make the tax more relevant to tourism operations. At the same time, a more holistic administrative structure is needed to manage the revenue. First, the management of various revenue streams should be consolidated. Second, the Tourist Site Protection Fund, or its equivalent, should include representatives from agencies responsible for environmental protection. Both steps would contribute to a more co-ordinated, strategic and efficient fund allocation.

One industry estimate suggests that to create a meaningful and sustainable tourism sector in Iceland, ISK 13 billion of public and private investment will be needed every year from 2013, rising to ISK 21 billion by 2023 (BCG, 2013). Around 80% would be for hotel development – new units and refurbishment – and investment in existing and new visitor sites. Around ISK 1.5 billion per year is needed to expand capacity at Keflavík International Airport. Capital investment is required in services, such as water supply, waste and

Box 5.5. **Tourist Site Protection Fund**

The Tourist Site Protection Fund became operational in 2012. It aims to support the development and maintenance of infrastructure that protects nature at frequently visited tourist attractions, and to support the development of such infrastructure at new sites in order to increase the number of sites visited by tourists.

The Tourist Site Protection Fund is financed by 60% of the revenue from an accommodation tax and additional government funding. In the first year of operations the Icelandic Tourist Board supported the fund with up to ISK 5 million, and the government allocated ISK 1.5 billion for the period 2013-15.

Both public and private entities are eligible for funding. While the fund can finance development and maintenance of built structures at tourist attractions that are under public ownership or in protected areas, it does not provide funding for operating costs of built structures at tourist destinations managed by private entities. Provision of funding to private entities is subject to a condition that the tourist destinations involved are always open to the general public and are free of charge.

The Tourist Site Protection Fund board is made up of four representatives appointed by the minister of industries and innovation. Two are appointed upon nomination by the Icelandic Travel Industry Association, one upon nomination by the Association of Local Authorities and one without nomination, who acts as chairperson. The board makes proposals to the minister regarding fund allocations, taking into consideration the views of environmental authorities and other stakeholders concerning the relative merits for proposed developments. Funds are allocated twice a year, although exceptions may be made in cases of urgent need. Information on allocations from the fund must be made public. The Icelandic Tourist Board oversees the management of the fund.

Source: ITB (2013b), "The Tourist Site Protection Fund".

sewage collection, and telecommunications, to serve higher numbers of tourists. Much of this is expected to be provided by the private sector, either from reserves or from privately raised bank or equity finance, e.g. for hotel and airport investment. However, a significant proportion, which could amount to ISK 7 billion in 2023, would need to be funded either by taxation or through new revenue sources (BCG, 2013).

The form of such sources has been subject to much debate. Mechanisms under consideration include i) a flat charge on all visitors, typically levied on arrival or departure, ii) a multisite access charge, often referred to as a "nature pass" or an "environment card", and iii) single-site access charges, with individual sites charging at point of entry. Whatever option is selected, it should take into account the following key objectives: i) maximise revenue to fund investment in existing and new site development, ii) minimise impact on visitor demand, except to deliberately manage flows of visitors at peak times, iii) ensure efficient distribution of resources across existing and new sites, while providing an incentive for site operators or owners to invest in high-quality product development, and iv) ensure that the charging mechanism is feasible and can be implemented at low cost.

One of the options is the nature pass. Such a solution typically involves visitors buying a card that allows them to enter a range of sites (e.g. the top 30) at no additional payment. The key advantage is that it allows tourism authorities to bundle the most popular sites with less visited attractions. This model has been successfully followed in both urban and

nature contexts, for example in Oslo, Rome, Granada and London, and in South African and US national parks (BCG, 2013).

Introduction of the pass could be supplemented at individual sites by additional services, such as meeting facilities, exhibitions and children's shows, which sites could provide in exchange for additional fees. If visitor numbers rise as forecast to reach 1.5 million by 2023, the nature pass could raise ISK 0.7-4.6 billion in its first year and ISK 1.2-7.8 billion by 2023 (BCG, 2013). Funds generated by the pass could be redistributed through grants focused on conservation and tourism development in less frequented areas, loans to provide access to finance for sites with potential to generate a commercial or near-commercial return on investment, or revenue sharing with site owners and municipalities, providing a direct link between visitor numbers and card revenue. Part of the funds should also cover operating costs of the pass system.

5.3. Strengthening quality of tourism operators

A key objective of creating the new ITB in 2005, prior to the reorganisation of the Tourist Council, was to establish an effective and efficient process of registration and licensing of tourism operators and to monitor their compliance with licence conditions. In this rapidly growing industry, professionalism and quality were considered key requirements, along with consumer protection and improved performance for the sector as a whole.

To achieve this objective, a harmonised quality and environmental system, based on the Qualmark system in New Zealand, was introduced in 2011 for the industry. It replaced the existing five star hotel classification system. Called VAKINN, the system aims to enhance and promote the quality of tourism in Iceland and to strengthen social and environmental responsibility of tourism operators. Created in co-operation with the tourism industry, VAKINN also addresses professional skills in response to the industry's rapid growth.

VAKINN is a voluntary, fee-based system offering a star rating system for accommodation quality and grading for all other tourism services, including environmental protection and sustainability. The environmental grading part of the system is free of charge to companies participating in the accommodation quality star rating system, but is not compulsory. It is not currently possible for companies to participate exclusively in the environmental part of VAKINN.

The environmental part of VAKINN reflects the principles of sustainable development and is based on eight main categories, which are used to assess a company's environmental responsibility as well as its relationship to the community (Box 5.6). Companies successful at the assessment stage are awarded gold, silver or bronze VAKINN certification. Companies that already hold ISO 14001, the Swan Nordic ecolabel or Earth Check certification receive the gold standard without assessment as long as they fulfil requirements relating to social responsibility.

The VAKINN system is a promising but relatively new initiative. As of August 2013, nine companies were participating, five of which had received environmental certification, and 47 applications were in process. All the Vatnajökull National Park visitor centres are certified by VAKINN. The VAKINN accommodation star rating is expected to be introduced in 2014.

Box 5.6. **VAKINN environmental award criteria**

The VAKINN environmental system is based on eight categories:

- *Strategy and work procedures*: Have the company's strategy and mission been presented to the staff?
- *Procurement and resources*: Is lifetime cost taken into account with regard to procurement and other decisions?
- *Energy*: Are cooling and heating systems regularly monitored and maintained?
- *Waste*: Is glass, paper, plastic or metal returned for recycling?
- *Nature preservation*: Is the revegetation of land supported?
- *Community*: Is there a company representative on a committee or board of a local association?
- *Suppliers and market*: Is it known where and how raw materials are manufactured?
- *Information to customers*: Are customers informed of the company's main concerns with regard to nature preservation?

The environmental criteria are accompanied by a simple checklist to help analyse the company's position on the path towards sustainable tourism. The company management must fill in this list when applying for environmental grading. The checklist provides guidance as to what could be improved, as well as serving as a basis for an action plan. Supporting materials are also provided, such as monitoring forms, advice and suggestions for the declaration of responsible and sustainable tourism. All companies participating in VAKINN must also accept and comply with the VAKINN Code of Ethics.

To obtain the bronze award, the company must have taken action in at least six of the eight main category areas, with at least one action in each of the following categories: reducing waste, saving energy (e.g. fuel, electricity and hot water) and encouraging more environmentally viable procurement.

To earn the silver award, companies must have fulfilled the bronze criteria and carried out regular measurements for 6 to 12 months. They must also demonstrate success in at least one area referred to in their action plan, e.g. with regard to reducing waste or saving electricity, hot water or fuel.

To achieve the gold award, the company must have fulfilled the silver criteria and taken action in at least 25 areas, with at least 5 actions in each of the following: reducing waste, saving energy and promoting more environmentally viable procurement.

Source: VAKINN (2014), "The environmental system".

If the benefits to participants can be clearly articulated, there remains significant potential to use VAKINN as a catalyst to improve the social and environmental responsibility of Icelandic tourism businesses. As the number of operators and accommodation providers is relatively small, it is feasible to aim for 100% participation, which would bring significant improvement in the quality and sustainability of tourism in Iceland. Another option would be to make the VAKINN system compulsory, including its environmental component.

5.4. *Promoting green innovation in tourism*

Innovation, in particular green innovation, has a fundamental role to play in improving sustainability and maximising the potential environmental, social and cultural benefits of tourism in the transition to a green economy. By adopting and encouraging the

development of innovative technologies and processes, businesses can make efficiency improvements in energy, water and waste infrastructure, while protecting ecosystems and creating the conditions for growth and sustainable development in local communities.

In an effort to enhance environmental awareness in the sector and promote product development and innovation, Iceland facilitated the participation of two tourism companies in a 2011 OECD/Nordic Innovation project on green business model innovation in tourism. The Icelandic companies joined 26 others in a project that aimed to guide them on how to work with green business model innovation and make the changes necessary for a transition to more strategic green innovation (Nilsson-Andersen and Andersen, 2012).

A survey of OECD member countries indicated that governments should play a more prominent role in better educating the public and tourism businesses concerning the environmental and financial benefits associated with adopting and supporting green innovation in tourism (OECD, 2012). Similarly, barriers identified by countries and participating companies – including information gaps, consumer reluctance, capacity constraints, investment cost, budget constraints and issues with access to finance – highlight potential areas of focus for government policy responses. The Icelandic government should continue to promote the benefits of green innovation for both tourism businesses and the environment.

5.5. *Information and research*

For many years the government put insufficient priority on measuring tourism's scale, growth and contribution to the economy. The growth in visitor numbers, however, has led to a broadening of the scope of collected statistics, which over time has come to include tourist arrivals and accommodation trends, frequency and seasonality of visits, type of tourist activities and visitor surveys. An improved information base, created by the National Account Division of Statistics Iceland with support from the industry ministry, allowed the first comprehensive set of tourism accounts to be published in 2008 (Statistics Iceland, 2011). The goal of the set, which was later updated, was to provide credible and coherent estimates of key features of the tourism sector and its contribution to the economy.

Monitoring efforts have been sustained by the ITB, which has started to map tourism industry resources throughout the country, with the results published as a user-friendly, web-based interface. These analyses have been used to build national and regional strategies, product development and marketing.

However, environment-related information has not been included in tourism statistics and indicators (Arnarson, 2012). The gaps were filled by independent research, but these data were partial and scattered. Only recently have some research projects on tourism carrying capacity been launched by the University of Iceland, with support from the MII and ITB. Such initiatives could inform the tourism policy debate and help decision makers identify and measure key environmental aspects of tourism policies. The key remaining gaps include information on the contribution of environmental assets to tourism and economic development, non-compliance with environmental regulations related to tourism, and trends in funding the development and improvement of tourism-related environmental infrastructure. Strengthening monitoring and policy evaluation can help ensure that proposed solutions are cost-effective and address key environmental challenges linked with tourism development. Building alliances with the research community could help augment limited administrative resources.

Notes

1. A new public-private partnership, Promote Iceland, created the campaign. The strategy was to advertise Iceland as "not for everyone", targeting "enlightened" tourists. To attract this visitor segment, Icelanders were encouraged to open their homes and invite tourists in for a unique Icelandic experience. The campaign was widely covered in international media. In addition, Icelandic landscapes were featured in several television series and movies with international distribution.
2. The MII was created in September 2012 through amalgamation of the Ministry of Fisheries and Agriculture, the Ministry of Industry, Energy and Tourism, and part of the Ministry of Economic Affairs.
3. Originally, the ITB was also responsible for tourism marketing and promotion in Iceland and abroad. In 2010, responsibility for international promotion was transferred to a new organisation, Promote Iceland, a public-private partnership under the Ministry for Foreign Affairs.
4. The council's chairperson and vice chairperson are appointed directly by the minister of industry and innovation. The remaining members are appointed by the minister upon nomination from the Icelandic Travel Industry Association (three representatives), the Association of Local Authorities (two representatives), the Iceland Tourism Association (two representatives) and Promote Iceland (one representative).
5. The tax is not levied per person but per "unit". Units can include houses, apartments, hotels or hostels with overnight charges, as well as stations for camping and places to park vehicles.

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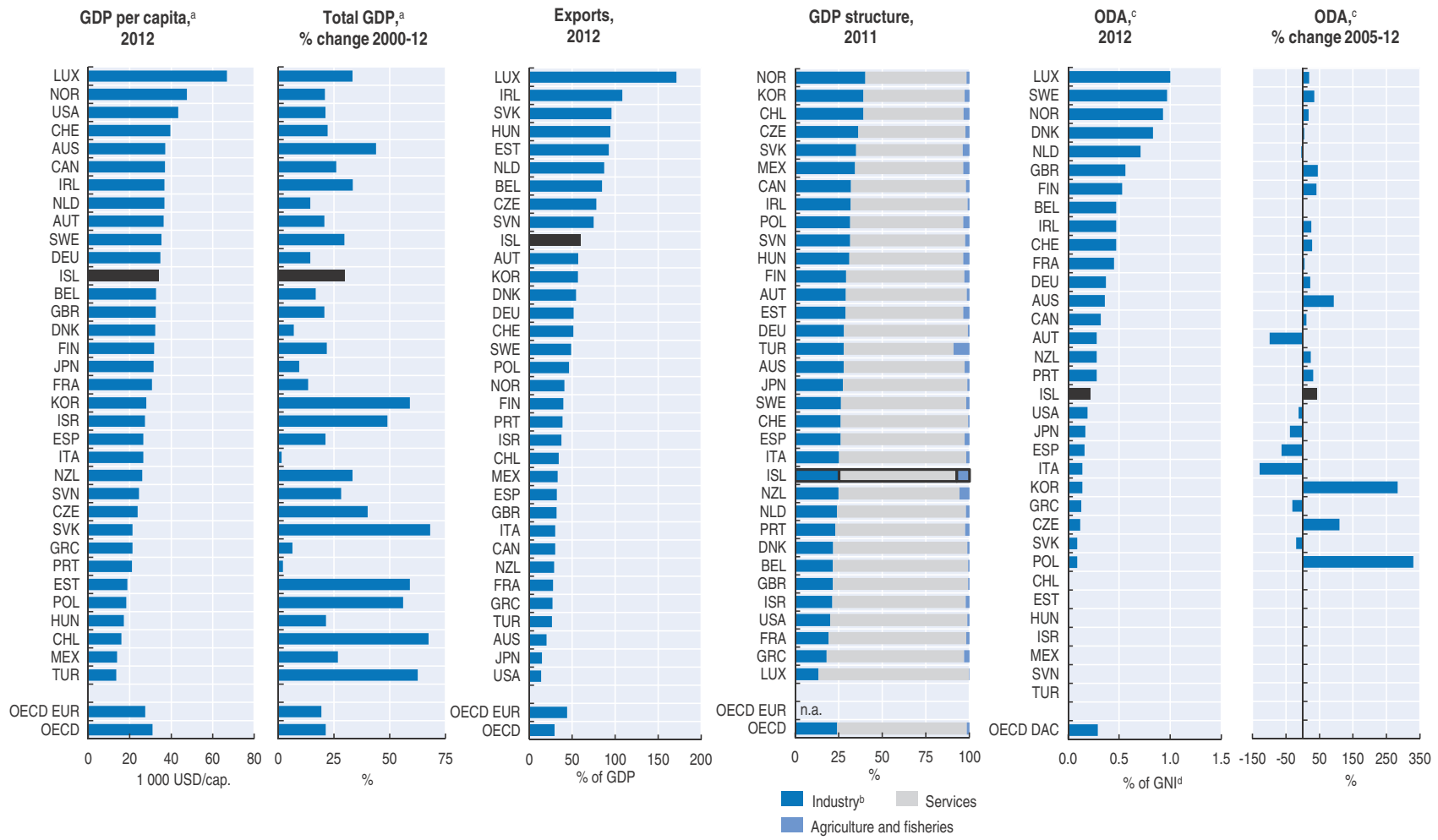
ANNEX I

*Selected data**

I.A. Selected economic data 154
I.B. Selected social data 157
I.C. Selected environmental data 158

* The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Annex I.A. **Selected economic data*– Economic context**



*) Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Partial totals are indicated by dotted borders.

a) GDP at 2005 prices and purchasing power parities.

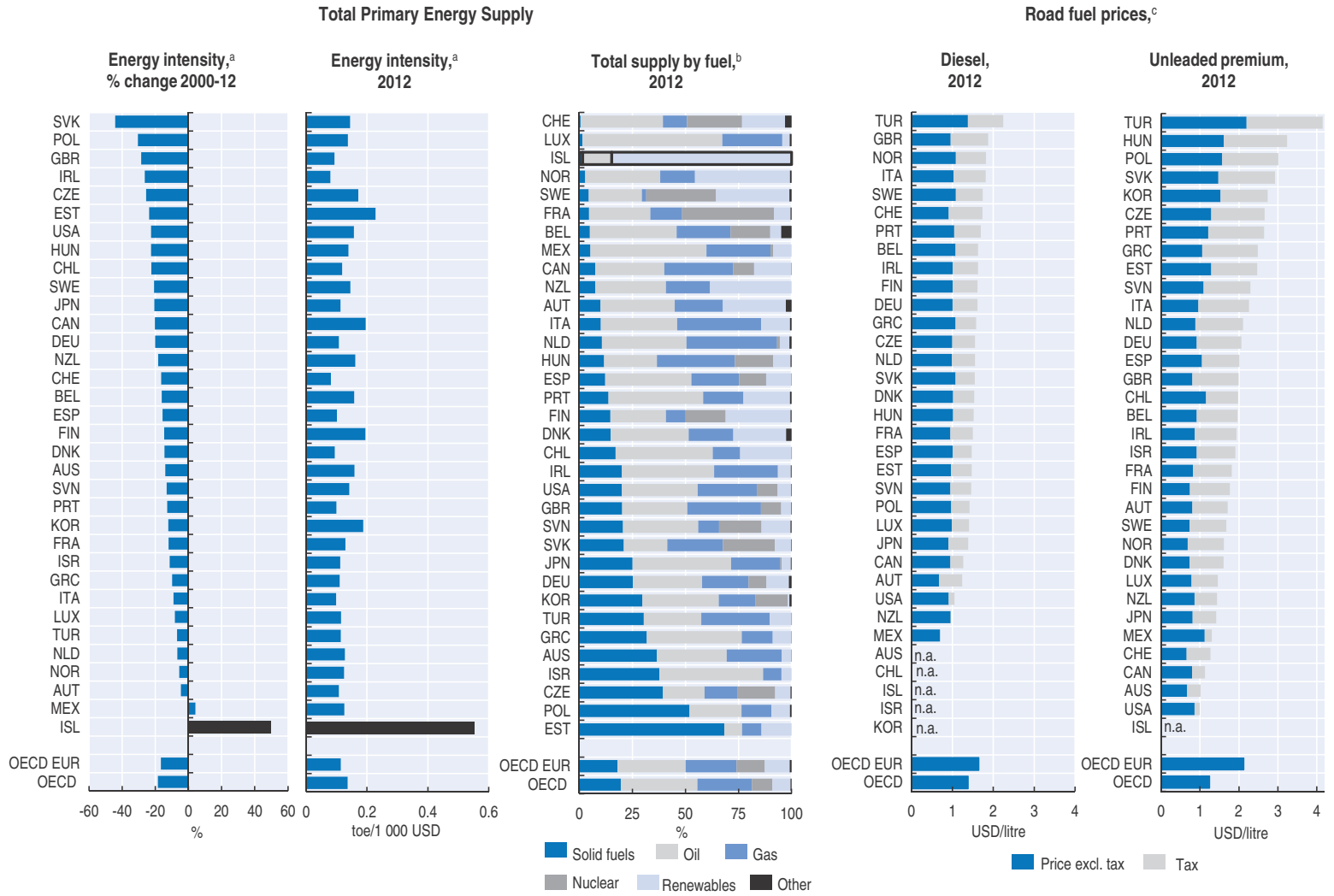
b) Includes mining and quarrying, manufacturing, gas, electricity and water, and construction.

c) Official development assistance by member countries of the OECD Development Assistance Committee. Total net disbursements at constant 2011 USD. CZE, ISL, KOR, POL and SVK became DAC members after 2005.

d) Gross national income.

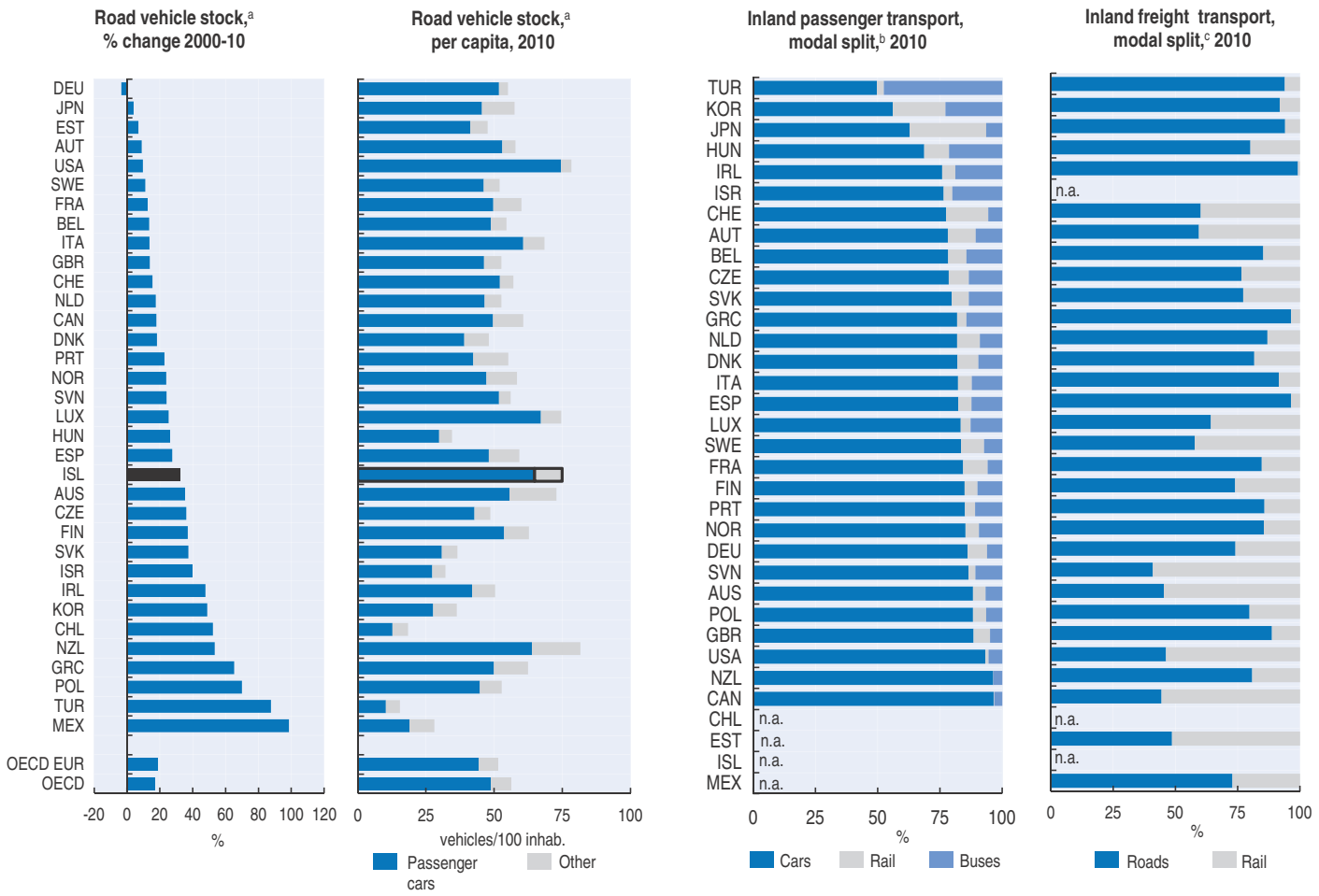
Source: OECD 2014, *OECD Environment Statistics* (database); OECD (2014), *OECD International Development Statistics* (database); OECD (2013), *OECD Economic Outlook No. 93* (database); OECD calculations.

Annex I.A. **Selected economic data*– Energy**



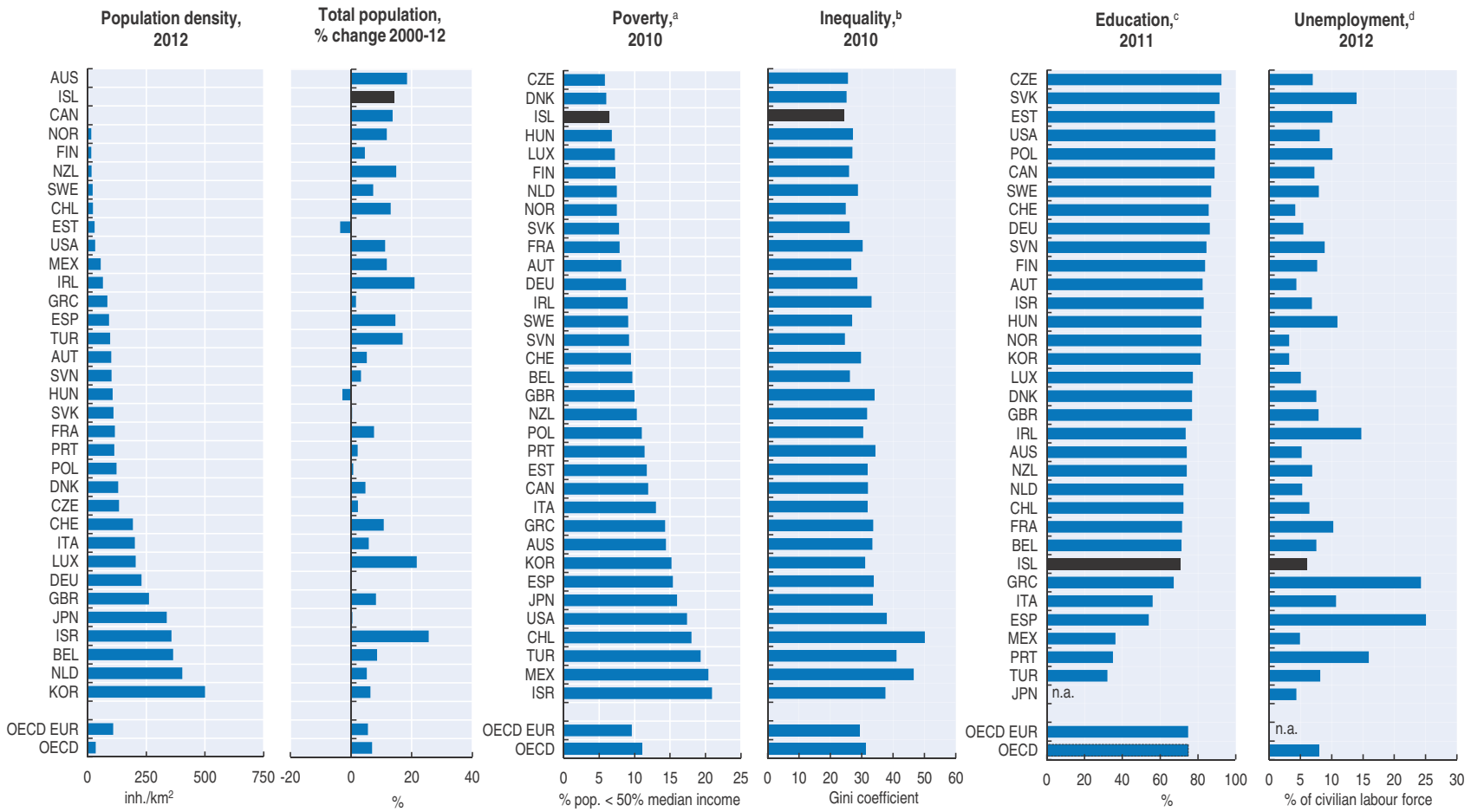
*) Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Partial totals are indicated by dotted borders.
a) Total primary energy supply per unit of GDP expressed at 2005 prices and purchasing power parities.
b) The breakdown excludes trade of electricity and heat.
c) Diesel fuel: automotive diesel for commercial use, current USD; unleaded petrol: unleaded premium (RON 95), except JPN (unleaded regular), USD at current prices and purchasing power parities.
Source: IEA (2014), *IEA Energy Prices and Taxes Statistics* (database); IEA (2013), *IEA World Energy Statistics and Balances* (database); OECD calculations.

Annex I.A. **Selected economic data*– Transport**



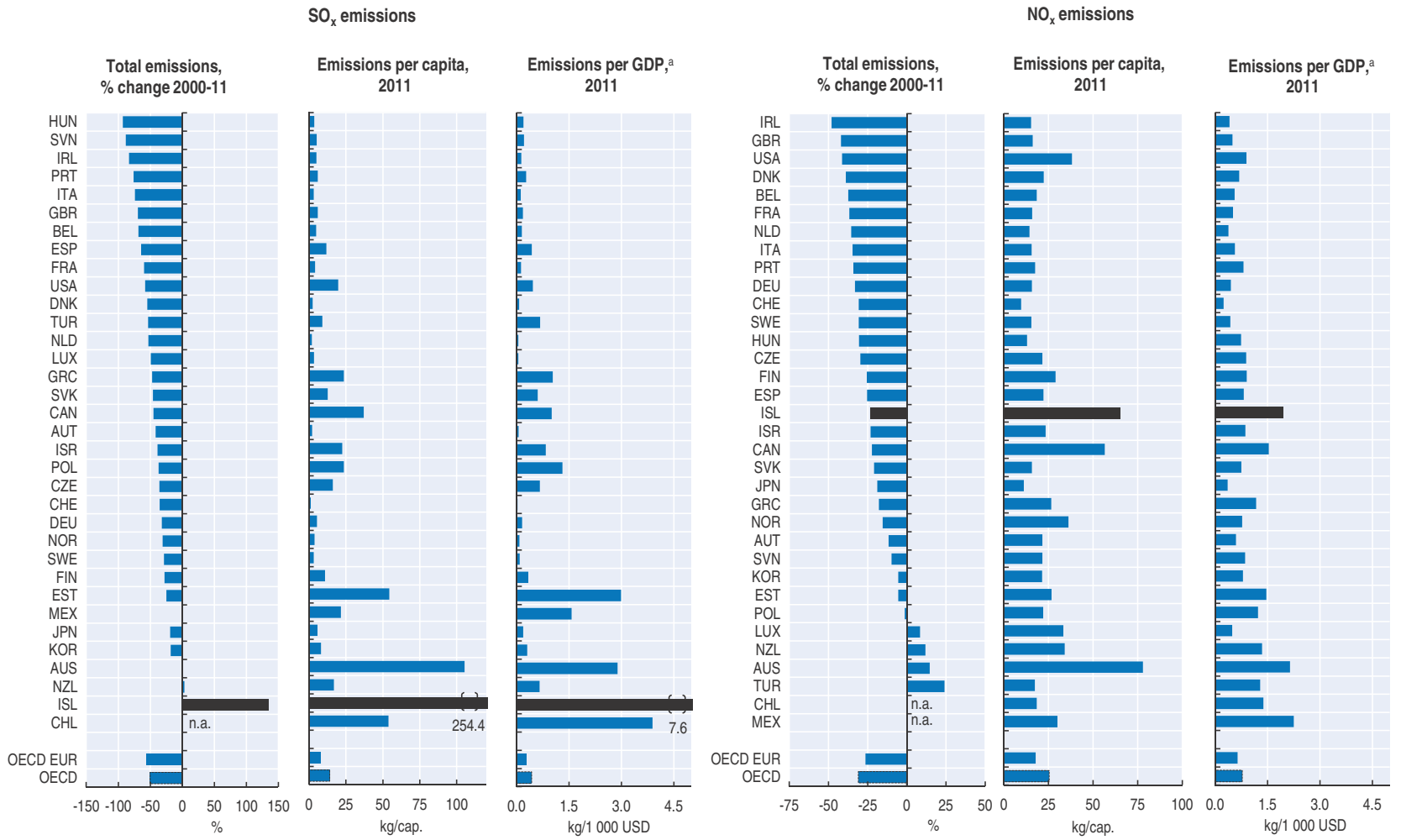
*) Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Partial totals are indicated by dotted borders.
a) Motor vehicles with four or more wheels.
b) Based on values expressed in passenger/km.
c) Based on values expressed in tonne/km.
Source: OECD (2014), *OECD Environment Satistics* (database).

Annex I.B. **Selected social data***



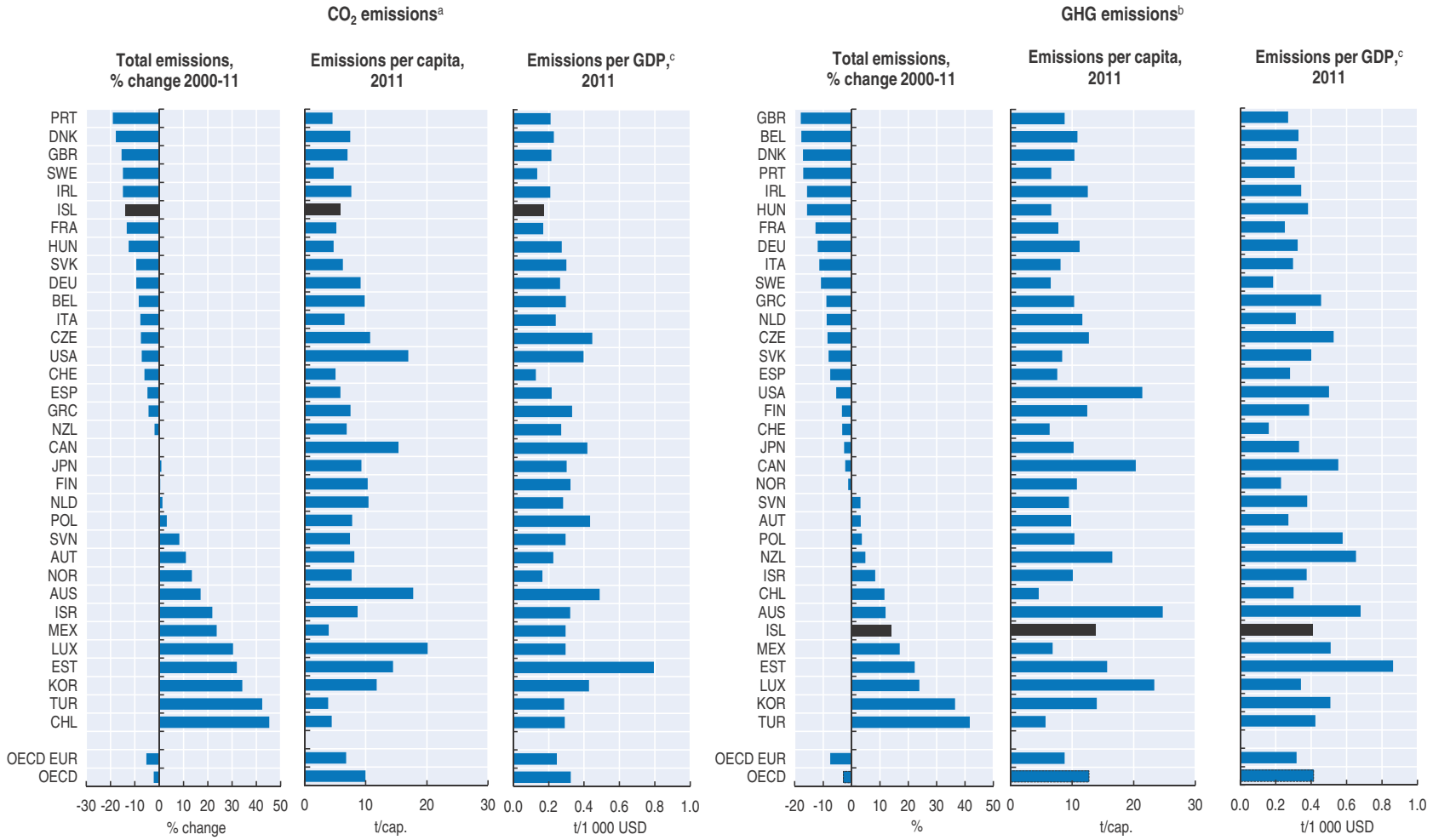
*) Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Partial totals are indicated by dotted borders.
a) Share of population with an income under 50% of the median income. OECD and OECD EUR: average of rates.
b) Ranging from 0 (equal) to 100 (inequal) income distribution, based on disposable income (incl. all incomes, taxes and benefits) for the entire population. OECD and OECD EUR: average of rates.
c) Share of population aged 25-64 years with at least upper secondary education. OECD and OECD EUR: average of rates.
d) Harmonised unemployment rates.
Source: OECD (2014), *Main Economic Indicators, OECD Education Statistics, OECD Environment Statistics*, *OECD Social and Welfare Statistics* (databases).

Annex I.C. **Selected environmental data* – Air**



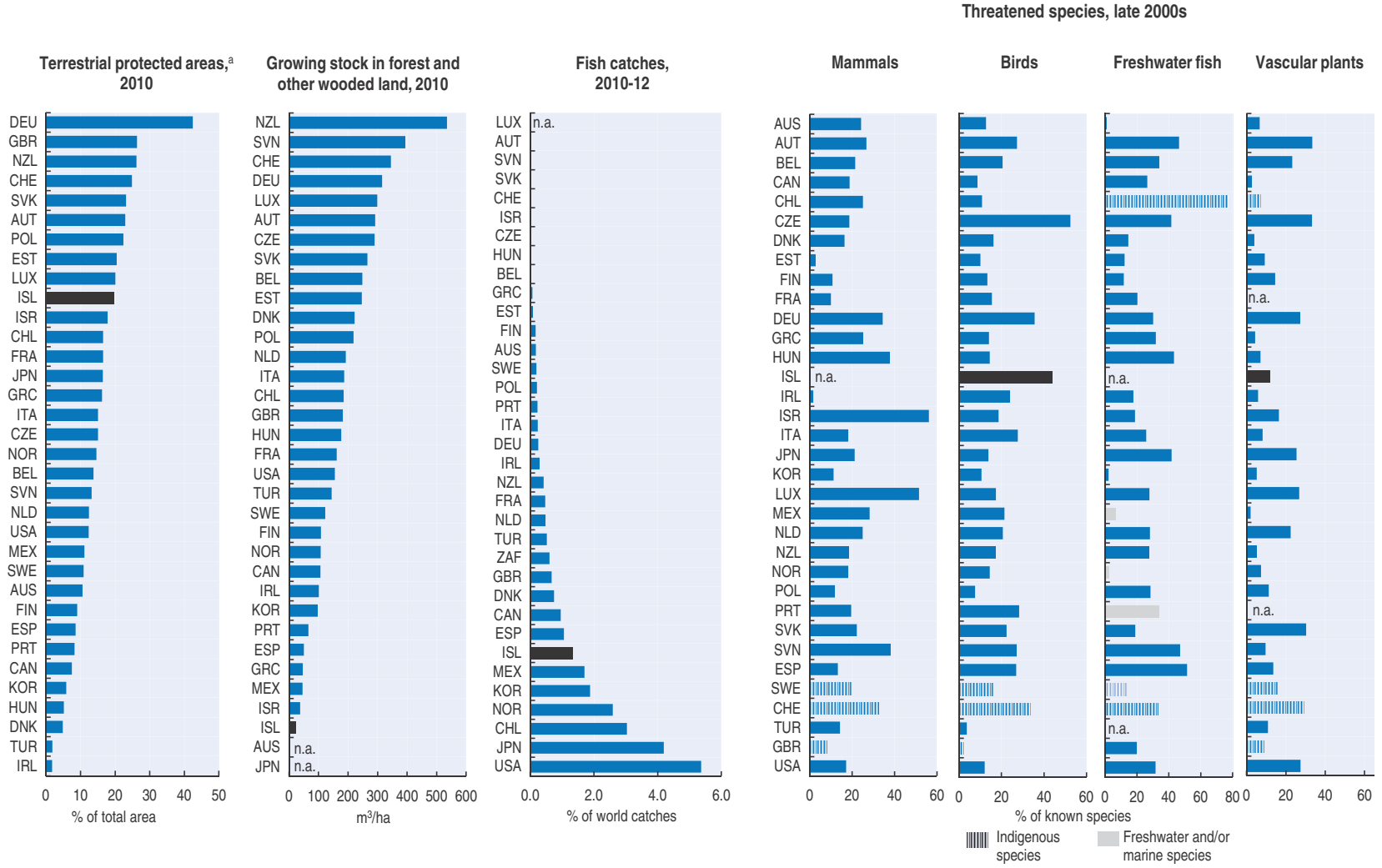
*) Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Partial totals are indicated by dotted borders.
a) GDP at 2005 prices and purchasing power parities.
ISL: SO_x emissions include emissions from geothermal energy. LUX: NO_x emissions exclude emissions from "fuel tourism".
Source: OECD (2014), *OECD Environment Statistics* (database).

Annex I.C. **Selected environmental data* – Climate**



*) Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Partial totals are indicated by dotted borders.
a) Emissions from energy use only; excluding international marine and aviation bunkers; sectoral approach.
b) Exluding emissions/removals from land use, land-use change and forestry. ISR: 2000 data exclude F-gases.
c) GDP at 2005 prices and purchasing power parities.
Source: IEA (2013), *IEA CO_2 Emissions from Fuel Combustion Statistics* (database), OECD (2014), *OECD Environment Satistics* (database); OECD calculations.

Annex I.C. **Selected environmental data* – Biodiversity conservation and sustainable use**

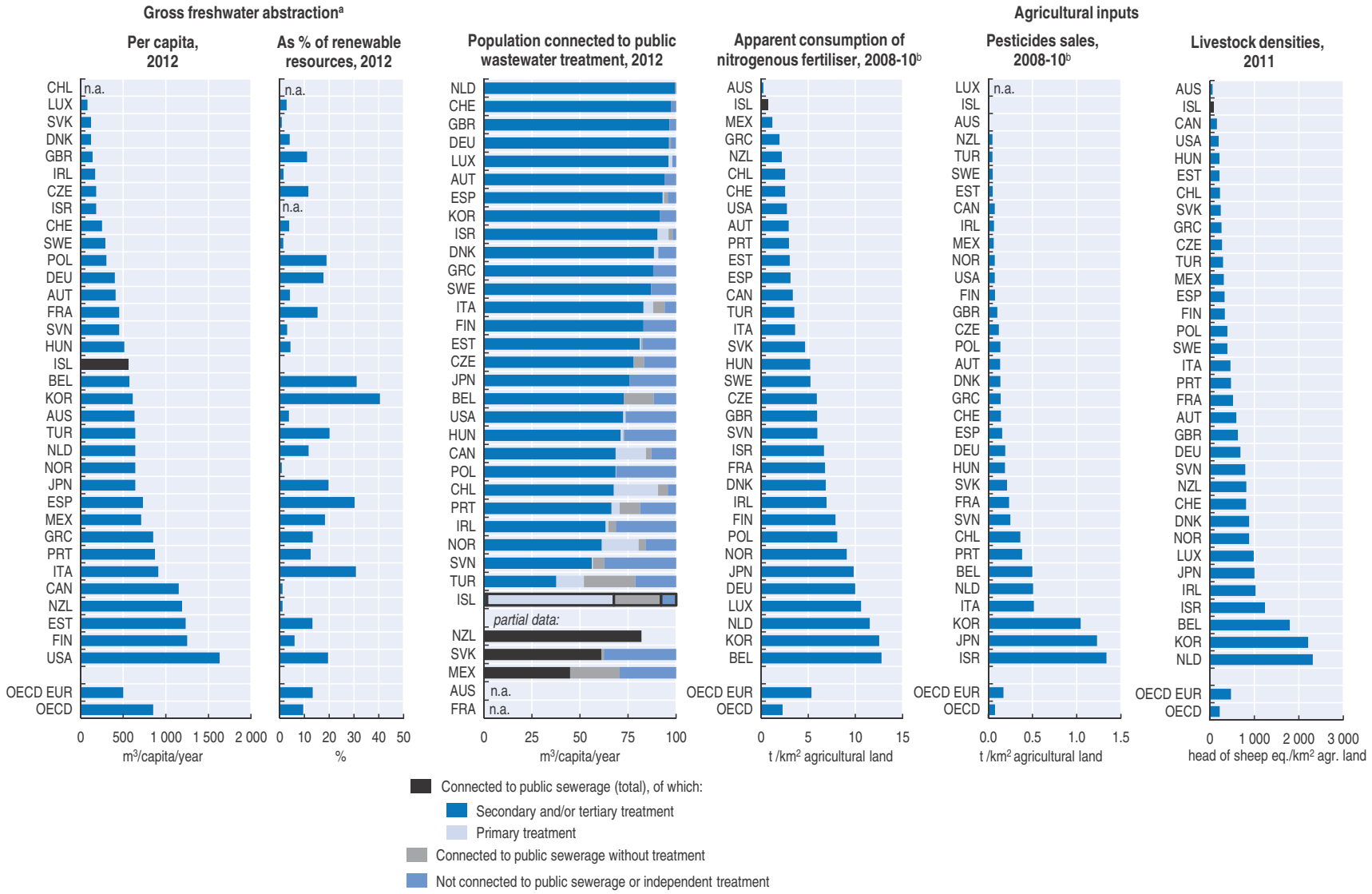


*) Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates.

a) Nationally designated terrestrial protected areas recorded in the World Database on Protected Areas (WDPA). National classifications may differ.

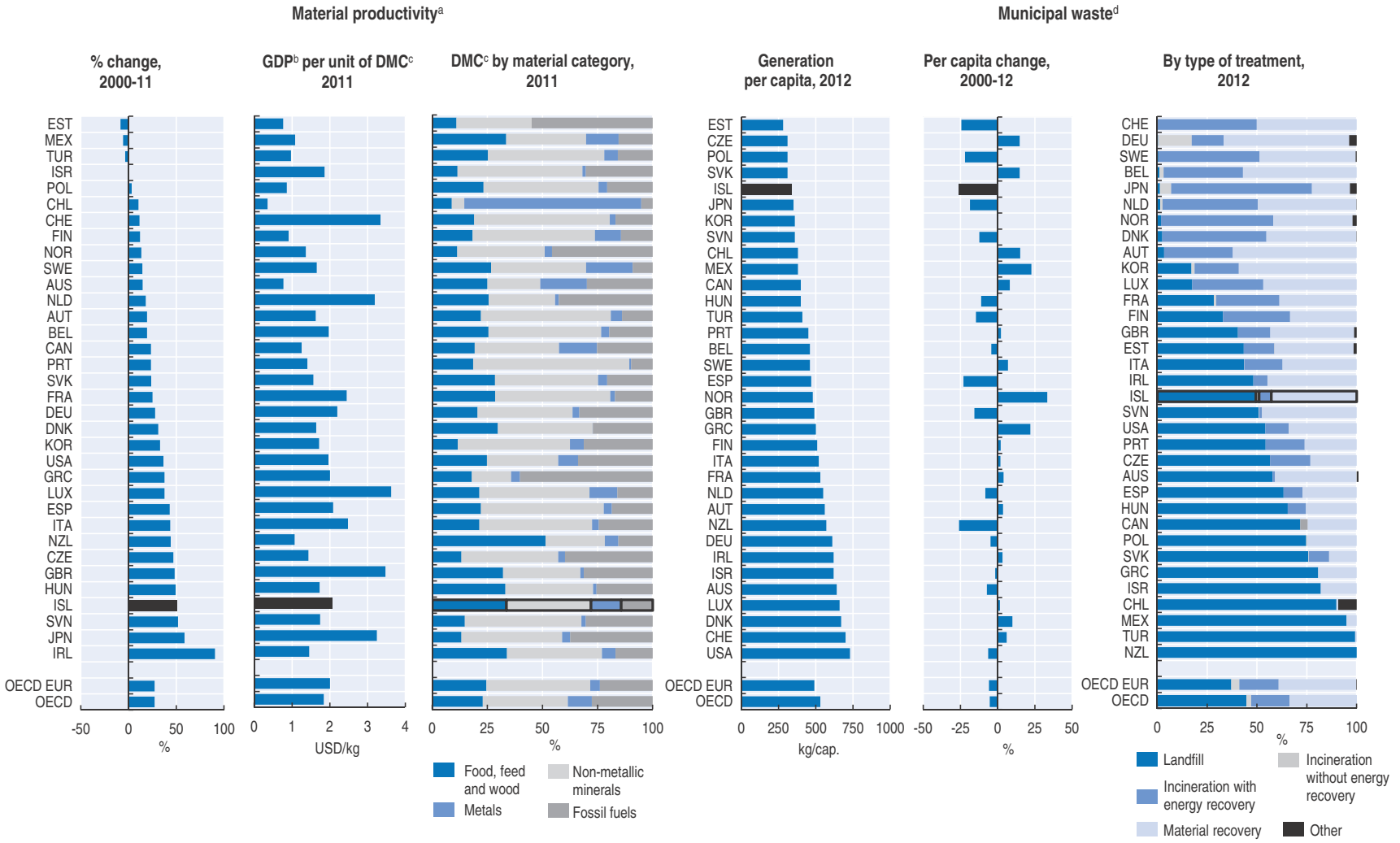
Source: FAO (2014), *FAO Global Capture Production* (database); FAO (2010), *Global Forest Resources Assessment*; OECD (2014), *OECD Environment Statistics* (database); UNSTATS (2013), *Millennium Development Goals Indicators* (database).

Annex I.C. **Selected environmental data* – Water and land**



*) Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Partial totals are indicated by dotted borders.
a) For some countries, data refer to water permits and not to actual abstractions.
b) Average data.
GBR: Water abstraction and public wastewater treatment: England and Wales only; pesticides use: Great Britain only; ISL: independent treatment: septic tanks associated with soil infiltration systems.
Source: FAO (2014); *FAOSTAT* (database); OECD (2014), *OECD Environment Statistics* (database); OECD (2013), "Agri-Environmental Indicators: Environmental Performance of Agriculture 2013", *OECD Agriculture Statistics* (database).

Annex I.C. **Selected environmental data* – Material productivity and waste**



*) Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Varying definitions can limit comparability across countries. Partial totals are indicated by dotted borders.
a) Amount of GDP generated per unit of materials used, ratio of GDP to domestic material consumption (DMC).
b) GDP at 2005 prices and purchasing power parities.
c) DMC equals the sum of domestic (raw material) extraction used by an economy and its physical trade balance (imports minus exports of raw materials and manufactured products).
d) Waste collected by or for municipalities, including household, bulky and commercial waste, and similar waste handled at the same facilities. CAN: household waste only and total incineration; NZL: lanfdilled waste only.
Source: OECD (2014), *OECD Environment Statistics* (database).

ANNEX II

Actions taken on selected recommendations from the 2001 OECD review

Recommendations	Actions taken
Policy-making environment	
1. Pursue efforts towards revising and implementing environmental legislation, taking account of Iceland's EEA membership.	As envisaged under the European Economic Area (EEA) agreement, Iceland's legal environmental framework on air pollution, waste management, drinking water, chemicals and climate change is largely in line with the body of EU law. The new legislation established more ambitious objectives; in some cases it is stricter than that of the EU. Iceland is late in adopting the requirements of the EU directives on floods and marine environment, and was granted an extended time frame to implement the Water Framework Directive. Even though not required by the EEA agreement, biodiversity legislation is partly in line with EU law (Chapter 2).
2. Strengthen environmental licensing and enforcement, e.g. by strengthening government inspection and environmental management by companies, and by ensuring that inspection fees cover inspection costs.	Environmental permitting procedures were reformed to reduce the regulatory burden while ensuring environmental protection, e.g. extended permit validity, quality manual and co-ordination mechanisms, such as monthly meetings among permit writers. A 2012 regulation established closer links between permitting and environmental impact assessment. Iceland strengthened and streamlined the inspection regime, and set up a system to track inspection records. Inspections fees were adjusted to better reflect the costs of inspections. An Inspection Quality Manual, based on provisions of the EU Recommendation for Minimum Criteria for Environmental Inspections, sets out procedures to help inspectors gather information prior to and during routine inspections (Chapter 2).
3. Define quantified environmental policy objectives.	Welfare for the Future: Iceland's National Strategy for Sustainable Development 2002-20 sets forth specific policy objectives under 17 themes. Each measure is accompanied by a set of indicators intended to monitor progress. Quantified environmental policy objectives are set in issue-specific policy documents (on waste, air, climate and water) and operationalized through environmental regulations (see recommendations 1 and 16) (Chapter 2).
4. Stimulate environmental management initiatives by industry.	The environment ministry and environment agency have encouraged the use of "green accounting" and ISO 14001 certification by industry. For some product categories, all brands being sold in the Icelandic market already have received the relevant environmental certification (Chapter 2).
5. Assure timely implementation of the physical planning functions of municipalities.	Most large municipalities have adopted land-use plans. An ongoing reform of the country's administrative structure aims to gradually reduce the number of municipalities (Chapter 2).
6. Adopt, as soon as possible, comprehensive waste management legislation.	The 2003 Act on Waste Management and subsequent amendments strengthened requirements for safe, effective waste management by incorporating EU rules on landfilling, treatment and disposal of hazardous and mining waste, and collection and treatment of specific waste streams (e.g. end-of-life vehicles, electrical and electronic equipment, batteries) (Chapter 2).
7. Extend producer responsibility to packaging waste, end-of-life vehicles and old tyres.	Since the adoption of the 2002 Act on Recycling, the proportion of waste under producer responsibility has expanded (packaging waste, end-of-life vehicles and used tyres). All manufacturers and importers of the products subject to the recycling act have to pay fees to the Recycling Fund (see recommendation 21) (Chapters 2 and 3).
8. Complete licensing of all landfills and incinerators as soon as possible, charge for landfill waste disposal and continue to develop modern municipal waste treatment.	All landfills and incinerators are now licensed and certified according to the EU waste management requirements. Three waste incineration plants have been closed since 2010 due to above-standard emissions. A charge for landfill waste disposal is applied at all waste deposit stations (Chapters 2 and 3).

Recommendations	Actions taken
9. Further implement mechanisms to encourage better interministerial co-ordination and co-operation related to sustainable development.	The Welfare for the Future strategy was developed through a broad consultation process, involving government agencies, stakeholders and civil society. Its implementation is overseen by an interministerial co-ordination committee, led by the environment ministry. At the working level, ministries and agencies dealing with environment-related matters hold regular meetings on topics of mutual interest (e.g. steering committees on climate change, waste electrical and electronic equipment; co-ordination group on preventing industrial accidents). Each committee involves government agencies, municipalities and businesses (Chapter 2).
10. Encourage private companies to improve environmental management standards, and implement "Environment Policy in Government Operations".	Ongoing reform of environmental permitting aims to promote better environmental management and internal quality controls in enterprises (see recommendation 2). Efforts have been made to promote green accounting and the application of ISO 14001 standards by industry (see recommendation 4). Iceland adopted the Government Policy for Ecological Procurement (2009) and the Policy on Green Procurement and Green Government (2013) (Chapter 3).
11. Improve public access to environmental information by publishing periodic state of the environment reports, environmental data and indicators showing the progress made towards goals and targets.	The city of Reykjavík has presented a report on its environmental performance since 2002. Since 2005, the Environment Agency of Iceland has published an extensive set of indicators to show progress in implementation of the Welfare for the Future strategy. The agency and Statistics Iceland publish detailed annual reports with environmental statistics and indicators. Detailed information on environmental quality is also provided at local level through municipal state of the environment reporting and, increasingly, in real time (Chapter 2).
12. Regularly carry out national surveys of public environmental awareness, and build consensus about environmental policies and their implementation.	Stakeholders, including NGOs, can extensively review, and comment on, policy proposals, both in writing and by appearing before parliamentary committees. The development of major government policy papers (e.g. Welfare for the Future, National Plan on Managing Waste, Climate Change Action Plan) involved extensive public consultations. Every other year, the environment ministry calls a two-day Environmental Congress open to NGOs, academics, members of the Parliament and city councils, and any other interested parties. The survey to assess public awareness of the Nordic Swan certification is the only example of surveying public environmental awareness (Chapter 2).
13. Develop the use of environmental information and economic instruments to provide appropriate signals to consumers.	Real time information is available to the public regarding air quality in urban areas. The environment agency's website provides information on "green lifestyle". A number of new environmentally related taxes, fees and charges were introduced or redesigned to provide environmental incentives (see recommendations 17 and 21).
14. Adopt a new national plan for sustainable development, with economic, environmental, social and regional dimensions, a long-term perspective and appropriate objectives and targets, based on extensive consultation.	In 2002, Iceland approved its national strategy for sustainable development 2002-20 (Welfare for the Future). The implementation of Welfare for the Future is subject to systematic reviews (in 2005, 2009, planned 2014) by the Environmental Assembly, a multi-stakeholder dialogue forum (see recommendations 3 and 11).
15. Adopt a national spatial plan on land use, co-ordinated with the sustainable development plan.	The 2010 Planning Act mandated the environment minister to present a comprehensive national land-use planning policy to the Parliament within two years of the following parliamentary elections (which took place in April 2013). A special guiding regulation for the content, presentation, consultation and procedures regarding a comprehensive land-use policy was issued in 2011 (Chapter 2).
16. Implement the newly transposed EU directives and collect necessary environmental data to meet international commitments.	The legal environmental framework on air pollution, waste management, drinking water, chemicals and climate change is largely in line with the body of EU law (see recommendation 1). Iceland has actively participated in the European Environment Information and Observation Network (Eionet) to improve data standardisation and collection (Chapter 2). The monitoring system was expanded. It includes monitoring of contaminants in marine biota and seafood products, as required by the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) and Arctic Monitoring and Assessment Programme (AMAP), as well as monitoring of air pollution in urban areas, as required by EU air quality legislation. Work is ongoing to improve monitoring of heavy metals, polycyclic aromatic hydrocarbons, and volcanos.
Towards green growth	
17. Increase the use of economic instruments in pollution prevention and control and in nature conservation.	A number of new environmentally related taxes, fees and charges were introduced, including an excise tax on diesel and a carbon tax on fossil fuels. Several taxes were redesigned to provide environmental incentives, such as the vehicle tax based on CO_2 emission levels. Iceland adhered to the EU Emissions Trading System for greenhouse gases (GHGs). The coverage of deposit-refund systems was extended (Chapter 3).
18. Continue investing in wastewater infrastructure.	A wastewater action programme was in force over five years to the end of 2008. A 20% matching fund was provided by the state to stimulate municipal investment in wastewater installations and sewage treatment facilities.

Recommendations	Actions taken
19. Apply the user pays principle in pricing for wastewater services to households and industry, e.g. through volumetric pricing.	Charging for wastewater services is a part of the annual real estate tax in all municipalities. It is not considered practical to apply volumetric pricing (Chapter 3).
20. Translate national sustainable development commitments into integrated policies and programmes in key economic sectors (e.g. fisheries, agriculture, energy, transport and tourism), with targets and timetables.	This has been done in the implementation of Iceland's commitments for the reduction of GHG emissions. Also, the Parliamentary report on strengthening the green economy contains many proposals with indications of the various ministries responsible for follow-up (Chapter 3).
21. Review the environmental effects of the tax system, integrate environmental concerns in fiscal policies and expand the use of economic instruments for environmental management.	No analysis has been done as regards environmental effects of the tax system. Economic instruments for environmental management are being used in the transport sector and other parts of the economy, including waste management (e.g. deposits on beverage containers for recycling, deposit on end-of-life vehicles, and processing charges on batteries, tyres and hazardous waste) (see recommendation 17) (Chapter 3).
22. Further increase public and private environmental expenditure so as to expand environmental infrastructure, implement national laws and translate international commitments into reality.	Budget appropriations to the environment ministry increased significantly over the decade, but part of the increase was due to structural reforms and transfers of agencies and programmes between ministries (Chapter 3).
23. Undertake further analysis of the economic, social and environmental implications of the ITQ system in the light of the latest evidence and experience.	Total catches measured in tonnes decreased significantly over the assessment period, while the economic rents of the sector increased. Taxation of the sector increased. A new task force has been charged with revising the tax structure (Chapter 3).
24. Fully incorporate small vessels into the ITQ system.	A separate coastal fisheries management system has been introduced, where small boat owners are subject to certain input and output restrictions.
25. Increase official development assistance, to reach the OECD-DAC average.	Official development assistance increased to a level well beyond the OECD-DAC average in 2008. The share of gross national income devoted to aid was cut in half in the aftermath of the economic crisis. It increased slightly from 2011 to 2012 (Chapter 3).
Energy and environment	
26. Develop and implement a meaningful programme of measures, in consultation with all stakeholders, to reduce GHG emissions from transport and fisheries, while seeking international support for the greater use of industrial processes based on clean and renewable energy sources.	Several measures to reduce GHG emissions from transport were introduced, including environmental requirements in vehicle public procurement; investment plan to expand the public transport network in the capital region; revision of the vehicle tax, now based on CO_2 emission levels; use of biogas from landfills for transport and favourable taxation of methane vehicles; VAT exemption for electric and hydrogen-powered vehicles (Chapters 3 and 4). Iceland imposed a carbon tax on fuel used to power fishing vessels. There was substantial renewal of the fishing fleet, with more fuel-efficient vessels. The government promoted the development of energy-saving fishing devices. Harbours have been gradually equipped with land-based renewable electricity. The Maritime Administration and other agencies have been working on pilot projects aimed at developing biofuels to power ships (Chapter 4).
Tourism and environment	
27. Extend protected areas significantly as regards wilderness and landscape protection (e.g. in the central highlands and coastal areas); prepare and implement management plans in all national parks, and extend Red Lists to cover all relevant species in Iceland.	The coverage of Iceland by natural protected areas expanded from 10% to 20% during the decade to 2012. Management plans are in place for three national parks, including the largest, Vatnajökull National Park, established in 2010 (Chapters 1 and 5). The Icelandic Institute of Natural History published lists of endangered plants and birds. The list of threatened vascular plants was reviewed in 2007. Red List data for lichens, mosses, algae and birds have not yet been reviewed (Chapter 1).
28. Increase ranger staff and funding for nature conservation, e.g. by applying the user pays principle to the tourism sector, inter alia, through fees and levies on visitors to protected areas.	The number of permanent rangers nearly doubled between 2006 and 2012. Their work is supported by temporary seasonal volunteers. In 2011 Iceland introduced an accommodation tax; 40% of the revenue is earmarked for the environment agency to support environmental protection measures, and 60% for the Tourist Site Protection Fund to develop, maintain and protect popular attractions (Chapter 5).
29. Diversify farm income by promoting agro-tourism and farm forestry.	The growth in agro-tourism is supported by the Farmers Union and the Icelandic Tourist Board. Farm forestry developed considerably over the decade, supported by five regional schemes.

Recommendations	Actions taken
30. Develop policy to protect Ramsar sites and natural parks of outstanding interest, with a view to maintaining the integrity of the Icelandic wilderness.	Three Ramsar sites were approved over the decade (Þjórsárver, Mývatn, Grunnafjörð). Applications for three additional sites are pending (Andakíll/Hvanneyri, Guðlaugstungur, Eyjabakkar).
31. Complete the national report on biodiversity.	National reports on biodiversity were issued as part of the preparation of the Nature Conservation Strategy for 2004-08 and its update for 2009-13.
32. Continue to implement the new legal framework and regional plan for the central highlands and increase the responsibility of local stakeholders in land reclamation by clarifying communal and individual land ownership and user rights in the highlands.	The Planning Act was adopted in 2010, on the basis of the analysis conducted by the Highlands Committee. The act mandated the environment minister to present a comprehensive national land-use planning policy (see recommendation 15) (Chapter 2).
33. Streamline soil conservation policy objectives by defining quantitative targets for sustainable land use, soil reclamation and vegetation cover.	Qualitative objectives were presented in the Soil Plan 2008-14. Only the reforestation/afforestation objective has been quantified so far (5% of land area), but with no time limit.

Source: Country submission; OECD Environment Directorate.

ANNEX III

Abbreviations

CO_2	Carbon dioxide
DAC	Development Assistance Committee, OECD
DMC	Domestic material consumption
EC	European Commission
ECTOS	Ecological city transport system
EEC	European Economic Community
EEA	European Economic Area; European Environment Agency
EFTA	European Free Trade Association
EIA	Environmental impact assessment
EMAS	EU Eco-Management and Audit Scheme
EAI	Environmental Agency of Iceland
EIA	Environmental impact assessment
Eionet	European environment information and observation network
EIS	Environmental Impact Study
ETS	Emissions trading system
EU	European Union
EV	Electric vehicle
EUR	Euro
FAO	Food and Agriculture Organization of the United Nations
FCEV	Fuel cell electric vehicle
FTA	Free trade agreement
GDP	Gross domestic product
GERD	Gross domestic expenditure on research and development
GHG	Greenhouse gas
GNI	Gross national income
H_2S	Hydrogen sulphide
ICI	Innovation Centre Iceland
IDDP	Iceland Deep Drilling Project
IEA	International Energy Agency
IMO	International Maritime Organization
IPPC	Integrated pollution prevention and control
ISK	Icelandic króna
ITB	Icelandic Tourist Board
ITQ	Individual transferable quota
LHEI	Local health and environment inspectorate
MARPOL	International Convention for the Prevention of Pollution from Ships

MENR	Ministry for the Environment and Natural Resources
MII	Ministry of Industries and Innovation
MW	Megawatt
NAO	National Audit Office
NGO	Non-government organisation
NMVOCs	Non-methane volatile organic compounds
NO_x	Nitrogene oxides
NPA	National Planning Agency
ODA	Official development assistance
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
PAHs	Polycyclic aromatic hydrocarbons
PFC	Perfluorocarbon
PM	Particulate matter
R&D	Research and development
REACH	Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals
RIA	Regulatory impact assessment
SEA	Strategic environmental assessments
SO_x	Sulphur oxides
STPC	Science and Technology Policy Council of Iceland
SUV	Sport utility vehicle
TAC	Total allowable catch
TFC	Total final consumption of energy
TPES	Total primary energy supply
UN	United Nations
UNU	United Nations University
USD	United States Dollar
VAKINN	Icelandic tourism quality and environmental assurance system
VAT	Value added tax
WFD	EU Water Framework Directive
WHO	World Health Organization

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