

European Green Capital Application 2012–2013 Reykjavík, Iceland



City of Reykjavík

NATURALLY
URBAN





European Green Capital Application 2012-2013 Reykjavík, Iceland

Award year

Award year: Either 2012 or 2013

Municipality

Name: Reykjavík City

Country: Iceland

Size: 275 km²

Number of inhabitants: 119.848 citizens

Mayor: Hanna Birna Kristjánsdóttir

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1 Local Contribution to Global Climate Change

- 1.1 The present situation and developments over the last five to ten years
- 1.2 Measures implemented over the past five to ten years to reduce GHG gas emissions, including resources allocated to implementing these measures
- 1.3 Short and long term objectives for reduction of GHG emissions, including measures adopted, but not yet implemented, and budgets for future measures already adopted
- 1.4 Documents, websites and documented decisions
- 1.5 Disadvantages resulting from historical and/or geographical factors



1 Local Contribution to Global Climate Change

1.1 The present situation and developments over the last five to ten years

The City of Reykjavik has set the goal of reducing emission of green house gases (GHG), from the activities in the city to the operation of the city itself. Excellent results have been achieved in sustainable use of renewable energy sources, hydro- and geothermal energy, so that GHG due to energy use and heat is negligible. Intra-city transportation is the main source of emissions and the city has actively worked toward reducing the overall demand for transport, promoting less environmentally damaging modes of transport and reducing individual motorised transport.

Commitments of Reykjavik City

On the 1st of September 2009, the Reykjavik Climate and Air Quality Policy were approved, under the title: The future is in the air. A decision was made to include issues of air quality in the city, as many contributory factors are common to both climate and air quality, and require the same mitigating measures. The City's policy stipulates the overall emission of greenhouse gases to be reduced by 35% by 2020 and by 73% by 2050, compared to 2007 emission levels. The policy covers six fields concerned with climate issues:

- Carbon sequestration,
- Transport,
- Waste,
- Green operations,
- Industry and agriculture and
- Urban planning.

The policy is implemented via the Green Steps for Reykjavik, a yearly, updated plan of implementation for the city's environmental issues, which are worked on in connection with the work schedule and budget of the City of Reykjavik (see appendix 2). In 2007, the Green Steps focused on climate strategy to reduce emissions of greenhouse gases, and 2010 a special focus will be on climate issues. This focus has been highlighted even further with the decision of the executive committee of the city council of Reykjavik in May 2010 that the city should become the instigator in climate conventions for the municipalities Covenant of Mayors. With conventions municipalities are obligated to reduce GHG emissions by more than 20% by 2020.

The first obligations for climate issues can be retraced to 1997 when Reykjavik became a member to the Aalborg Charter in 1997, and formally ratified the Aalborg Commitments +10 in 2005. One of the commitments, no. 10, focuses on climate issues and is the cornerstone for the climate policies pursued by the City authorities. It can also be noted that the current version of Local Agenda 21, approved in 2006, addresses the principal source of greenhouse gas emissions in Reykjavik, i.e. transport.

GHG emission in Reykjavik

Since 2002 the City of Reykjavik has estimated greenhouse gas (GHG) emissions from private vehicles and public transport, as part of its programme of Reykjavik Environmental Indicators (to monitor progress and to encourage knowledge-based decision making, see appendix 3). The methodology is built on using data on average driving, fuel consumption and the average num-

ber of automobiles in Reykjavik to measure carbon dioxide (CO₂) emissions. By statistically evaluating changes of this size, development of GHG emissions from transport in Reykjavik was assessed. Calculations have been made for the period from 1999, and for comparison emission levels have been estimated for the period since 1990. The calculations for 1990 are, however, based on slightly differing principles and are therefore not comparable. Emissions for the year 1990, have not been estimated further since it was preferred to analyse as close to current emission as possible and form plans for the city in relation to those emission values. The results from this estimation show that total CO₂ emissions from transport have raised by 40% since 1999 (see figure 1.1, 1.2 and table 1.1).

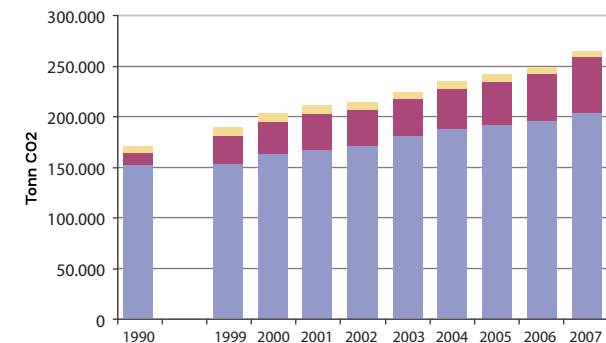


Figure 1.1
Estimated total CO₂ emissions from transport in Reykjavik, 1990, 1999-2007. Emission from public transport (yellow), petrol cars (blue), diesel oil cars (red).

Table 1.1
Estimated total CO₂ emissions from transport in Reykjavik 1990, 1999 and 2006-2007.

CO ₂ emissions in tonnes		1990	1999	2006	2007	1999-2007 (%)	2005-2007 (%)
Private cars	Petrol	150.145	151.836	193.368	200.991	32,4%	5,9%
	Diesel oil	11.902	26.947	46.004	55.385	105,5%	33,4%
Buses	Diesel oil	6.955	8.723	6.535	5.476	-37,2%	-27,9%
Total		169.002	187.506	245.907	261.853	39,7%	9,6%

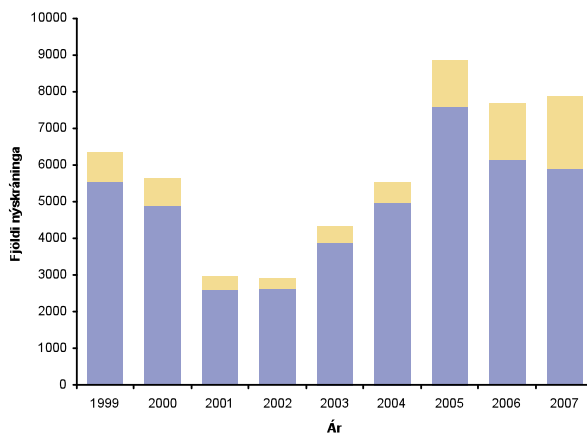


Figure 1.2
Number of newly registered private cars in Reykjavik, 1999-2007. Petrol cars (blue), diesel oil cars (yellow).

Parallel to the formation of the Reykjavik Climate and Air Quality Policy, an overall analysis of GHG emissions within the city was carried out, by assessing the emission for one year, i.e. 2007, following the IPCC guidelines. Emissions were counted from vehicle transport (both private and commercial), industry, aviation and navigation (fishing vessels and cruisers) all within Reykjavik. Data on emissions from various sources is based on models for the Reykjavik municipality, such as a transport model. GHG are considered CO₂, methane (CH₄) and nitrous oxide (N₂O) as other emissions are considered negligible. The methodology is similar to the CO₂ Calculator (Danish National Environmental Research Institute, Local Government Denmark and COWI) and targets all GHG point of generation emissions within the city borders regardless of the origin. The “emission values available” are in relation to that emission estimation for the year 2007, and it should be pointed out that considerable change has taken place since then, i.e. concerning more environmentally friendly modes of transport in the city.

No.	Categories	Amount of CO ₂ -eq	Emission of GHG (%)	Climate	Air quality
1	Carbon sequestration	5.035		X	
2	Waste	74.000	22%	X	X
3	Motor transport	235.600	69%	X	X
4	Constructions				X
5	External air pollution				X
6	Environmentally friendly management			X	X
7	Planning			X	X
8	Industry and agriculture	19.746	6%	X	X
9	Other – flight, fishery and ship transport	10.240	3%	X	X
Total		334.551	100%		

Table 1.2
Origins of GHG emissions.

A. Total CO₂ equivalent per capita, including emissions resulting from use of electricity

Total emissions in Reykjavik amounted to 334.550 tonnes CO₂-eq in 2007, or about 3 tonnes per capita, which is not particularly high, in view of the national average of about 15,3 tonnes in 2008. Emission levels vary somewhat between categories: 69% of GHG emissions in the city were attributable to motor traffic while the second-largest factor was waste disposal, 22% (included in the business category). Electricity is generated from hydro and geothermal sources and all buildings are in a way heated by sustainable geothermal energy. Origins of emissions are shown in more detail in table 1.2.

B. CO₂ per capita resulting from use of natural gas

Natural gas is not used in Reykjavik outside of isolated use in food preparation.

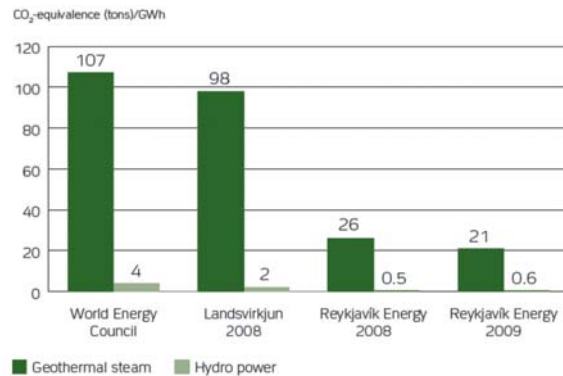


Figure 1.3
GHG emissions per produced GWh (CO₂-eq/GWh) from electricity production with geothermal energy and hydroelectric power.

C. CO2 per capita resulting from transport

GHG emissions from cars (private and commercial) amounted to about 2 tonnes per capita (total 236.000 tonnes) in 2007.

D. Gram of CO2 per kWh used

All electric power and space heating in Reykjavik derive from renewable energy sources; this ratio is around 99% of the electricity and around 98% for space heating in Iceland. About 82% of all primary energy use in Iceland derives from sustainable domestic energy sources. Most of the electricity consumed in Reykjavik is generated by geothermal power plants at Nesjavellir and Hellisheiði, while some is produced by hydro-electric power (HEP) plants (see figure 1.3). Thus heating and electricity are negligible environmental issue in the city.

Emissions from the Reykjavik Energy geothermal power plants in average were 21 gr CO₂-eq/kWh in 2009, while emissions from the HEP plant reservoirs were only 0,6 gr. For comparison, the carbon footprint of solar power (PV cells) is about five times this amount or 107 gr. CO₂-eq/ kWh according to the World Energy Council (see figure 1.3).

E. District heating

All citizens are connected to district heating originating from geothermal energy. This energy is used in multiple ways that contribute greatly to improved environmental performance, public health and quality of life in the world's northernmost capital. It is in a way used for central heating in all houses in Reykjavik and has totally replaced coal and oil as a source of energy for heating of homes. The geothermal hot water from the low-temperature geothermal areas is passed directly into the distribution systems as the high-temperature geothermal areas is used to warm up cold groundwater.

1.2 The measures implemented over the past five to ten years to reduce GHG emission, including resources allocated to implementing these measures

Examples of climate measures over the last few years:

A. Energy supply

All electric power and space heating in Reykjavik derive from renewable energy sources, geothermal and hydro power. Reykjavik Energy, an independent utility service majority owned by the City of Reykjavik (98%), is among other things responsible for electricity generation and water heating for use in homes in Reykjavik. The total production of electricity from renewable energy sources increased by 73% from 2004-2009 (see table 1.3).

Almost all electricity and space heating in the city is provided from green sources: hydro and geothermal. Therefore, the main focus has been on replacing fossil fuel for transportation with alternative fuel e.g. methane gas derived from landfill gas, hydrogen or electricity. Nine-tenths of the City's waste-collection vehicles are

powered by methane gas and the City also has 2 buses and 23 cars powered by methane. The public transport company, Strætó bs., owned 60% by the City of Reykjavik participated in the ECTOS (Ecological City Transport System) project, which was supported by the EU's Fifth Framework Programme to experiment with the use of hydrogen to power buses.

B. Transport

Reykjavik area, an urban area of seven municipalities and 200.000 inhabitants, was largely developed in the latter half of the 20th century. Low density, segregation of land use and emphasis on the private automobile have characterised urban development in the area in past decades. In the last years, however, this trend has lessened while a portion of more environmentally friendly transportation has increased, e.g. usage of public transport and carpooling, in addition to a visible increase in the number of bicycles in the city. These developments can, at least in part, be attributed to the city's efforts:

- The City has defined eco-friendly vehicles in terms of fuel use and CO2 emissions and such vehicles can park for free in central Reykjavik since 2007.

- Bus priority lanes have been introduced at points of greatest congestion, and buses now have priority at junctions.
- Bus fares have been heavily subsidized, particularly for secondary-school and university students, who have for two years enjoyed free bus travel. During the first year the number of bus passengers increased by 1 million, or 5% (note that the population of Reykjavik is about 120.000).
- Today pavement and paths available to pedestrians and cyclists in the city amount to 800 km. The Reykjavik Bike Plan was endorsed in January 2010 and a bike map has also been published regularly. The main paths have the same level of maintenance as the road network.
- In recent years the number of woonerfs with a speed limit of 15 km/h has been increased as well as 30 km/h limit areas.
- Green Travel plans have been agreed on in schools, encouraging parents not to drive their children to school.
- Recharging points for electric vehicles have been installed in the city, where vehicles can be recharged for free.

Table 1.3
Reykjavik Energy's total production.

	2004	2005	2006	2007	2008	2009	Change from the previous year
Hot water m3	64,000,000	71,000,000	72,700,000	78,275,000	79,200,000	82,019,000	4%
Electricity from geothermal steam MWst	672,800	779,500	1,201,000	1,808,400	2,102,700	2,672,626	27%
Electricity from hydropower MWh	42,600	32,800	39,800	32,800	35,200	33,660	-4%
Electricity from biogas MWh	2,300	4,200	1,000	183	157	478	204%

- Methane production from landfill gas. The City of Reykjavik has, through waste management company Sorpa and Metan Ltd., started processing and marketing methane from landfill gas in collaboration with motor service retailer N1.
- The City Council has over the last 10 years placed emphasis on densification of the city's built-up areas as well as on expanding residential areas in the city centre. At the same time efforts are being made to develop suburban centres and to improve levels of service within the suburban areas. These priorities are stated in the current Reykjavik Municipal Plan, approved in 2003.

C. Buildings

Energy use in buildings is not a significant environmental aspect of the City's activities. Over 98% of electrical and heating supply derives from sustainable utilisation of hydro and geothermal energy. Close to 100% of houses in Reykjavik are connected to district heating with geothermally heated water. The carbon footprint of electrical production by a geothermal power plant in Iceland averages 38 tonnes CO₂-eq/GWh, and for hydro-power the footprint is 2 tonnes CO₂-eq/GWh. The City of Reykjavik has installed a permanent monitoring system for energy consumption in several municipal buildings resulting in general, 10-20% less energy than equivalent buildings without energy monitoring system.

D. Industry

Today GHGs are emitted by industry activities within the City's territory by a very small amount. According to the list of industrial companies which are subject to authorisation and do green accounting in accordance with regulations, the emission is only 1.000 tonnes CO₂-eq.

E. Agriculture

Emission from agriculture amount up to 18.700 tonnes CO₂-eq. In 2009, 80.000 trees were planted at the city periphery and 20.000 in the city itself. Since 2007 a total of 340.000 plants have been planted. Carbon sequestration in forestry plantations in Reykjavik hinterland was estimated at 5.050 tonnes CO₂-eq in 2007. When present newly-planted trees reach a height of two metres, they are predicted to capture 3.800 tonnes CO₂-eq, bringing total carbon capture from forestry plantations to about 7.300 tonnes. This figure does not take account of carbon sequestration by vegetation in urban Reykjavik and in other areas outside formally-designated forestry plantations.

F. Waste management

Waste management and disposal entail emissions of GHGs. In recent decades waste has gone to landfill sites at Álfsnes and Gufunes, which are estimated to have emitted about 74.000 tonnes CO₂-eq in 2007. At the present landfill site at Álfsnes, about 70% of the landfill gas is harvested to produce methane, which is used as a fuel for vehicles, as a substitute for fossil fuels. Part of the remaining 30% which is not captured by the harvest-

ing system is oxidised in a surface layer placed over the landfill. The City has encouraged residents to reduce their waste production and to recycle more by e.g. relating waste collection fee to amount of waste produced, offering recycling bins, high density drop-off centres and recycling centres.

G. Green public procurement

The City procurement rules were revised in 2009. One of the main objectives of the revisions was to make green procurement a principle in the entire City's procurement. With the new procurement rules procurers have to evaluate the release of GHG prior to procurement. Criteria such as alternative fuel use and EURO emission standards have been included in tendering for waste collection and bus transport. The City hosted an international conference on procurement and climate change in March 2009 in collaboration with ICLEI, EcoProcura 2009, with participants from 41 countries. The conference theme was Climate Neutral through Procurement and the main topics were the importance of sustainable procurement in the global climate debate, and how sustainable procurement can support climate mitigation and adaptation strategies.

1 Local Contribution to Global Climate Change

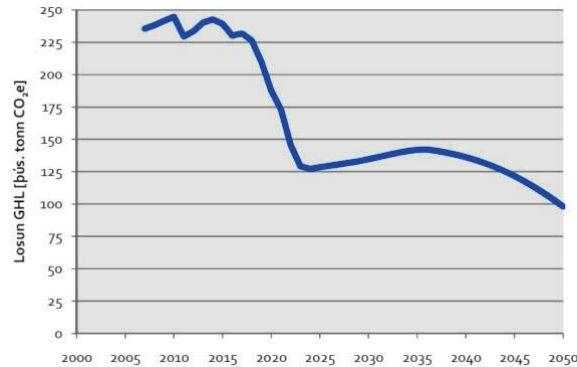


Figure 1.5
Forecast GHG emissions (business-as-usual).

H. Education and information

In recent years the City of Reykjavik has regularly issued news and tips on environmental issues in the city. In January 2010 the City distribute a brochure containing information, both for the public and for businesses, on easy measures against climate change. The City has from 2000 sponsored six weeks courses on a greener lifestyle, Global Action Plan (GAP). In 2009 the guest reception areas of Reykjavik Energy's geothermal power stations in Hellisheiði and Nesjavellir were given certification under "EarthCheck" (previously "Green Globe"). The number of guests visiting reception has grown, and in 2009 the total number of registered guests was 103.232 growing from 33.500 in the previous year. Reykjavik Energy's geothermal power stations are thus among the most popular tourist destinations in Iceland.

In 2009 an overall analysis of GHG emissions within the city was carried out, and a climate policy was formulated on the basis of those data. At the same time a forecast was made on a business-as-usual basis, and the main opportunities were pinpointed for reducing GHG emissions vis-à-vis the business-as-usual levels (see figure 1.5).

The finding of this analysis was that the main opportunities in Reykjavik are in the field of transport and waste management. Projects were outlined for the most reduction in waste management in as economically sensible of a manner as possible. The evaluation underlined the need to undertake systematic and effective measures in the fields of transport, planning and waste management in order to achieve the City's ambitious targets for reducing GHG emissions. If the City objectives for total GHG emissions in Reykjavik are achieved, total emissions per capita will be about 1,7 tonnes CO₂-eq in 2020 and 0,6 tonnes in 2050. Measures have been set up in the City's environmental action plan, Green Steps in Reykjavik.

1.3 Short and long term objectives for reduction of GHG emissions, including measures adopted, but not yet implemented, and budgets for future measures already adopted

Short term objectives

- The City's environmental action plan, Green Steps for Reykjavik, is based upon its Local Agenda 21 and other City policies on environmental issues (see appendix 1 and 2). A total of 1,4 million EUR will be allocated to various structural projects relating to the Green Steps in 2010 which will emphasise climate issues. Costs of changed services, publicity, education and other tasks are not included in that sum.
- In 2010 the City will plant 20.000 trees within the city borders with the objective of capturing carbon and thus compensating for GHG emissions from its activities.
- In 2010 the City will open a website devoted to climate change and air quality in the city and sponsor courses on a greener lifestyle, Global Action Plan (GAP).
- In 2010-2011 the City will construct a Sustainable Energy Action Plan including a baseline emission inventory which outlines how the objectives will be reached in relation to its decision in May 2010 to become the instigator in climate conventions for the municipalities Covenant of Mayors.
- In 2010-2011 the City will also form an implementation report on its GHG emission objectives for evaluation, monitoring and verification purposes, based on the forecast made in 2009 on a business-as-usual basis, and the main opportunities which were pinpointed for reducing GHG emissions vis-à-vis the business-as-usual levels.
- 2011 the City will organise Energy Days, in co-operation with the European Commission and with other stakeholders, allowing citizens to benefit directly from the opportunities and advantages offered by more intelligent use of energy.
- A new Municipal Plan, which is intended to be adopted in 2010, emphasises densifying built-up areas and enhancing services in suburban areas to shorten people's routes to and from work and encourage eco-friendly modes of transport such as walking and biking. Climate adaptation measures will be implemented through the revised Municipal Plan.
- At schools the emphasis is on children learning to find safe routes to school and that they are not driven to and from school, the cost of this will be 31.000 EUR in 2010. Priority will also be placed on introducing Green Travel Strategies in more of the City's primary/lower-secondary schools.
- In order to achieve more sorting and recycling of waste, it is intended to introduce collection of sorted waste from every household in Reykjavik. Such sorting has up to this point been optional, but recycling bins will now be made compulsory. The various options associated with collecting sorted waste from households have been examined in Reykjavik; changes may be expected in relation to waste collection methods in the city at the end of 2010, beginning of 2011.
- Almost all electricity and space heating in the city is provided from green sources: hydro and geothermal. A waste-to-energy incineration plant is therefore neither a competitive nor a green option in Reykjavik. Hence the intention is to install a combined anaerobic digester and composting plant, using the methane gas produced as fuel for vehicles, as an alternative to fossil fuel. This is an especially important project in Reykjavik, as transport is the main source of emissions of greenhouse gases in the city. Work is scheduled to commence on the facility in 2010, and it is to start operating in 2012 or 2013.
- In order to set an example for the public and businesses in Reykjavik, the City administration has introduced Green Steps within its own system of workplaces and will implement the plan in 2010-2011. The City's divisions, offices and agencies can take Green Steps, which will be verified and certified. Provisions are made for four defined environmental phases, each of which includes actions in nine fields, including transport, waste production, procurement etc. The Green Steps and supporting information, guidelines etc. are now mostly completed. The presentation of the project is now in preparation, before the system is implemented. An environmental officer will be appointed within each department, who will be a contact for individual workplaces.

Long-term objectives

- By its confirmation of the Climate and Air Quality Policy on 1st of September 2009, the City of Reykjavik set its first overall objectives with respect to GHG emissions. The policy aims for a 35% reduction in net emissions of GHGs by 2020, and 75% by 2050, based on 2007 levels. Furthermore, joining the Covenant of Mayors the City is obligated to reduce GHG emissions by more than 20% by 2020.
- Public transport's share of total transport is to double over the next 30 years according to the City Climate and Air Quality Policy.
- According to Reykjavik City first Bike plan, 10 km of bike paths will be established every year for the next 10 years. The City is currently preparing the financing of the Bike Action Plan. For instance, the City has been looking into financing and support through the ELENA project. ELENA is a joint effort set up by the European Commission and the European Investment Bank to support municipalities in Europe to reduce GHG emission. The City of Reykjavik is also looking towards ELENA to renew the City's bus fleet and provide better facilities at bus stops such as bicycle parking. Estimated cost for the Reykjavik Bike Action Plan is 25 million EUR and cost for bus priority lanes is 1 million EUR until 2014.
- Due to EU and Icelandic regulation requirements, landfilling of biodegradable waste has to be reduced. According to a Waste Management Plan 2009-2020 which the City is a part of, landfilling of biodegradable waste is planned to be reduced to 50% of what was

produced in 1995, by the year 2013. Disposal of biodegradable and combustible waste in landfills is scheduled to cease not later than 2020 which is stricter than both EU and Icelandic legislation requirements. Methane will continue to be processed from the present landfill site for as long as it remains harvestable.

- The Hellisheiði geothermal power plant is one of the plants which provide Reykjavik residents with electricity and district heating. The harnessing process leads to release of CO₂-eq, and plant management aim to capture this CO₂-eq and pump it back into the basalt strata below, where it will be sequestered in the form of calcite for thousands of years. An international research programme, CarbFix, has been launched, a collaborative project of Reykjavik Energy, the University of Iceland, Columbia University in New York and the Centre National de la Recherche Scientifique in Toulouse, France.

1.4 Documents, websites and documented decisions

Decisions

- City of Reykjavik Climate and Air Quality Policy – the Future is in the Air, 2009. (ice)
- Shaping Reykjavik, Reykjavik's Local Agenda 21, 2006. (eng)
- City of Reykjavik transport policy, 2006. (ice)
- Reykjavik Bike Plan, 2010. (ice).
- Green Communities – working party on development of green districts with respect to revision of the Reykjavik Municipal Plan [draft], 2010. (ice).
- Green Steps in Transport - Travel plan: The City's strategy for environmentally friendly transport for its operations, 2009. (ice)
- Reykjavik procurement policy. (ice)
- Checklist for green procurement, 2010. (ice)
- Covenant of Mayors Adhesion Form for Reykjavik, 2010. (eng)

Documents

- Reduction in emissions of greenhouse gases – Realistic objectives in Reykjavik until 2020 and 2050, 2009. (ice)
- Estimated emissions of greenhouse gases from car traffic in Reykjavik, Summary for 1999-2007 w. comparison with 1990, 2008. (ice)
- Environmental Indicators of Major Nordic Cities – Energy Consumption and Emission of Greenhouse Gases, Inter-Nordic Big Cities Cooperation 2006. (eng)
- Technical possibilities of mitigating greenhouse gas emissions in Iceland, 2009. (ice / eng sum.)

- Estimated emission of GHG in Iceland 2008- 2012, 2008. (ice)
- Environmental Report of Reykjavik Energy, 2009. (ice / eng)
- Environmental Report of Reykjavik Energy 2008. (ice / eng)
- Environmental Report of Reykjavik Energy 2007. (ice / eng)
- Annual Report SORPA, 2008. (ice)
- Annual Report SORPA, 2007. (ice)
- Annual Report SORPA, 2006. (ice)

Websites

- Published material on Green Steps in Reykjavik: www.Reykjavik.is/desktopdefault.aspx/tabid-2229
- Reykjavik City Climate and Air Quality website: www.Reykjavik/loft.is
- Aalborg Commitments website: www.aalborgplus10.dk/
- Procura+ website: www.procuraplus.org
- Sorpa website: <http://sorpa.is/en>
- Strategic Planning for Waste Management 2009-2020: www.samlausn.is
- Reykjavik Energy website: www.or.is/English
- EcoProcura 2009 website: www.iclei-europe.org/index.php?id=ecoprocura2009
- Methane Ltd. website: <http://metan.is/user/cat/show/85/341>
- Industrial activity which is subject to authorisation and does green accounting in accordance with regulations: www.ust.is/Mengunarvarnir/Graent_Bokhald/

1.5 Disadvantages resulting from historical and/or geographical factors which may have influenced this indicator area negatively

The current economic situation in Iceland means that loans are not readily available, and this leads to uncertainty about climate measures (see appendix 7). It should also be mentioned that there is a long tradition of utilisation of sustainable green energy, which is abundant near the Reykjavik area. Fossil fuels have been relatively inexpensive, and hence there has been little incentive to economise up until this point. The City is spread out and traditionally has been aimed toward usage of private cars which is difficult to reverse, though in recent years changes in a greener direction can be seen. Moreover, the capital district is divided into several municipalities so a concerted effort is needed in order to make development go in a new direction.

2 Transportation

- 2.1 The present situation and development over the past five to ten years
- 2.2 Measures implemented over the past five to ten years aimed at reducing the total transport volume and encouraging a shift away from transport by car
- 2.3 Short and long term measures in relation to demand for travel, individual motorised transport and less environmentally damaging modes of transport
- 2.4 Documents, websites and documented decisions
- 2.5 Disadvantages resulting from historical and/or geographical factors



2.1 The present situation and development over the past five to ten years

Transportation is an important part of the City's environmental agenda. Car ownership is high, partly due to the booming economy in the past decade and also because of car dependency in a considerably spread out city, see figure 2.2.

Public transport has been difficult to plan because of the size and low density of the city. This along with the topography and weather conditions that characterise Reykjavik's northern location, have not been conducive to walking and biking as a mode of transport. In recent years, however, the trend has been towards more environmentally friendly traffic and city planning, supporting biking and walking.

The Reykjavik City Transport Plan, the first of its kind in Iceland, was approved in 2006 by the City government. Public participation projects involving Reykjavik's citizens has provided valuable information concerning how the inhabitants see their city in the future, for example as an important part of the work on the Local Agenda 21 for Reykjavik (see appendix 1).

Transportation is one of six Environmental Indicators regularly monitored by The City of Reykjavik since 2002 (see appendix 3). Car traffic effects on sound level, PM-levels, climate change and general transport habits are among the information gathered.

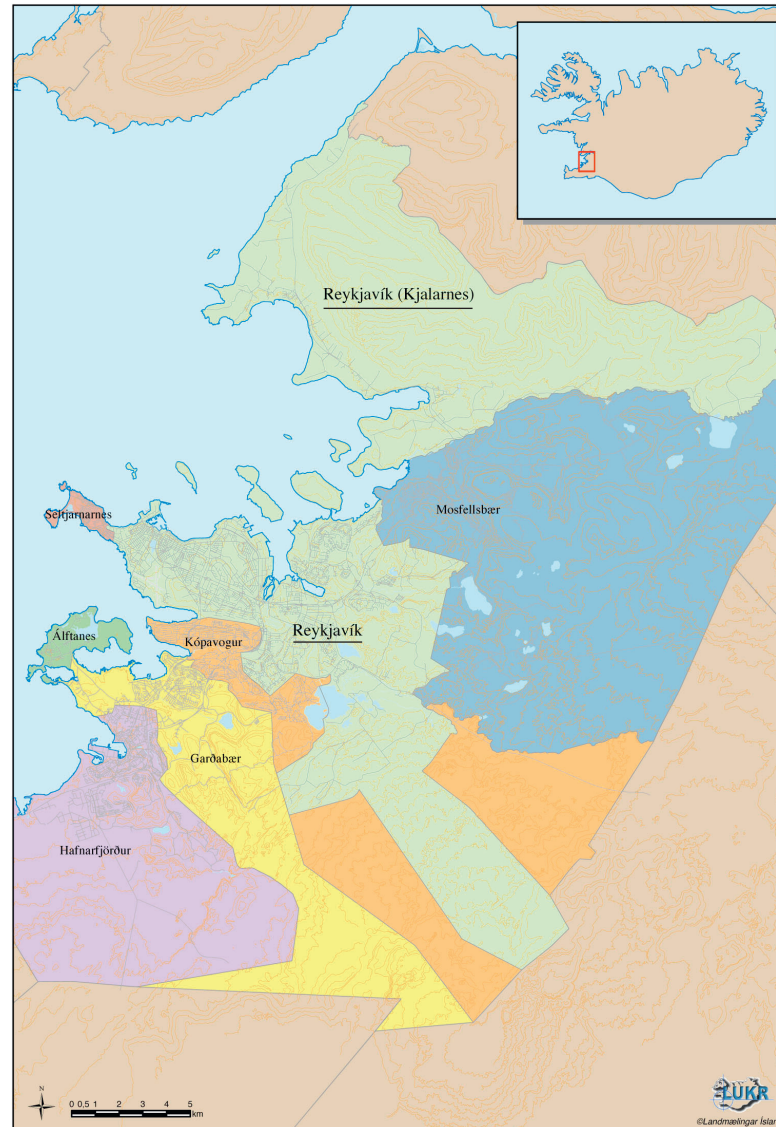


Figure 2.1
Capital area overview.

Figure 2.2
City density.



A. Length of designated cycle lanes in relation to total number of inhabitants in the city

The city's pedestrian and cycle path system amounts to approximately 74 km, 0,63 m per inhabitant (see figure 2.3). The number of citizens who travel by bicycle has increased considerably in recent years. Until now there has been minimal bicycle culture in Reykjavik as in Iceland in general. This is something the City aims to change, preferably as quickly as possible. In 2005 the city's first bicycle path (100 m) was established to give priority to cyclists and encourage people to use their bikes on more occasions. The length of designated cycle routes now amounts to 9 km and is steadily increasing. Reykjavik's cyclists are in addition to this also permitted to ride their bikes on sidewalks as well as on the city's streets. Pavements and paths available to pedestrians and cyclists in the city amount to app. 800 km.

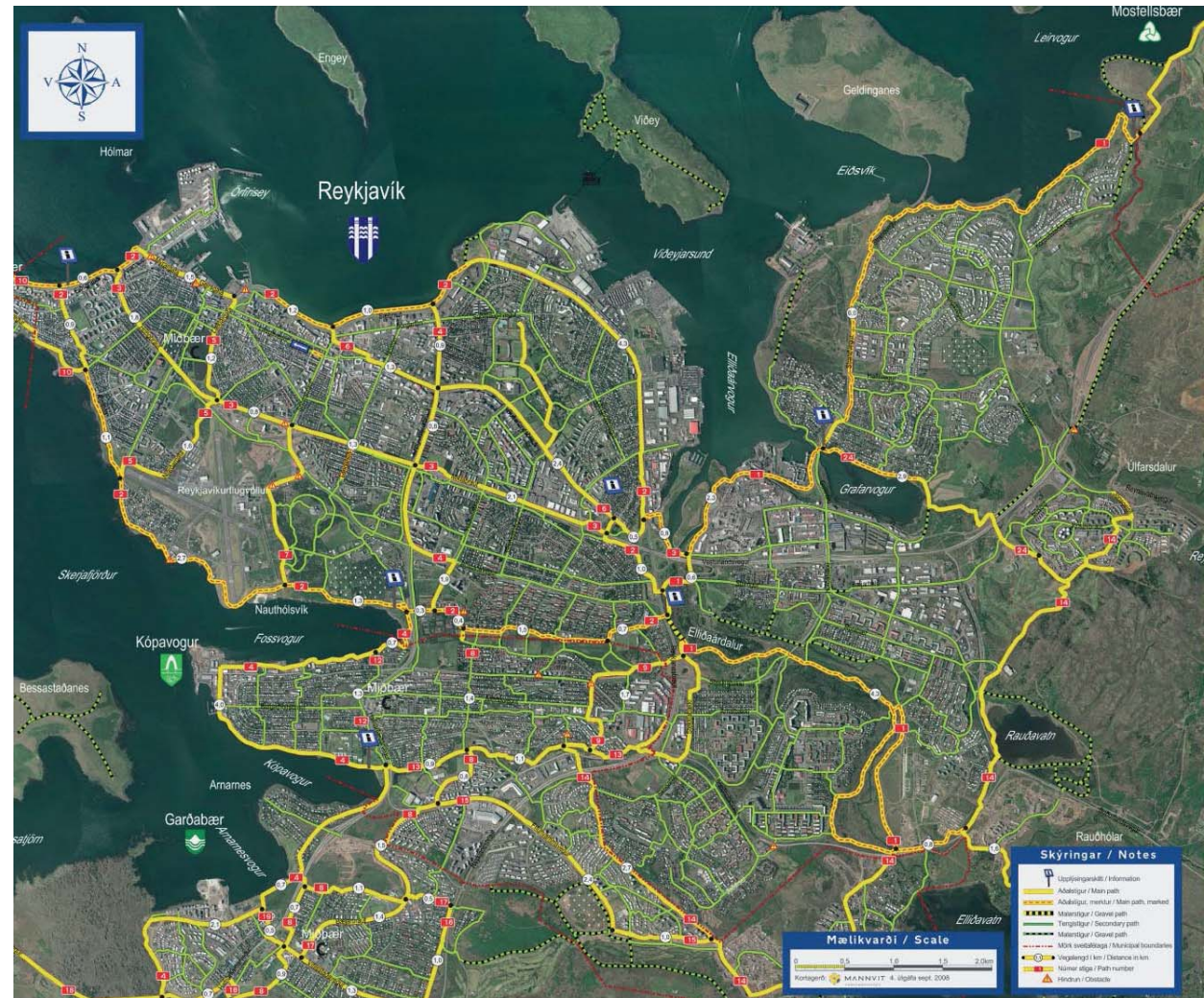


Figure 2.3
Map showing paths for bicycling and walking in Reykjavik city and the capital area.

2 Transportation

B. Share of population living within 300 metres from an hourly (or more frequent) public transport service

Currently 85% of all citizens live within 300 m of a bus stop (see figure 2.4).

The bus system is the only public transport network in the City of Reykjavik and is interconnected with the surrounding municipalities (see figure 2.5).

Figure 2.4
Map of 300 m radius at bus stops in Reykjavik.

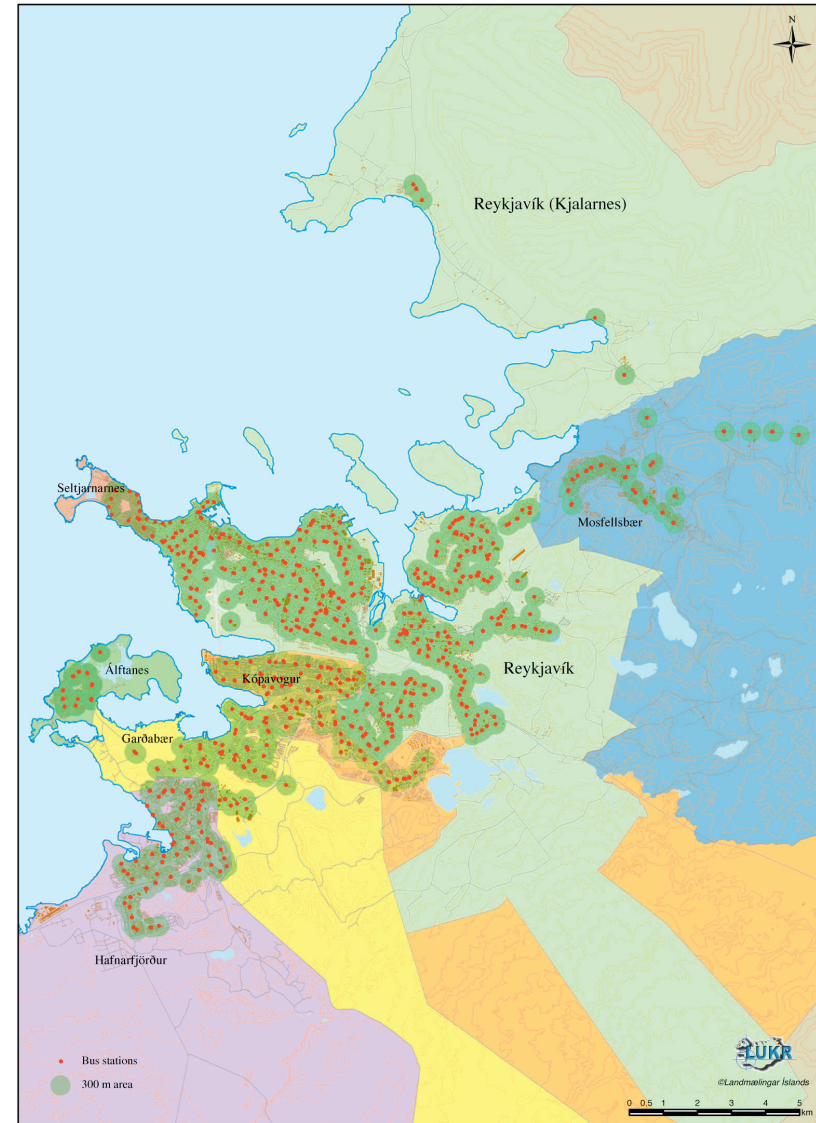
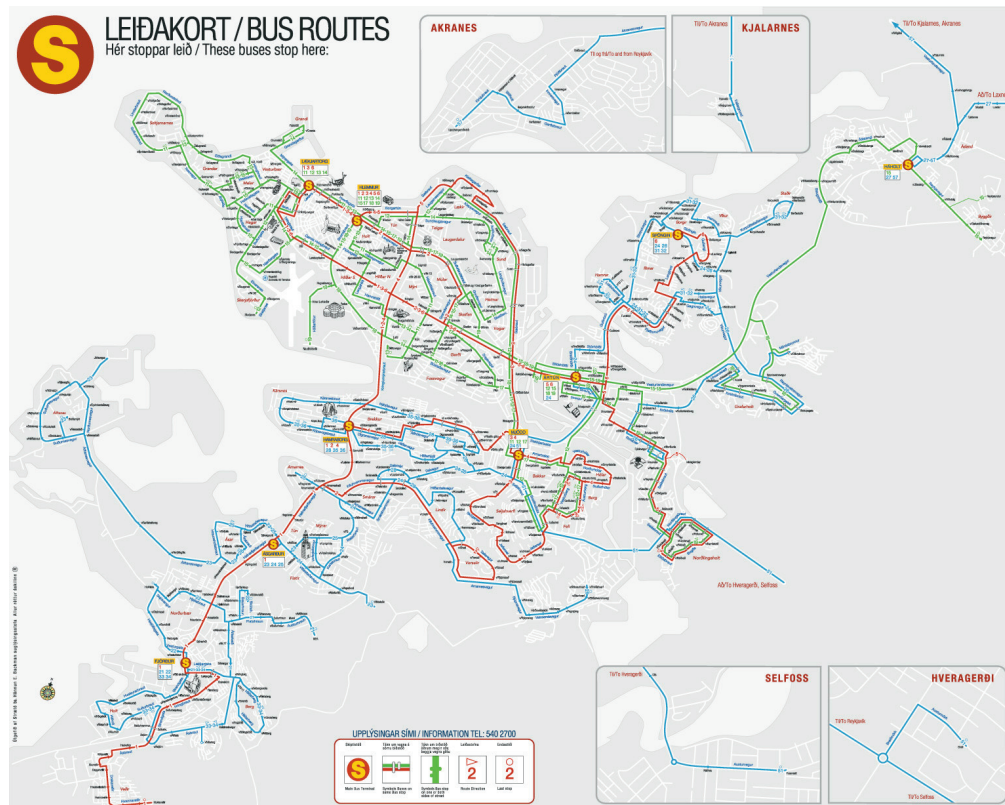


Figure 2.5
Bus route map, for the capital area.



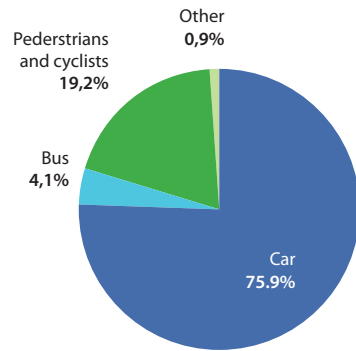


Figure 2.6
Modal split in Reykjavik.

C. Proportion of all journeys under 5 km by private car

A modal split survey carried out in 2002 showed that 76% of all private car journeys were less than 5 km long (see figure 2.6). The survey also showed that of total journeys made, just over 19% were on foot or by bicycle and 4% by bus.

Since then, travel surveys have pointed to as many as 86% of journeys being undertaken by private car. Most recently though, surveys and traffic monitoring in the city do show, however, that traffic now seems to be decreasing, with a higher average occupancy per car (see figure 2.7).

D. Proportion of public transport classed/classified as low emission

The vast majority of buses used for public transport today, or 91%, are Low Emission (LE). All new buses purchased are LE. Use of non-LE buses is rapidly decreasing, and they are now only used as back-up vehicles. About 6% share of the bus fleet is classified as EURO IV and below.

The City of Reykjavik participated in a project supported by the European commission called ECTOS, of which the objective was to implement a demonstration of state-of-the-art hydrogen technology by running part of the public transport system with fuel cell buses within Reykjavik. Domestic geothermal and hydro-powered energy sources were used to produce hydrogen at an electrolytic hydrogen station in the city. The project was without a doubt valuable for future technological development concerning hydrogen and fuel cell technology. Some biomethane buses are a part of the bus fleet, running on fuel produced from local household waste. The aim of Reykjavik City's Climate and Air Quality Policy is that all buses will be fuelled with domestically-produced energy such as methane or electricity. Public transport will thus be powered using sustainable means in the future. Reykjavik City's bus drivers have participated in eco-driving courses to minimize the environmental impact of the public transport system.

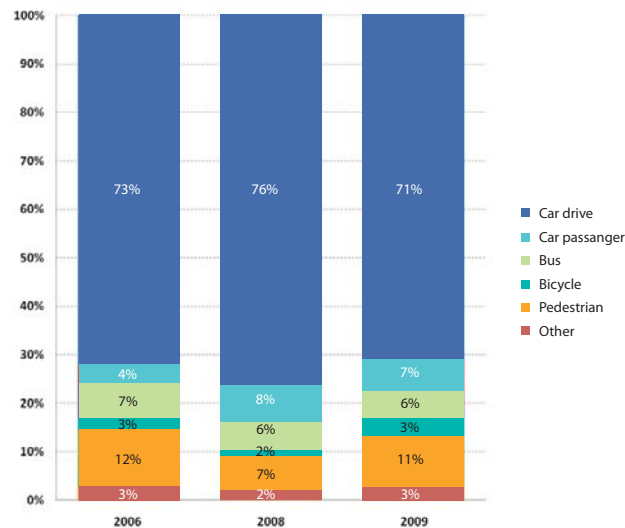


Figure 2.7
Travel journeys development since 2005.

2.2 Measures implemented over the past five to ten years aimed at reducing the total transport volume and encouraging a shift away from transport by car

Reykjavik City's environmental indicators provide useful information regarding challenges faced in the city. These indicators form a basis for an action plan called Green Steps for Reykjavik which is upgraded annually in coherence with the gathered data.

The city has taken a variety of approaches reducing traffic load and to encourage greener and healthier transport habits. Densification of inhabited areas is one of the most important elements in the reduction of traffic. The City Council has over the last 10 years placed emphasis on densification of the city's built-up areas as well as on expanding residential areas in the city centre. At the same time efforts are being made to develop suburban centres and to improve levels of service within the suburban areas. These priorities are stated in the current Reykjavik Municipal Plan. A number of measures to achieve more sustainable transport have been implemented, as outlined in Local Agenda 21 for the City of Reykjavik, Reykjavik Bike Plan, Reykjavik Transport Policy and other City documents. These include:

Improved public transport

- Bus priority lanes have been introduced at points of greatest congestion and buses now have priority at junctions. Bus routes based on a bus rapid transit model have also been introduced in order to shorten

travelling time. In winter bus routes have priority for snow and ice clearance. Bus stops have also been given names in order to improve service and make it easier for people to navigate the network.

- Bus fares have been subsidised, particularly for students in secondary-schools and universities, who have for two years enjoyed free bus travel. During the first year of the project the number of bus passengers increased by 1 million users, from 4% to 5%.
- In January 2010 the City government decided to invest money in an experimental project involving "Hobby-buses". This project has been a success in various neighbourhoods where for example local sports clubs have had the opportunity to organise bus trips to better combine school and leisure for children.

Encouraging walking and cycling

- There has been a major campaign to develop an intensive network of paths for pedestrian and bicyclists, both by extension and improvement. Currently pavements and paths available to these groups in the city amount to 800 km. In recent years the emphasis has moved to improving and augmenting designated bicycle paths to encourage greater use of bicycles in the city. The main cycle routes have the same level of maintenance as the road network. The first Icelandic bike plan was introduced for Reykjavik in January 2010, focusing on new standards and routes to be carried out in the near future. According to the plan, bike paths will be quintupled in the next 5 years and increased by tenfold in the next 10 years. A bicycle route

map has been published annually since 2005 and distributed free of charge and in cooperation with local bicycle associations. There has been active collaboration with the city's most prominent cycling organisations on the development of the Reykjavik city bike plan as well as on measures to increase the profile of cycling as a mode of transport. The City puts emphasis on involving users of the proposed or actual infrastructures in the design process to obtain the best possible results. Members of local cyclist federations have provided constructive criticism to city officials at meetings as well as via email and telephone.

- Walking routes for pupils in elementary schools have been mapped as a part of a special campaign to enhance traffic safety in these areas. Mapping is done electronically, with pupils drawing the routes in collaboration with their teachers and parents and marking the walking routes with potential hazards. The data will be used to enhance accessibility for children and thus increase the likelihood of biking and walking as a mode of transport to school.
- In recent years there has been a systematic effort to encourage people to adopt alternative modes of transport to the private car via promotional campaigns. Such encouragement has inter alia been directed at persuading adults to bike or walk to work and children and young people to walk to school. Reykjavik City supports the We Cycle to Work campaign which is organized by The Icelandic Olympic and Sports Association every year. The support is financial, organizational and through active participation. Each year the campaign in Iceland grows

gradually with more and more teams participating and currently has the highest participatory numbers in northern Europe. That shows how the atmosphere is changing towards greener traffic modes. It also demonstrates the opportunities the City of Reykjavik has to affect people's travel behaviour. The City has participated in The European Mobility Week for the last 7 years. A program promoting alternative transport modes is organized which also puts an effort into encouraging the surrounding municipalities to get involved. Bus days, family bicycle trips and green energy conferences are among the events organized during the week in September each year. The 15 minute map is one of the successful projects promoted during the European mobility week (see figure 2.8).

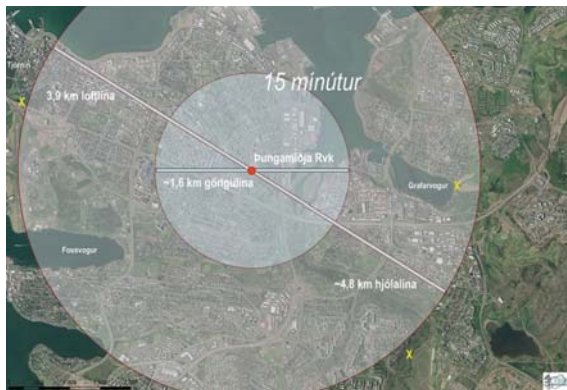


Figure 2.8.

A 15 minute map, showing the distance an average bicyclist can travel in Reykjavik city in 15 minutes.

Enhancing traffic flow

- Reykjavik's traffic-lights system is now partially controlled by a Green wave system, which reduces traffic speed and tailbacks at traffic lights, and thus reduces exhaust emissions. Recently it was accepted by the City government that pedestrians should nevertheless have priority at junctions on the expense of the system for cars to further encourage these modes of transport.
- Reduction of private car use near schools. Co-operation between schools and after-school programmes has been established, to reduce the need for children to travel between school and after-school activities. Green Travel plans were adopted in primary schools in 2009 encouraging parents not to drive their children to school.
- Woonerfs in the Reykjavik city centre have been increased to give pedestrians and cyclists better accessibility. In recent years effort has been made to increase the number of woonerfs in the city centre with a speed limit of 15 km/h and a bias towards pedestrian traffic. The 30 km/h areas are still being augmented, particularly in the vicinity of schools and the City government has recently accepted a plan to further slow down traffic in residential areas.

2.3 Short and long term measures in relation to demand for travel, individual motorised transport and less environmentally damaging modes of transport

Short term measures

Each year the City of Reykjavik sets out objectives for transport in Green Steps in Reykjavik, an action plan based on its environmental policies and an annual Environmental Indicator report.

Following are a few of the objectives on the city's agenda in the near future:

- A decision has been made by the city to establish a group to plan for the change-over to electric vehicles.
- The City of Reykjavik has committed to offering its employees the option of a transport allowance instead of, as previously, a motoring allowance. Employees undertake, in return, to travel to and from work by various means without using a private car.
- City employees with flexible working hours will be encouraged to travel to work outside rush hour in order to reduce peak-time traffic in the city.
- Reykjavik will ensure good facilities for employees and clients who walk or cycle. Particular attention will be paid to access to workplaces. The intention is to provide shower facilities wherever possible. A Green Travel Plan for the City administration has been agreed and this will be conducive to improving the travel habits of the City's employees.

2 Transportation

- Bicycles and environmentally friendly vehicles will be available for as many as possible of the City's employees for work-related journeys.
- Estimated cost for the Reykjavik Bike Action Plan is 25 million EUR until 2014.
- Estimated cost for bus priority lanes is 1 million EUR until 2014.

Long term measures

A. Reduction of overall demand for transport

ICT Projects

Internet access is very common in Reykjavik households as in all of Iceland. On November 27th 2009 the City of Reykjavik, along with 13 other large European cities, signed the Eurocities Green Digital Charter. The initiative is intended to minimize use of paper and car use at the city level. The city agreed to:

- Deploy five large-scale ICT pilot projects before 2015;
- Decrease ICT's direct carbon footprint by 30% by 2020; and
- Create a partnership of cities on ICT & Energy Efficiency to work until 2011.

The current Reykjavik Municipal Plan aims for densification and mixed-use development of built-up areas. A new Municipal Plan, which is intended to be adopted in 2010, emphasises these issues even further. The strategy of densifying built-up areas and enhancing services in suburban areas will shorten people's routes to and from work and encourage eco-friendly modes of transport such as walking and biking. In the City's Local Agenda

21 and in Reykjavik's Transport Policy the objectives are to reduce the number of private car journeys, provide a better and healthier city for the inhabitants and improve the environment. The time plan for implementing the Transport Policy is 20 years and its objectives include:

- Securing efficient transport while preserving precious assets such as the environment, health and city character.
- Providing for diverse travel needs for all without discrimination.
- Promoting full use of the city's transport systems.

The City's environmental policies also form the basis for future vision in transportation, and target a reduction in private car use. Larger businesses are collaborating in pursuit of this target. The City has accepted a green travel plan for its administration and institutions and is leading by example and encouraging local companies to do the same (see figure 2.9). Transport subsidiaries are taking over from gasoline subsidiaries and the City's institutions are to have parking meters installed. Pool bikes are available for City employees as well as showers and changing rooms at City offices.

Figure 2.9
The Reykjavik City Travel Plan.



B. Reduction of individual motorised transport

Walking and cycling

At schools the emphasis is on children learning to find safe routes to school and that they are not driven to and from school, the cost of this will be 31.000 EUR in 2010. It will also be prioritized to introduce Green Travel Strategies in more of the City's primary/lower-secondary schools.

Increasing the number of cycle paths and improving facilities for cyclists will reduce private car use in the city (see figure 2.10). Reykjavik's first bicycle plan, Reykjavik Bike City, was approved by the City Council in January 2010.

To fulfill the plans of establishing 10 km of bike paths every year for the next 10 years. Decision regarding financing will taken annually as a part of the City's annual Budget. Also, the City has been looking into financing and support through the ELENA project. ELENA is a joint effort set up by the European Commission and the European Investment Bank to support municipalities in Europe to GHG emission (see figure 2.11). This will also be intended to renew the City's bus fleet and provide better facilities at bus stops such as bicycle parking.



Figure 2.10
A map of the planned Reykjavik bicycle network. The blue lines represent the secondary paths interconnecting the neighbourhoods and the red show primary paths throughout the city to be established in co-operation with the regional road administration.



Figure 2.11
A 3 year plan for the implementation of increased bicycle network in the city.

Car pooling

The City government has declared that on a particular road that runs towards Reykjavik University, car pooling will be obligatory and solo drivers must take alternative routes to the University.

C. Promotion of less environmentally damaging modes of transport

Green policies

Reykjavik's Local Agenda 21, the Transport Policy and the Green Travel plan for the City's administration all aim towards improving the health of the public, enhancing the environment, improving the city character and, by densification of built-up areas, enabling more people to walk or cycle to work or school. The recently approved Bike Plan for Reykjavik will aim to promote this mode of travel by enhancing the path network as well as general accessibility within the city. The plan is to create 90 km of cycle paths in the next 10 years. The Reykjavik Climate and Air Quality Policy declares the intention to reduce emissions of greenhouse gases from transportation in Reykjavik and to minimise its effect on air quality. The following objectives are also defined:

- Increased use of eco-friendly transport choices to be favoured and journey requirements of Reykjavik's residents and employees to be reduced.
- Use of non-motorised modes of travel to be increased, with a target of 30% for the proportion of cyclists and pedestrians by 2020.
- Proportion of public transport to double in the next 20 years.

- Pollution from road surface erosion to be reduced, inter alia by cutting the use of studded tyres to less than 20% of all vehicles by 2012.
- Introduction of environmentally friendly energy sources to be encouraged, along with an increase in numbers of eco-friendly vehicles.
- Negative environmental impact to be reduced with good design and technical solutions.
- Priority to be given to utilisation of energy from waste products such as methane in transport for Reykjavik.

Alternative energy solutions

The City has appointed a working group that has the task of preparing for the change-over to electric vehicles in the city. There are prime conditions in the city for citizens to be able to change over to electric vehicles and this is something on which the city wants to place emphasis. Methane is and will continue to be collected from the capital area's landfill sites and will increasingly be utilised in future both for private cars and for City buses. Most of the City's refuse collection vehicles are now methane-fuelled along with some of the operating buses. Recently 10 hydrogen-powered cars were imported for experimental use in the city. For some years the City has purchased eco-friendly service vehicles for use by its employees. This policy will be continued, with the existing fleet gradually being replaced with more eco-friendly vehicles.

Complimenting eco-friendly vehicles

On-street parking in the city is free for 90 minutes for eco-friendly vehicles, defined as having a CO₂ emission rate not exceeding 120 g/km and fuel consumption not exceeding 5,0 L/100 km for petrol vehicles and 4,5 L/100 km for diesel. Alternative energy sources such as biomethane, hydrogen etc. also qualify for free parking given the fact that they also fulfil the criteria for emission. As Reykjavik is extremely well suited for electric cars, with abundance of green electricity being produced with hydropower and geothermally, power outlets have been installed at roadsides as well as in multi-storey car parks for electric vehicles.

Petrol stations

A policy has been formulated for petrol stations in the city, proposing to counteract the rise in numbers of stations, and requiring all new petrol stations to offer alternatives to fossil fuel. In May 2009 the policy was accepted by the City government after consulting the local fuel companies and sharing a mutual interest with them to aim for more sustainable fuel consumption in the city.

2.4 Documents, websites and documented decisions

Decisions

- Shaping Reykjavik, Reykjavik's Local Agenda 21, 2006. (eng)
- Reykjavik Transport Policy, Environment, health and city character are the values the City sets for itself when planning transport according to the policy, 2006. (ice)
- The City of Reykjavik Climate and Air Quality Policy, 2009. (ice)
- Reykjavik Transport Plan – Analysis of status quo and direction, 2006. (ice)
- Green Steps in Transport, Travel plan, The City's strategy for environmentally friendly transport for work related business, 2009. (ice)
- Plans for alternative fuel stations in Reykjavik, Plan for Reykjavik to implement fuel stations in line with increased numbers of vehicles fuelled by environmentally friendly fuel, 2009. (ice)
- The Reykjavik Bike Plan, Plan for improved access for cyclists in the city, 2010. (ice)
- The Reykjavik Bike Action plan, 2010. (ice)
- Municipal Plan 2024: The existing Municipal Plan 2001-2024 is currently under revision and a new Plan is expected to be agreed this year. (ice)

Documents

- Environmental indicators in Reykjavik, 2008. (ice)

Websites

- 15 minute bike map: desktopdefault.aspx/tabid-2293
- Reykjavik Parking Service: www.reykjavik.is/desktopdefault.aspx/tabid-2225/
- Reykjavik City Climate and Air Quality website: www.reykjavik/loft.is
- Strætó bs. Public transport: www.straeto.is
- Methane Ltd. website: <http://metan.is/user/cat/show/85/341>
- The city's pedestrian and cycle path system: Portaldata/1/Resources/umhverfissvid/myndir/skyrlsur/Hj_lrei_akort_2008-small.pdf

2.5 Disadvantages resulting from historical and/or geographical factors which may have influenced this indicator area negatively

Reykjavik as a city is relatively young and grew rapidly from the sixties along with increase in general car ownership. At the time local pollution, global warming and other effects of automobile dependency were not of common knowledge. Municipal plans from that time are obviously focused on providing space for cars and giving all the people in Reykjavik the possibility to drive their cars to work and park without a charge outside



Figure 2.12

Bicycle routes designed to avoid hills in Reykjavik city.

their places of business. Citizens in Reykjavik therefore are used to being able to drive their cars without running into congestion and finding a parking space tends not to be a problem. Of course this has also resulted in suburban sprawl which again boosts car ownership. The sprawl in Reykjavik has also partly been related to suitable building areas in the city. Marsh land and other areas with deep soil were left out which has created gaps in the urban fabric, although some of these areas have later been developed. Following the economic boom in the beginning of the 20th century, car ownership in Reykjavik reached record heights and is now among the highest in the world.

3 Green Urban Areas

- 3.1 Percentage of green and water areas
- 3.2 The present situation and the development over the past five to ten years
- 3.3 Measures implemented over the past five to ten years aimed at increasing the size and quality of green urban areas
- 3.4 Short and long term measures for the establishment and management of green urban areas
- 3.5 Documents, websites and documented decisions
- 3.6 Disadvantages resulting from historical and/or geographical factors



3.1 Percentage of green and water areas

Public open space in relation to built up areas within the city boundaries

The capital area consists of seven municipalities (200.000 inhabitants) of which the population of Reykjavik is 120.000 inhabitants. The city was largely developed in the latter half of the 20th century and is characterised by low density, segregation of land use and large open areas that run through the city along valleys, and the seashore complimenting the natural topography of the city. These areas are used for recreational activities and are popular for their natural appeal and salmon rivers. The total area of Reykjavik City is 273 km², of which approximately 18% is built area (urban and suburban) extending over an area of 51 km². The rest, or 222 km², consists of agricultural land (12%), natural areas such as heath lands, lava fields and mountains (46%), the Green Scarf Reykjavik hinderland and other nature conservation areas (21%), water areas, i.e. lakes and rivers (1%), and islands (2%) (see figure 3.1).

About 62% of the urban fabric is residential and commercial, 28% public green open spaces and water areas, 10% is dedicated to the airport, and highway rights of way.

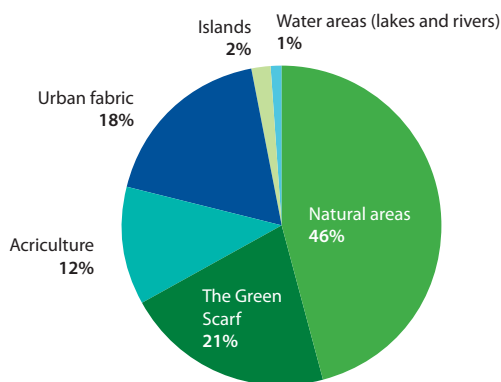


Figure 3.1
The percentage of green and water areas in relation to the overall area of Reykjavik. The inland sea or "Sundin" is not included in these figures.

A study from 2004 indicates that transportation areas comprise about 37% of the total built up area in Reykjavik, residential and commercial areas 30%, and open green areas 33%. It should be noted that the proportion of green areas would increase considerably if private gardens were also included due to the low density development pattern. The proportion of green areas within the city boundaries has been relatively constant over the past 5 to 10 years.

Urban boundaries and the Green Scarf

One of the main emphases of the 2003 Regional Plan for the capital area was to establish urban boundaries for the municipalities in the area, in order to slow down urban sprawl and increase the density of urban development. The urban boundaries of Reykjavik are drawn along the boundaries of the Green Scarf and will thus mark the limit of urban growth to the east of Reykjavik in the future, extending the total urban and suburban land cover in Reykjavik from 51 km² to approximately 63 km² or 23% of the city's total area. The Green Scarf is a nature conservation area and is visited by some 500.000 people every year. It consists of extensive cultivated woods and lava fields.

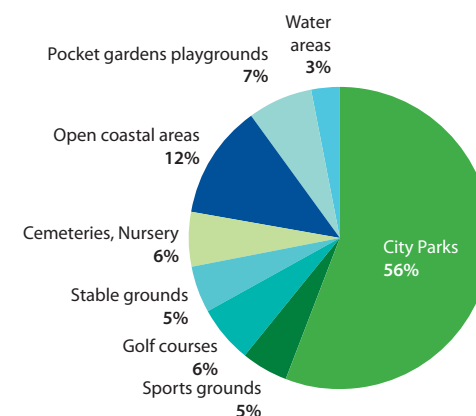


Figure 3.2
The subdivision of public open areas within the city boundaries. Public streets and squares are excluded.

C. The Green Structure Plan

The Green Structure Plan (GSP) originated as a planning strategy for open spaces within the city boundaries as a part of the 1996 Municipal Plan for Reykjavik and it is still valid to this date. The plan's aim is to form a continuous Greenway system extending from the Green Scarf to the seashore linking every major recreational area within the city. The Greenway system is linked throughout with a system of pedestrian paths and cycle routes. The GSP covers a diverse mix of open spaces, from public squares and streets to urban parks and natural areas (see figure 3.2).

The planning principle of the GSP is to ensure that the proportion of public open spaces in relation to the urban fabric is constantly maintained as the city extends and grows towards the Green Scarf. Currently, 28% or 14.3 km² of the total land use area within the urban fabric consists of recreational and other urban green areas which are open to the public. The GSP also aims to establish a balance between recreational use and protection of natural habitats and other natural features within the built-up area (see figure 3.3).

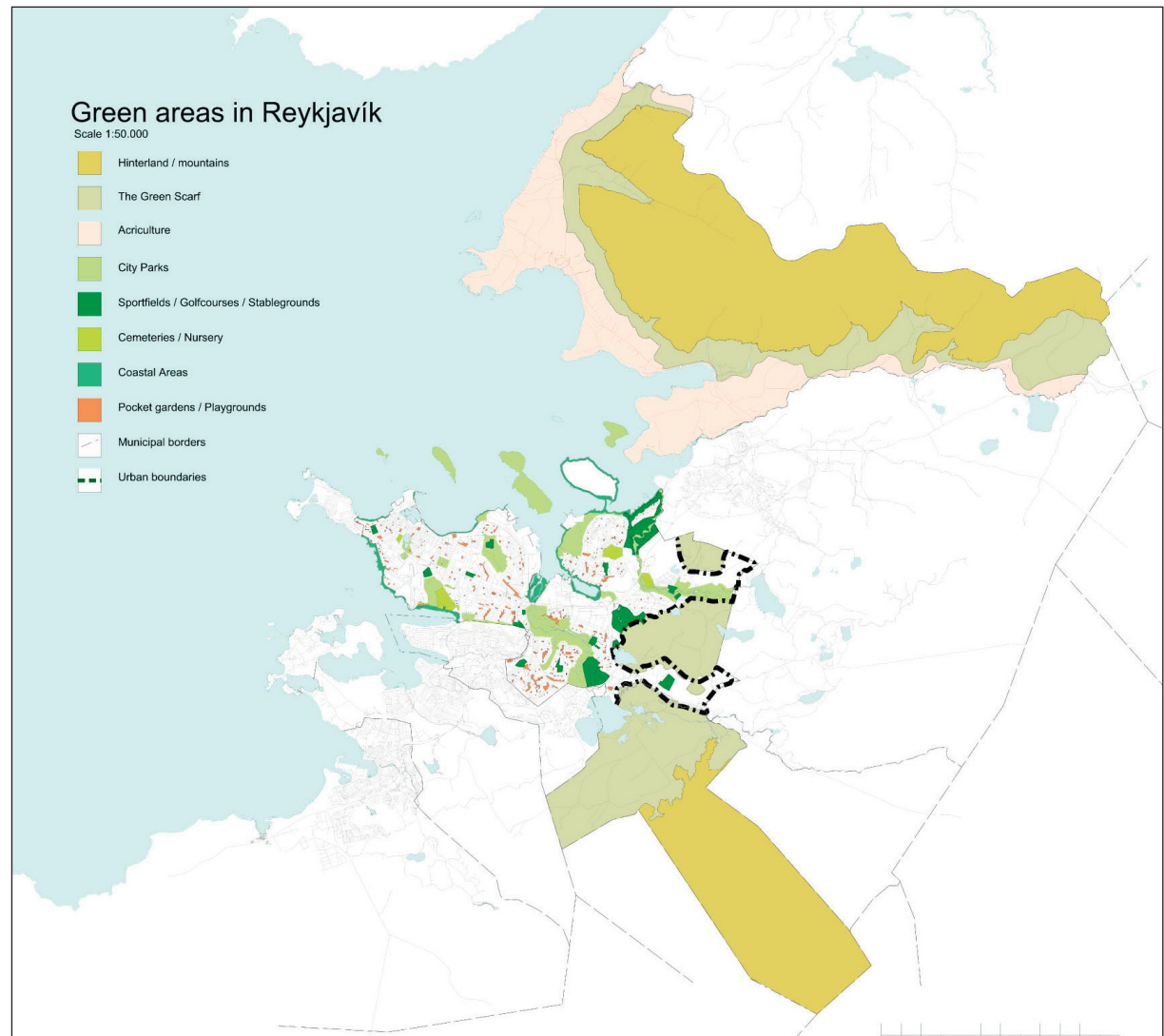


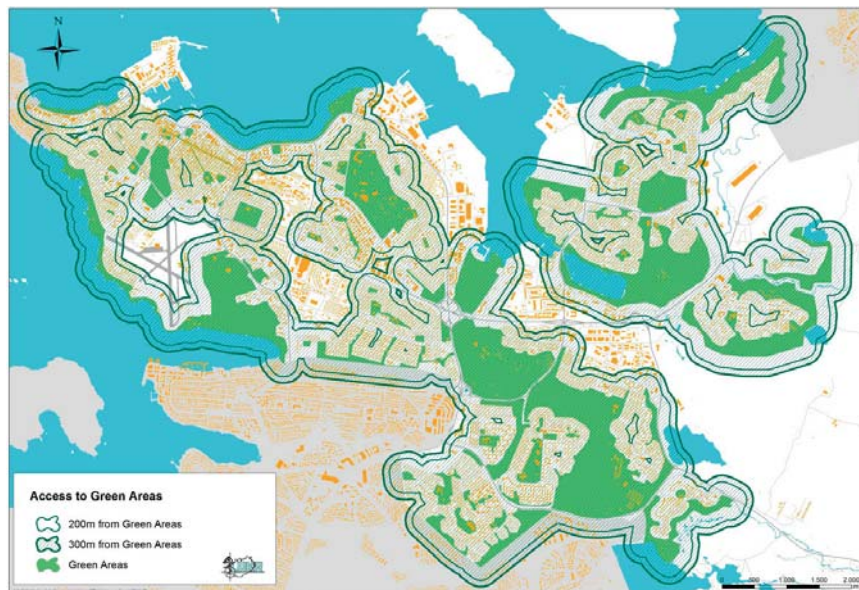
Figure 3.3
A map indicating; the proportion of area located within the inner city or on city boundaries, the distribution across the city, size of areas and fragmentation.

3.2 The present situation and the development over the past five to ten years

A. Percentage of citizens living within 300 m of public green urban areas

About a third of the built-up area of the city is designated as recreational areas (see figure 3.4). In 2007, 92% of inhabitants lived within 300 m, or around 5 minutes walking distance, from recreational areas or other areas of recreational status such as squares, churchyards or other public open spaces larger than 2.000 m². In 2009 the map was updated, resulting in the similar figure of 91,7%.

Figure 3.4
Access to green areas.



B. Total number of square metres of green urban areas per capita

The number is 120 m².

C. Public green urban areas per capita

The number is 270 m².

D. Development of other green elements

- Green Steps in Reykjavik 2007 (see appendix 2) scheduled the planting of 500.000 trees within Reykjavik over the next four years as part of the objective of improving air quality in the city. A total of 40.000 trees were planted in the Green Scarf in 2007, 160.000 in 2008 and 80.000 in 2009.

- Each year around 20.000 trees and shrubs are planted within the urban area, providing greenery in both new and renovated recreational and residential areas, and on the periphery of inhabited areas along roads. Various species are planted and the planted areas consist of border and undergrowth species, with a view to the plants being self-sustaining. The choice of plants was made in light of the seasons, with berry bushes and perennial flowering plants being planted to attract birds.
- City residents have good access to a diverse range of natural and recreational areas. Green areas permeate built up areas, from the coast up to the heath lands. In recent years, access to these areas has been improved and they have been connected with footpaths and the building of footbridges and tunnels.



Figure 3.5
Öskjuhlíð is a popular woodland on the periphery of the city centre. It is accessible by a 10 km long footpath, which never crosses any roads, and which passes through the recreational areas of Fossvogsdalur, Elliðaárdalur and Heiðmörk. Elliðaárdalur is a popular recreational area consisting of a forested valley and a salmon fishing river and Heiðmörk is a natural forested area within the Green Scarf.

3 Green Urban Areas



Figure 3.6
The Green Scarf (green) with the path (yellow).



Figure 3.7
The city mountain, Esja. The City authorities, together with various organizations, have worked to improve the most popular walking route onto the mountain. The mountain is also accessible via bus routes, ca. 10 km from urban areas.

- The Green Scarf is a co-operative venture of the local authorities in the capital area, in collaboration with forestry bodies in the area. The aim is to create a continuous forest and recreational zone on the outskirts of the local authority areas (see figure 3.6). The Green Scarf was established in the Regional Plan for the capital area in 2001. In 2006 a working party set up by the local authorities and forestry associations delivered a report on the Green Scarf to the Organisation of Local Authorities in the Capital Area; its recommendation was to create a continuous path through the area from north to south, linking the main access points to the Green Scarf. Work has commenced on incorporating the path into the Reykjavik Municipal Plan.
- Mount Esja (914 m) dominates the city skyline and is largely located within the city limits. A lot of people walk onto the mountain every week, pretty much all year round. The Úlfarsfell mountain (280 m), located on the edge of the city, is also visited by ramblers.
- The city has ca. 250 recreational areas and the planning scheme outlines that recreational areas be located within 300 m of residential areas. The areas are for play and recreation and represent breathing spaces within the city. Increased emphasis is placed on the areas being a meeting place for local inhabitants, as well as being recreational areas. This applies both for new areas and older renovated areas, with there having been a concerted effort to renovate older areas in the older city districts (see figure 3.9).



Figure 3.8
Baking a sand cake.

- The largest recreational areas contain museum areas, offering a wider range of recreational activity. Árbæjarsafn museum holds a collection of old buildings and artefacts from Reykjavik and is located in Elliðaárdalur. Árbæjarsafn museum is centred on an old farm and old buildings from the city have been transferred to the museum, with the last building having been transferred in 2005. The Reykjavik Zoo and Family Park in Laugardalur contains a collection of wild Icelandic animal species and domestic farm animals, as well as offering a family garden with numerous family rides. Science World was opened in the park in 2002 and the Aquarium was opened in 2004. Laugardalur also contains the Reykjavik Botanical Gardens and the Ásmundarsafn museum, which contains a museum and sculpture garden containing works by the artist Ásmundur Sveinsson.
- The city of Reykjavik has leased kitchen gardens for several decades, Garden areas have been increased both within and outside the city and an agreement

3 Green Urban Areas

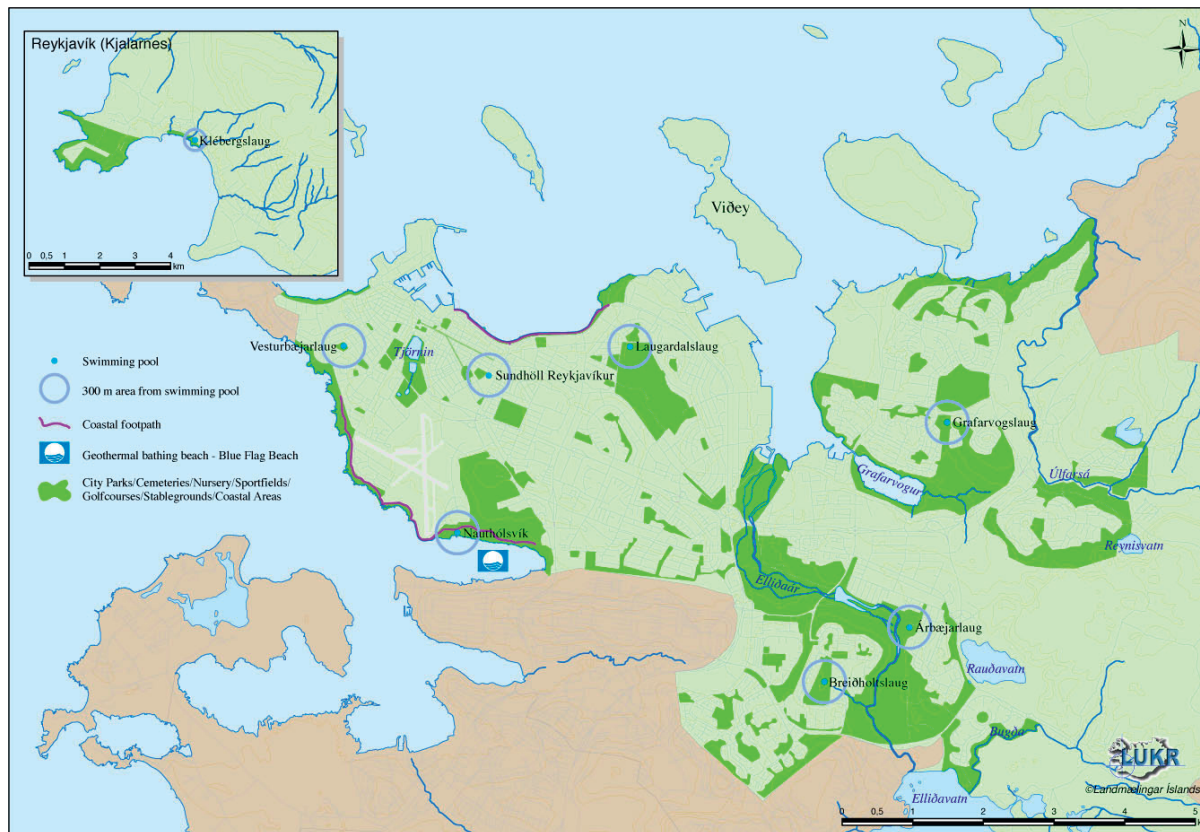


Figure 3.11
Blue map of Reykjavik, swimming pools and green areas in Reykjavik.

- Most swimming pools in Reykjavik are outdoors and located within or next to major recreational areas. City residents use the swimming pools on a regular basis to maintain their health, even daily. In good weather the pools are full of city residents of all ages, particularly families, enjoying outdoor life in the pools. Tourists also frequent the pools, especially as they are open all year round and even in the evenings.

- In the last 10 years, many of the large roads in the city centre have been renovated, with an increase in pedestrian areas and the planting of trees.
- Lækjartorg is one of the oldest city squares and, for a long time, was used as a meeting point for large meetings, although it has not been used much recently. Conditions in the square were improved last year, when the number of benches and flowerpots were increased and a green area placed in the square centre.



Figure 3.12
Despite the cold weather, it is pleasant to take a swim in a heated pool and relax in a hot pot, even in the most recent addition - heated seawater.



Figure 3.13
Laugavegur. The number of trees on the city centre streets number ca. 320, with most of them having been planted in the last 10 years.



Figure 3.14
Improvements being made to Lækjartorg square.

3.3 Measures implemented over the past five to ten years aimed at increasing the size and quality of green urban areas

Recreational areas and planning

- In recent years, rest-points have been put in place with benches and a map showing the main pedestrian and cycle routes. Drinking fountains have been placed in 7 locations along these routes.



Figure 3.15
A drinking fountain in Fossvogsdalur. There are plans to add two fountains every year.

- In 2007 a review of the Miklatún recreational area was carried out. A working party drew up a specification in consultation with the residents' association and district councils. A public meeting was called in 2009 in order to canvass ideas. A plan was subsequently drafted taking into account views expressed at the public meeting, along with other proposals. The plan will be implemented in stages over the next few years.
- Viðey is an island around 1,6 km² in size just off Reykjavík's northern shore. It is a natural treasure rich in cultural relics, and home to works by artists such as Richard Serra. Viðey is a few minutes sailing from

the mainland, and regular boat trips are available. Viðey is a popular place to visit, not least for school trips. In recent years footpaths have been laid around the island and information boards erected. On October 2007, a tower of light was lit in the Imagine Peace Tower, a work of art by Yoko Ono. The work was dedicated to the memory of John Lennon on what would have been his 67th birthday. The Mayor of Reykjavík and artist Yoko Ono attended a special opening ceremony with other guests. Electrical power for the light is generated by geothermal heat.

- The Reykjavík Botanical Garden's mission is to preserve plant collections and pursue education and research in the field of botany, garden design and horticulture. The Botanical Garden is also a popular recreational area. Work has been carried out to enlarge the garden, which will expand by 2,2 ha in the coming years.
- A review of the Reykjavík Municipal Plan is under way and includes a proposal for overall planning of open spaces. To canvass as wide a spectrum of opinion as possible, a brainstorming session was held with a variety of stakeholders and organisations with a concern for recreational areas. The messages and conclusions of the session were presented at a public meeting where lectures on outdoor recreation were also given and the issues discussed afterwards.
- A strategy for rivers and lakes was approved in the Executive City Council in 2001 with the aim of ensuring preservation of the natural resources of the water catchment areas and appropriate use of their environment. Among its proposals were: a 100 m



Figure 3.16
The Imagine Peace Tower in Viðey.



Figure 3.17
Education at the Reykjavík Botanical Garden.

no-build zone surrounding water catchment areas; classification and monitoring of catchment areas in respect of anti-pollution regulations; research to be carried out and action plans established for all such areas. All the water catchment areas have now been examined and classified and are subject to monitoring by the city's Public Health Inspectorate. Planning of new suburban localities has taken into account the 100 m no-build zone.

- Surveys have been carried out to establish how many visitors attend some of the city's principal recreational areas. Visitors have been asked about the purpose of their visit and asked for suggestions. These questionnaires provide useful information on which to base decisions about improving the quality of the areas.
- A detailed land-use plan has been made for a recreational area in Úlfarsdalur, on the outskirts of the city, based on assessment of its natural features and heritage sites. The local development plan for Heiðmörk is near completion, and it has been composed using the same methodology.

Educational projects

- Lessons from the Forest and Reykjavik Nature School are projects aimed at increasing awareness and use of the city's recreational areas by children in elementary school and playschool. The Lessons from the Forest is an interdisciplinary school developmental project that aims to utilise the forest for experience and teaching. The Nature School project integrates outdoor teaching and environmental education (see appendix 5 and figure 3.18).
- The Reykjavik Municipal Work School (RMWS) provides young people aged 14-16 with summer holiday jobs (see appendix 4). All young people are

eligible, and around 70% of young people register with the school. In its educational work the school aims to improve gardening know-how in order to optimise the maintenance of green areas. Supervisors with horticultural qualifications oversee the work and environmental training of pupils and fellow employees. The RMWS is an eco-school, which last year was awarded the Green Flag in acknowledgment of its excellent achievements in environmental matters and education.

Monitoring

- Water quality, access to recreational areas and the size of protected areas have been monitored via the Environmental Indicators of Reykjavik project since 2003 (see appendix 3). The results of this monitoring help form the yearly action plan for environmental issues, the Green Steps of Reykjavik.
- A consultative group was formed in 2002 dealing with the Elliðaár river, with the principal aim of keeping the river as clean and pollution-free as is possible in a city environment, and with a view to sustaining vigorous fish stocks. The group concentrated inter alia on ensuring that the management of water-flow in the river for the purposes of hydro-electric power was better adapted to the ecosystem of the river, and sediment ponds were built. They also monitor the fish population, and make proposals for catch limitations.

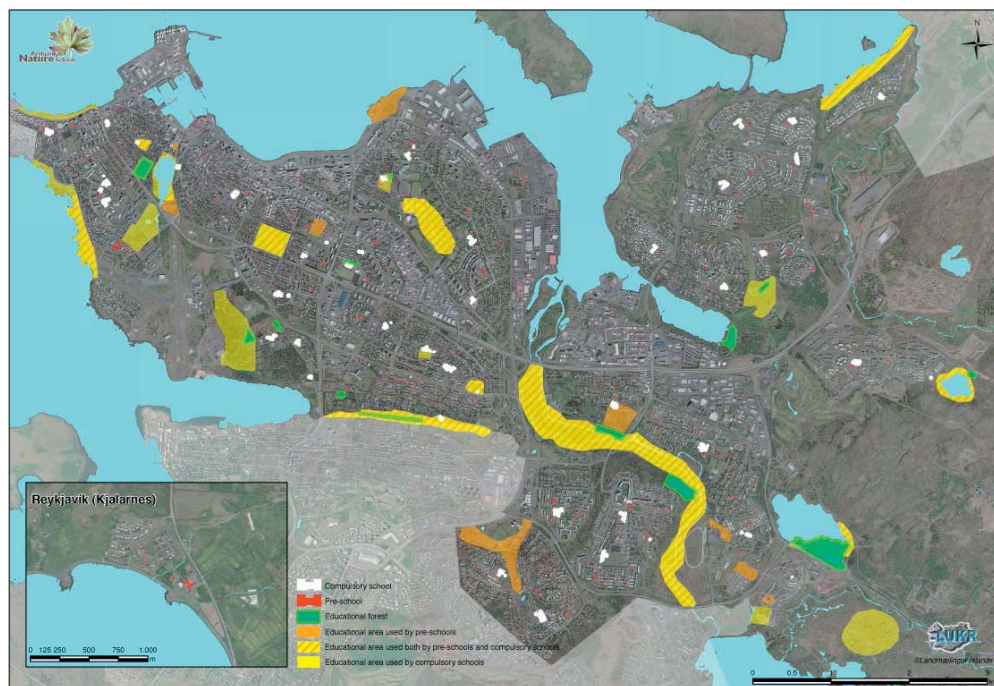


Figure 3.18
Organised outdoor education in Reykjavik.

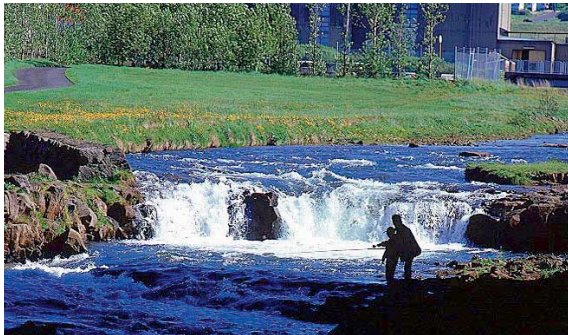


Figure 3.19
Fishermen by the Elliðaár river.

Other

- The City of Reykjavík Department of Environment and Transport has had a certified ISO 14001 system since April 2010. The Department of Environment and Transport is one of the City's eight administrative departments, handling inter alia refuse collection, gardens and transport. This environmental system includes the maintenance of recreational areas, i.e. the handling of various materials, soil etc.
- The City operates its own plant nursery. A great deal of work has been done in the last three decades to develop plants suitable for the city's recreational areas, and the nursery has developed considerable expertise in the selection and cultivation of varieties suitable for the urban environment. Experience gained in the field feeds directly back into the development work of the nursery.

3.4 Planned long and short-term measures for the establishment and management of green urban areas. A consideration of their function regarding people's quality of life and recreation and additional ecosystem services and functions

Short term measures

- In 2009 Reykjavík City Council agreed to make it possible for citizens, by means of an online poll, to prioritise money for smaller new projects and maintenance work in their localities when the municipal budget for 2010 was being drawn up. The idea was to give residents a direct say in the management of resources within their own immediate environment. 620.000 EUR have been set aside for these projects.
- In recent years, rest-points have been put in place with benches and a map showing the main walking and cycle routes. This year it has been agreed to put in place two new rest-points with benches and maps, and 8 new rest-points with exercise equipment. The cost for 2010 is estimated to be 186.000 EUR. Additionally, 250.000 EUR will be set aside for the renovation and setting up of new recreational areas.
- One of the Green Steps for 2009 consists of increased consultation with the people of the city, and collaboration between the people and the City to improve the environmental quality of green areas in the city. The City of Reykjavík decided to offer interested individuals or residents associations

the opportunity of a contract with the City on collaboration in the maintenance of green areas and play areas. Talks have already taken place with residents of three districts.

- The budget estimate for the Reykjavík Botanical Gardens is 372.000 EUR in 2010.
- Vatnsmýrin is a marshland located near the heart of the city, which supplies the city lake, Tjörninn, with water. Nesting birds that live on the Lake Tjörninn use the area. This nature reserve will undergo improvement so that it can better serve its function. The project will be a collaborative effort between the Nordic House, the University of Iceland and the City of Reykjavík. At the moment 15.500 EUR have been secured and further funding has been applied for. It has been planned to link the improvements to the centenary of the University of Iceland in 2011. People will be able to observe the reserve and the families of birds, learn about the importance of marsh lands and even observe scientists at work.



Figure 3.20
Vatnsmýrin, marsh land.

3 Green Urban Areas

- In recent years work has been carried out on categorising and defining cultivation benchmarks for city gardens and tree beds under the care of the City's Horticulture department as well as developing software named Cultivation Manager. Cultivation Manager oversees management and upkeep of cultivated areas but also acts as an information bank providing an overview over tree vegetation and city parks. The plan is to feed this information to the City Webview, an internet tool open to all, providing simple access to basic information from Reykjavik's Geographic Information System (GIS).

Long term measures

- Forestry zones at the edge of the city were mapped out and carbon binding levels investigated. The estimated carbon binding level for 2007 was ca. 5.000 tonnes of CO₂. A project is underway to measure the level of carbon binding of tree growth within urban areas (see figure 3.21).
- As part of the ongoing review of the current Reykjavik Municipal Plan, a working party has been set up to develop ideas for the overall planning of recreational areas. The draft Municipal Plan includes a proposal for a strategy for the environment and recreation, dealing inter alia with inter-relationship between city parks, fringe zones and nature areas, interlinked through a network of foot and cycle paths. The basis of the strategy was presented in a pamphlet of keynotes on the environment and recreation published as

part of the Reykjavik Municipal Plan 1996-2016. In light of the ongoing review of the Municipal Plan it is timely to form an overall perspective of the city's recreational areas, their design and execution. The working party consists of City experts on planning and environmental matters supervised by an independent project manager. This review underlines the importance of relying on methodology and the right tools. Included in the toolbox will be a specification, checklists and a quality strategy, along with a professional approach and clear procedures.

Emphasis is placed on classification of different areas, recreational areas, reserves and so on. In the ongoing review, emphasis has been placed on widespread consultation with special interest groups to secure diversity in the development of the city's recreational areas. Furthermore, an integral plan will be made for the coastline and offshore islands, in order to strengthen the city's image as The City by the Bay (see figure 3.22). The plan will also emphasise enhanced access to the coast, and preservation and protection of the diverse biosphere of Reykjavik's coastline.

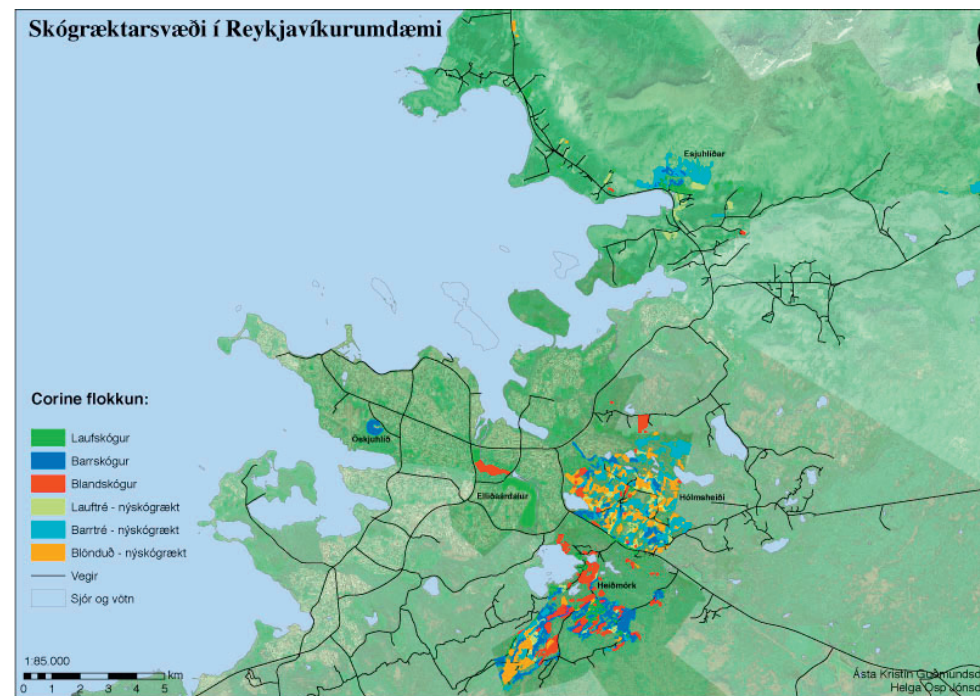


Figure 3.21
Forestry zones in Reykjavik.

3 Green Urban Areas

- A bike plan for Reykjavík was introduced in January 2010, introducing new standards and routes to be carried out in the near future. According to the plan, bike paths will be quintupled in 5 years time and increased by tenfold in the next 10 years. A bicycle route map has been published annually since 2005 and distributed free of charge and in cooperation with local bicycle associations. There has been active collaboration with the city's largest cycling organisations on the development of the Reykjavík city bike plan as well as on measures to increase the profile of cycling as a mode of transport. The improvement of walking and cycle routes strengthens the network of green areas and will lead to better public health.



Figure 3.22
Reykjavík, the city by the bay.

- The City of Reykjavík is a partner in the Good Plants Project. This is a co-operative venture under the auspices of the Agricultural University of Iceland in collaboration with the Iceland Forest Service, the Association of Garden Plant Producers and others. Its purpose is to identify, classify, study and share information about garden and landscape plants, i.e. hardy plants used in the development of green recreational areas.
- The Reykjanesfólkvangur nature reserve is a protected area in the proximity of Reykjavík. The area has been protected, not least for its volcanic features. The City of Reykjavík runs the reserve with six other municipalities. It provides 12.500 EUR on a yearly basis and additionally 62.000 EUR go to a project in 2010 that aims to establish a volcanic park in the area.

3.5 Documents, websites and documented decisions

Decisions

- Municipal Plan 2024: The existing Municipal Plan 2001-2024 is currently under revision and a new Plan is expected to be agreed this year. (ice)
- Shaping Reykjavík, Reykjavík's Local Agenda 21, 2006. (ice)
- The City of Reykjavík Climate and Air Quality Policy, 2009. (ice)
- Strategy on rivers and lakes. Strategy dealing with ends and means for protecting rivers and lakes and their environment. (ice)

Documents

- Ecoprofiled residential areas, Reykjavík Municipal Plan. Report on strategy for green residential areas. 2009. (ice)
- Report from advisory group on the Elliðaár river. Report covering achievements made in improving the biosphere of the Elliðaár river. 2007. (ice)
- Questionnaires on visits to recreational areas. Fossvogsdalur. 2006. (ice)
- Questionnaires on visits to recreational areas. Hljómskálagarður. 2006. (ice)
- Questionnaires on visits to recreational areas. Miklatún. 2006. (ice)
- Questionnaires on visits to recreational areas. Heiðmörk, Elliðaárdalur 2005. (ice)
- The Green Scarf. Description of the Green Scarf, an extended recreational area surrounding the capital, with a proposal for a continuous path through the area. 2006. (ice)
- Plan for Úlfarsárdalur. Overall plan and analysis of natural features, heritage sites and recreational value. 2008. (ice)

- The Value of Heiðmörk. Research reports, 2009. (ice)
- Assessments of Nature. Heiðmörk 2006. (ice)
- Assessments of Nature. Heiðmörk – map 2006. (ice)
- Assessments of Nature. Flóra Elliðaárdalur 2004. (ice)
- Assessments of Nature. Hafravatn 2008. (ice)
- Assessments of Nature. Elliðavatn 2004. (ice)
- Assessments of Nature. Flóra Grafarvogur 2004. (ice)
- Assessments of Nature. Kálfamói 2008. (ice)
- Assessments of Nature. Vatnsmýri 2003. (ice)
- Proposed plan for Miklatún and report, 2009. (ice)
- Report on Carbon fixation, 2007. (ice)
- Environment and transport departments nature action plan, 2010. (ice)

Websites

- Reykjavík Municipal Work School website: www.vinnuskoli.is
- Reykjavík Nature School annual report and website: www.natturuskoli.is/
- Reykjavík Botanical Garden website: <http://grasagardur.is>
- Viðey Island website www.videy.com
- Good Plants website: <http://yndisgrodur.lbhi.is/>
- Reykjavik Forestry Association website: www.heidmork.is (ice)
- Árbæjarsafn museum website: www.arbaejarsafn.is/
- The Reykjavík Zoo and Family Park website: www.mu.is
- The Icelandic Environment Association, Green Flag website: <http://www.landvernd.is/graenfaninn>

3.6 Disadvantages resulting from historical and/or geographical factors, which may have influenced this indicator area negatively

Icelanders, being a small nation in a big country, are used to great freedom, wide-open spaces, generous sources of food, access to energy, clean drinking water and hot water. Land for development in the capital area has historically also been widely available. Taking this abundance into account, the need for preservation and conservation in the capital area has not been considered urgent until more recently. However, open space and its resources are greatly valued. It is not long ago that the Icelandic economy was mainly based on agriculture and fishing and outdoor life was part of daily life. Icelandic people thus still have close ties with nature. During the recent boom years demand for new construction areas escalated, which in turn increased awareness of the value and importance of the green areas in Reykjavík. This is reflected in the current revision of the Municipal Plan, which emphasises densification of already built up areas and preservation of recreational areas.

Reykjavík is very young city compared with other European cities: its population being only 6.000 at the start of the twentieth century. Areas specifically set aside for recreation are consequently a relatively new development compared with elsewhere in Europe. In the wake of the 2008 crisis less funding is now available for developing and maintaining those green areas (see appendix 7).

Iceland has suffered from deforestation and wind erosion. While there is great interest in soil reclamation and reforestation among the population in general, there is also disagreement over the introduction of foreign species. Today, Reykjavik is one of the largest areas of cultivated woodland in the country. The appearance of the country is subject to rapid change, with more restricted fields of view and in many places domestic vegetation giving way to invasive species.

4 Sustainable land use

- 4.1 The present situation and developments over the past five to ten years
- 4.2 The measures implemented over the past five to ten years
- 4.3 Short and long term measures in relation to sustainable land use
- 4.4 Documents, websites and documented decisions
- 4.5 Disadvantages resulting from historical and/or geographical factors



4.1 The present situation and developments over the past five to ten years

Reykjavik area, an urban area of seven municipalities and 200.000 inhabitants, was largely developed in the latter half of the 20th century. Low density, segregation of land use and emphasis on the private automobile have characterised urban development in the area in past decades. Consequently, the private car has been the prevalent mode of transport in the area for more than five decades. The City of Reykjavik has in the past 10 years been placing emphasis on high density development and an environmentally-friendly transportation system, while the other municipalities have continued to plan for low density development and car-based transportation system. The regional plan approved in 2003 has not been very successful so far in changing this situation, even though it places emphasis on densification and sustainable development.

Since the late 1990s there has been increasing awareness among politicians, professionals and the public within the City of Reykjavik of the need to control urban sprawl and to encourage sustainable land use and transportation. The change in emphasis is reflected in approved planning and environmental policies, as well as in several projects that have been under way over the past several years. Approved in 2003, sustainable policies and projects were grounded in the Municipal Plan 2024. The Municipal Plan 2024 is now under revision, with even more emphasis on densification and sustainable development.

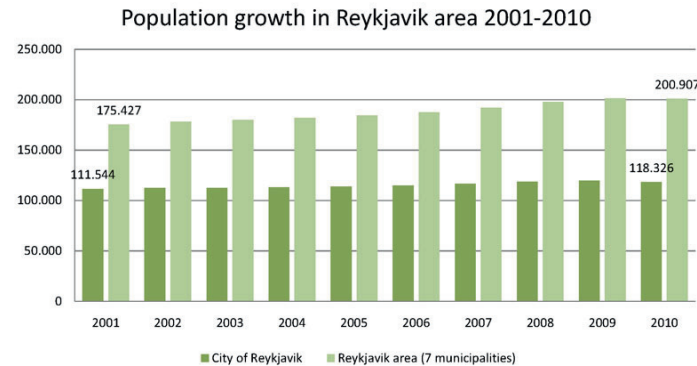


Figure 4.1

The suburban communities around Reykjavik have been growing much faster than the city itself. In last 10 years the annual population growth in City of Reykjavik has been 0,66%, while it has been 1,52% in the whole Reykjavik area.

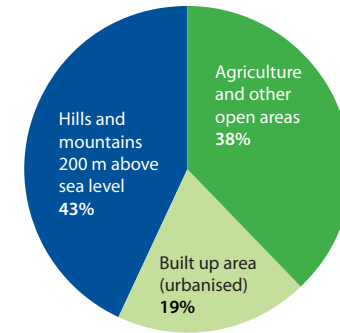
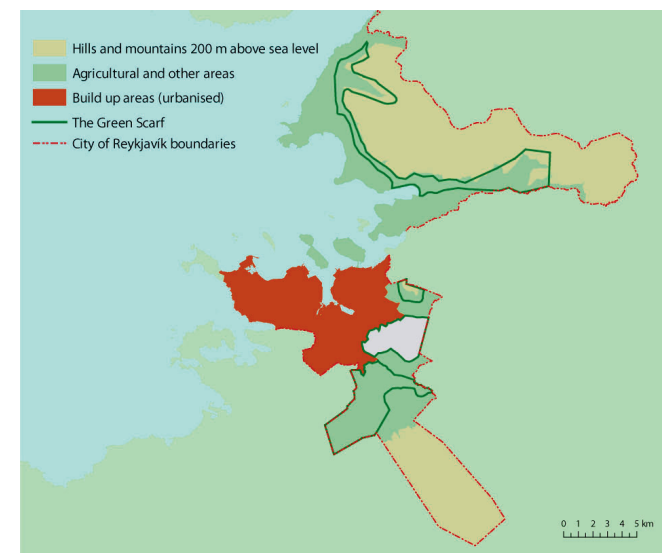


Figure 4.2 and 4.3

Land use within City of Reykjavik, total area.

A. Percentage of green areas, water areas, residential areas, industrial/economic areas, mixed areas, brownfields

The total area of the municipality of Reykjavik is 274 km². About 43% is mountains and hills more than 200 m above sea level, unsuitable for urban development, 38% is agricultural land and other open areas, and approximately 19%, or 51 km², is built-up area i.e. urban and suburban areas (see figure 4.2).



4 Sustainable land use

The Green Scarf is the name of a green hinterland within the municipality of Reykjavik. The area is a defined recreation and forestry zone that connects the seven municipalities and is about 12% of the total size of the municipality. Water areas, not including the sea, are about 1% of the total and islands are less than 1%. About 61% of the built up land is residential, commercial or mixed areas, 28% is public green areas and 11% is dedicated to the domestic airport located within the city, highway rights of way etc. (see figure 4.4 and 4.5). Note that land use of transportation in general is not considered here or in the given question.

A study from 2004 indicates that transportation areas, including all streets, car parking, cycle and foot paths, are about 37% of land within the defined urban boundaries, while building areas count for 30% and open green areas 33%.

There are several underused industrial sites within the city which are available for re-use. In the statistics above such sites are included in the appropriate land use category, mainly within commercial/industrial areas and mixed areas. Redevelopment has been proposed on most of these sites, residential or commercial. The total size of areas that can be defined as brownfields and ready for redevelopment is approximately 188 ha, or 3,6% of the total built up area.

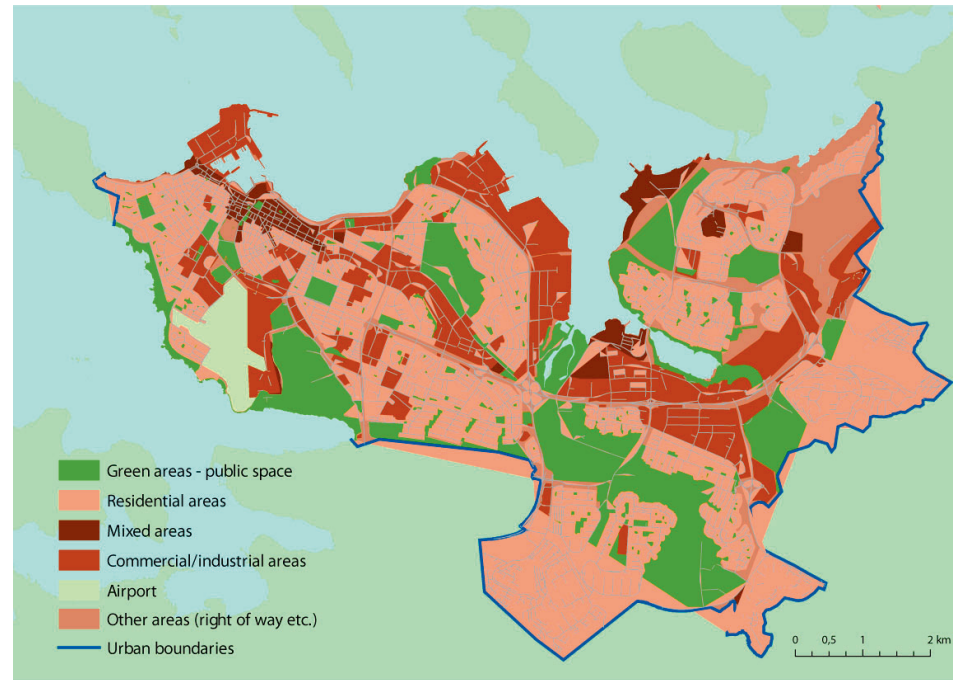


Figure 4.4
Land use in Reykjavik within the urban boundaries.

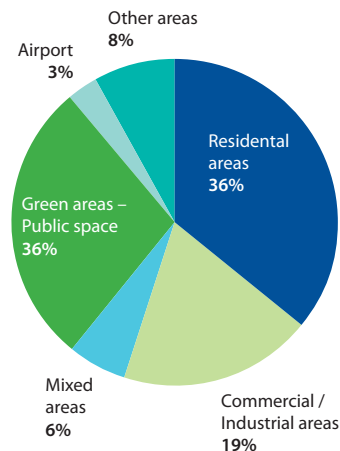
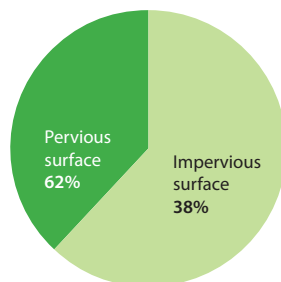


Figure 4.5
Land use in Reykjavik 2010 within the urban boundaries i.e. built-up area. Transportation facilities are included in the size of the main land use categories. It should be noted that the proportion of green areas would increase considerably if private green areas, within lots, were also included.

B. Soil sealing (m² per inhabitant)

Approximately 38% of total built-up land within defined urban boundaries is currently impervious surface (see figure 4.6). Impervious surface spans 5,0 km² in housing areas, 11,0 km² in transportation areas, 0,5 km² in the airport area, i.e. runways etc. and 3,3 km² in other impervious areas within private gardens etc. This result in assuming 1/10 as impervious surface. The total impervious surface areas thus span approximately 19,8 km² or about 38% of the total built-up area in the city (51,8 km²). Soil sealing is about 167 m² per inhabitant. Soil surface is about 268 m² per inhabitant. It should be noted that the green hinterland, called the Green Scarf, is not included in this calculation.

Figure 4.6
Approximately 38% of land within defined urban boundaries is impervious surface.



C. New developments: proportion of on brownfield sites, densification in the inner-city or urban cores, on greenfields

One of the main principles of current planning policy, as stated in the Muncipal Plan 2024 and emphasised in its ongoing revision, is to encourage compact development in currently developed areas; to capitalise on existing infrastructure and redevelop brownfield sites within the city. The Municipal Plan for the period until 2024 proposes that at least 40% of all new dwellings should be located within the current city structure, on densification sites which are mainly brownfields. Implementation of the plan has been especially successful with regard to this goal. Since approval of the Plan in 2003, about 50% of all new dwellings have been located within the city centre or close to the centre, compared to 10-15% a few years ago. In the past 10 years, approximately 43% of all densification projects, in terms of size of sites of both residential and commercial development, are located on former brownfields, 43% are on reclaimed land and 14% on greenfields (see figure 4.7). Note that the density of development is similar in all these areas, except on reclaimed land within the harbour area, where the density is lower.

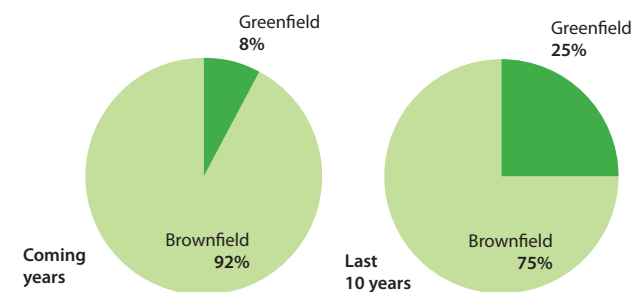


Figure 4.7
Proportion of greenfield vs. brownfield in densification projects, in last 10 years and in coming years as proposed.

D. Population density in built-up areas in inhabitant/hectare

Population density within current urban boundaries, i.e. total built up area, is approximately 2.300 inhabitants per km² or 23,0 inhabitants per ha. If only residential areas are considered, the density is about 63 inhabitants per ha, comparable to the number given below.

E. Population density for new developments in inhabitant/hectare

Population density is approximately 84 inhabitants per ha in new developments undertaken in the last five years, or 33% higher than the figure for residential areas in the city, which have a density of 63 inhabitants per ha. Note that these numbers assume 50% of new dwellings in the last five years on densification sites, 60 dwellings per ha/2,0 inhabitants per dwelling, and 50% in new suburban neighbourhoods, 20 dwellings per ha/2,8 inhabitants per dwelling.

4.2. The measures implemented over the past five to ten years

The main principles in the current Municipal Plan which was approved in 2003 are:

- Establishment of ultimate urban boundaries and preservation of the Green Scarf.
- To create a compact and sustainable city. Encourage compact development in currently developed areas; capitalise on existing infrastructure, to reduce travel demand and land consumption. Increase density in new suburban areas and encourage mix of land use within residential neighbourhoods and make them more self-sufficient; increase the number of jobs located in suburban centres and in adjacent employment areas.
- Sustainable transportation; transit-oriented planning principles.
- Strengthen the city centre; increase number of jobs and especially numbers of inhabitants within the city centre, and above all improve the quality of the city environment.

A. Minimising the total area of derelict land and contaminated land

Densification within the current city structure is one of the main goals of the Municipal Plan 2024. It is stated explicitly in the Plan that densification will first and foremost take place on abandoned and underused industrial sites. Some of these sites were or are contaminated. The general planning policy is thus conducive to minimi-

zation of such sites within the city. In that way, redevelopment of brownfield sites yields not only a more coherent and sustainable urban structure, but improves the quality of the environment in general within the city (see figure 4.7).

Furthermore, systematic monitoring of the city environment by the City minimises the risk caused by contaminated land and ensures appropriate land use. Contaminated areas, such as old landfills and former industrial grounds are well documented by the Public Health Authority. Extensive cleaning programs have been executed at several sites, such as the old shipyard by Reykjavik Harbour, a metal scrap yard, a shooting range and a former military site near the airport. Contaminated soil was removed from all of these areas and treated at a different location or disposed of in a safe way. Some sites have been left undisturbed as of yet, but are monitored by the Reykjavik Public Health Authority.

B. Increasing or sustaining population density

A key principle in the Municipal Plan 2024 is to preserve the green structure within the city as well as the Green Scarf. Densification within current built-up areas should not lead to a decrease in sizes of green areas designated for recreation or outdoor activity; densification will first and foremost take place on abandoned and underused industrial sites. Priority for redevelopment on brownfield sites is an essential step in creating a more compact urban structure and in improving the quality of the city environment. As the figures given above show, redevelopment takes place mainly on brownfield sites (see figure 4.7). The greenfield sites that have been developed for housing in recent years were in most cases unplanned

open spaces, not natural areas or important recreational areas. In recent years the City has redeveloped some old industrial areas at the seafront close to the city centre, in order to increase the number of inhabitants within the city centre by 700 to 800 dwellings. The areas are now mainly residential. A concert hall is under construction near the city centre. The project makes it a priority to extend the city centre to the seafront. Parallel to this construction, redevelopment of underused harbour areas has taken place in order to build the concert hall, conference centre, hotel, offices, retail units and dwellings. In this district an old shipyard area called Slippur has also been redeveloped, focusing on mixed development of dwellings and commercial premises.

C. Renovating urban land and renewing urban design

Sustainable land use planning, densification and mixing of land use, are a key principles in the Municipal Plan 2024 and in the City environmental policies, in order to create more viable and efficient urban neighbourhoods, reduce travel distances from homes to workplaces and services, and create a more compact urban structure and feasible environment for public transportation, walking and cycling in the long run. Implementation has been especially successful regarding densification, but to a lesser degree with regard to mixing of land use within new areas. Residential densification close to major employment areas has, however, been considerable, which reduces travel distances and increases access to services in general.

D. Limiting urban sprawl by cooperating with the neighbouring municipalities

A Regional Plan for the Reykjavik area was approved in 2003. The planning work was initiated by the City of Reykjavik in 1998 and a regional planning committee was established. The Regional Plan 2024 emphasises sustainable planning principles which are also reflected in the Municipal Plan for Reykjavik:

- to establish urban boundaries and preserve the green hinterland,
- to create a coherent urban area; develop first under-utilised areas between the municipalities,
- to redevelop old industrial areas within current built-up areas,
- to increase density in new areas on the outskirts,
- to mix land uses within new areas, and
- to control location of retailing, offices and services in centres or clusters within each municipality which are served with good public transportation.

In short, the main goal is to slow down the expansion of the urban area and increase density of development. Unfortunately, many of the policy goals have not been met so far, except within the City of Reykjavik.

E. Integrating current and future changes such as economic growth, demographic or climate change through sustainable land use planning

Sustainable land use planning is essential, in order to create more viable urban neighbourhoods, reduce travel distances, pollution and energy use, establish a more feasible environment for public transportation and environmentally friendly travel modes, improve access for all social and age groups, stimulate more variety in supply of housing and create a more efficient city structure. The City of Reykjavik's Local Agenda 21 is the City's policy for working towards a sustainable community, and the principal policy statement on environmental issues (see appendix 1).

Economic efficiency, housing policy, reflecting demographic and lifestyle changes, and environmental policies are inevitably integral parts of the general planning policy on sustainable urban development. In the current revision of the Municipal Plan, special attention is given to the impact of urban development on climate change, climate adaptation, housing for all social groups and cost, effectiveness of development, in relation to the policy on densification and sustainable land use. In September 2009 the City of Reykjavik agreed the first Climate Mitigation plan for a municipality in Iceland, and climate adaptation measures will be implemented through the revised Municipal Plan.

4.3 Short and long term measures in relation to sustainable land use

The Municipal Plan is currently under revision and the short term measures described below are grounded in it. The long term measures are mainly based on policy statements under consideration in the revision.

Short term measures

Emphasis on densification will continue in the coming years and in the long run. Several densification projects are under way, most of them located on brownfield sites (see figures 4.7, 4.8 and 4.9). With respect to both residential and commercial development in coming years, approximately 81% of densification projects, in terms of size of site, noting that density of development is similar in all these areas, are located on brownfields, 7% on greenfields and 12% in other areas, mainly infills or old buildings revitalised for new use.

Given the projects which are under way and proposed, more than 50% of all new dwellings will be located on sites within current city structure. This is in accordance with the goals of the Municipal Plan, stating that at least 40% of new dwellings will be on densification sites. Commercial development is proposed on several densification sites within and close to the city centre. While such development will strengthen the city centre and its hinterland, it creates imbalance in location of jobs within the city in general. In accordance with the goals of the municipal plan for mixes of land use and balanced location of jobs, incremental densification within the largest employment areas in the suburbs is proposed. This will counterbalance the densification in the city centre.



Figure 4.8
Proposed redevelopment and densification sites within Reykjavik west. Most of the sites are brownfields or other derelict land. Any of the larger scale redevelopment projects, under way, are located within the historic city centre.



Figure 4.9
Science Park on University of Iceland's campus in Vatnsmýri. Mixed land use of offices, institutions, research laboratories and dwellings. The grid structure and the urban character of the plan is in accordance with the overall plan of Vatnsmýri area, the current airport area, see figure 4.10.

Long term measures

A new Municipal Plan for the City of Reykjavík will apply for the period 2010-2030, based on a vision to 2050. The main theme of the revision work is sustainable urban development and densification of the urban structure; to create a more compact, diverse and attractive city. The goal is that 60-75% of all new dwellings will be located on densification sites close to the city centre or within the current city structure compared to the current goal of 40% in the Municipal Plan 2024, and 10-15% ten years ago. Other main goals of the revision are:

- Formulation of effective policy on development of sustainable and green neighbourhoods. Comprehensive guidelines for development of green neighbourhoods, buildings and infrastructure are a key project in the revision work. General provisions will be formulated that will guarantee that sustainable principles will be considered in development of all new neighbourhoods. One or more of these areas will be selected as a prototype for sustainable urban development.
- Relocation of the domestic airport near the city centre. Development of the area is essential to reach the goals of a more compact and sustainable city in the long run (see figure 4.10).

Figure 4.10

Vatnsmýri is an area of around 140 hectares near the centre of Reykjavík, which is currently occupied by the domestic airport. The municipal plan calls for the airport to be relocated. Development of the area is essential to reach the goals of a more compact and sustainable city in the long run. An integrated series of strategies ensure sustainable development: an integrated public transport system; the harnessing of geothermal power and other low-carbon technologies to ensure secure and sustainable energy provision; SUDS drainage and waste management's strategies; the preservation and extension of existing habitats to create a continuous and bio-diverse landscape.



- More sustainable transportation, changing travel behaviour in the city from car-based to walking and cycling. Decreasing negative impacts from car traffic by formulating a green transport strategy where densification and mixes of land use stimulate changes in travel behaviour (see figure 4.11). Favouring walking and cycling over private cars and supporting public transport with designated bus lanes for instance. A cycling plan has already been formulated for the City of Reykjavík and made public in January 2010. Feasibility of light rail has been assessed, as well as major transportation projects such as city tunnels.

Figure 4.11

Integration of land use and transportation planning. Public transportation corridors, proposed in the new municipal plan. High density development and mixed land use along the corridor, especially close to bus stops.



- Formulate comprehensive guidelines on quality of the urban environment, including design guidelines and architectural policy. One aspect of such guidelines is to view the street as a public space rather than a channel for traffic flow; the goal is to reclaim some of the land currently dedicated to transportation for other, more environmentally friendly, uses.
- Strengthen the green structure plan within urban areas and the Green Scarf.
- Assess overall planning strategy and land use plan with regard to sustainable principles, climate mitigation and adaptation, energy use and land consumption (see figure 4.12).
- Encourage public participation and involve neighbourhoods (public meetings have been held in every neighbourhood, workshops, dedicated website etc.) in formulating the general planning policy.

4.4. Documents, websites and documented decisions

Decisions

- Regional Plan for the Reykjavik Area 2001-2024. (ice)
- Municipal Plan 2024: The existing Municipal Plan 2001-2024 is currently under revision and a new Plan is expected to be agreed this year. (ice)
- Densification or sprawl, planning scenarios for Reykjavik 2040. Strategic environmental assessment of development alternatives. Impacts of development on CO2 emission, energy use, traffic flow and land consumption (Progress report (draft) – Revision of the Municipal Plan 2024))2008. (ice)
- Shaping Reykjavik, Reykjavik's Local Agenda 21, 2006. (ice)
- The City of Reykjavik Climate and Air Quality Policy, 2009. (ice)

Documents

- Land use of transportation in Reykjavik, 2004. (ice)
- Travel behaviour in Reykjavik area and density of development, 2004. (ice)
- Report on working towards eco-friendly development, 2010. (ice)

Websites

- Current Municipal Plan: www.rvk.is/desktopdefault.aspx/tabid-871/
- Municipal Plan (under review): <http://www.reykjavik.is/desktopdefault.aspx/tabid-3753/>
- Reykjavik Municipal Planning Information System: skipulagssja.skiptbygg.is/
- Reykjavik Geographical Information System (GIS): arccgis.reykjavik.is/borgarvefsja/
- Select your place, website for new building sites: www.reykjavik.is/desktopdefault.aspx/tabid-3572/5704_view-932/

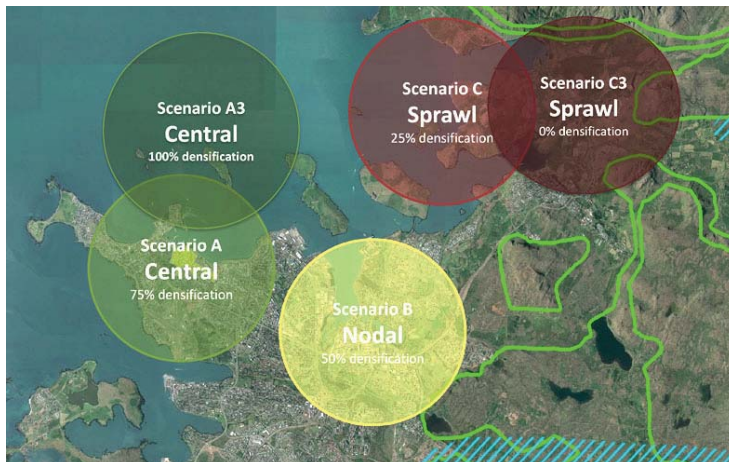


Figure 4.12

Development scenarios 2050 for Reykjavik area. The scenarios reflect different planning principles, densification, job location and land use in key areas. An environmental study has been performed focusing on the impacts of development on transportation, travel behaviour, green house gas emission, energy use, and natural areas. The results from this study have played important role in creating consensus about the new planning policy.

4.5. Disadvantages resulting from historical and/or geographical factors which may have influenced this indicator area negatively

Reykjavik and its six neighbouring municipalities were largely developed in the latter half of the 20th century. Hence low density, segregation of land use and emphasis on the private automobile have characterised development in the area in past decades. This is reflected in the population density, modal split and a greater land use of transportation than one would expect in older and denser cities where there is, for example, a long tradition of efficient public transportation systems.

5 Nature and biodiversity

- 5.1 The present situation and the development over the last five to ten years in relation to areas designated for nature protection and biodiversity under either municipal, communal, national or local schemes
- 5.2 Measures implemented over the past five to ten years
- 5.3 Short and long term measures to protect urban nature and biodiversity
- 5.4 Documents, websites and documented decisions
- 5.5 Disadvantages resulting from historical and/or geographical factors



5 Nature and biodiversity

5.1 The present situation and the development over the last five to ten years in relation to areas designated for nature protection and biodiversity under either municipal, communal, national or local schemes

One of the most prominent characteristics of Reykjavík is its proximity and interplay with untouched nature. The outermost neighbourhoods of Reykjavík are surrounded by The Green Scarf and the inner ones by coastline and sea, in addition to water areas of rivers which have been nearly undisturbed. The access of man to nature and the connection of man to nature is emphasized in Reykjavík's policy.

Measures to ensure cross-sector integration of biodiversity policy lies mainly in the position of the Division for Environment and Transport in the organization chart for the City of Reykjavík. The position is one of seven permanent employees in the city's government and has been responsible for environmental issues since 2005.

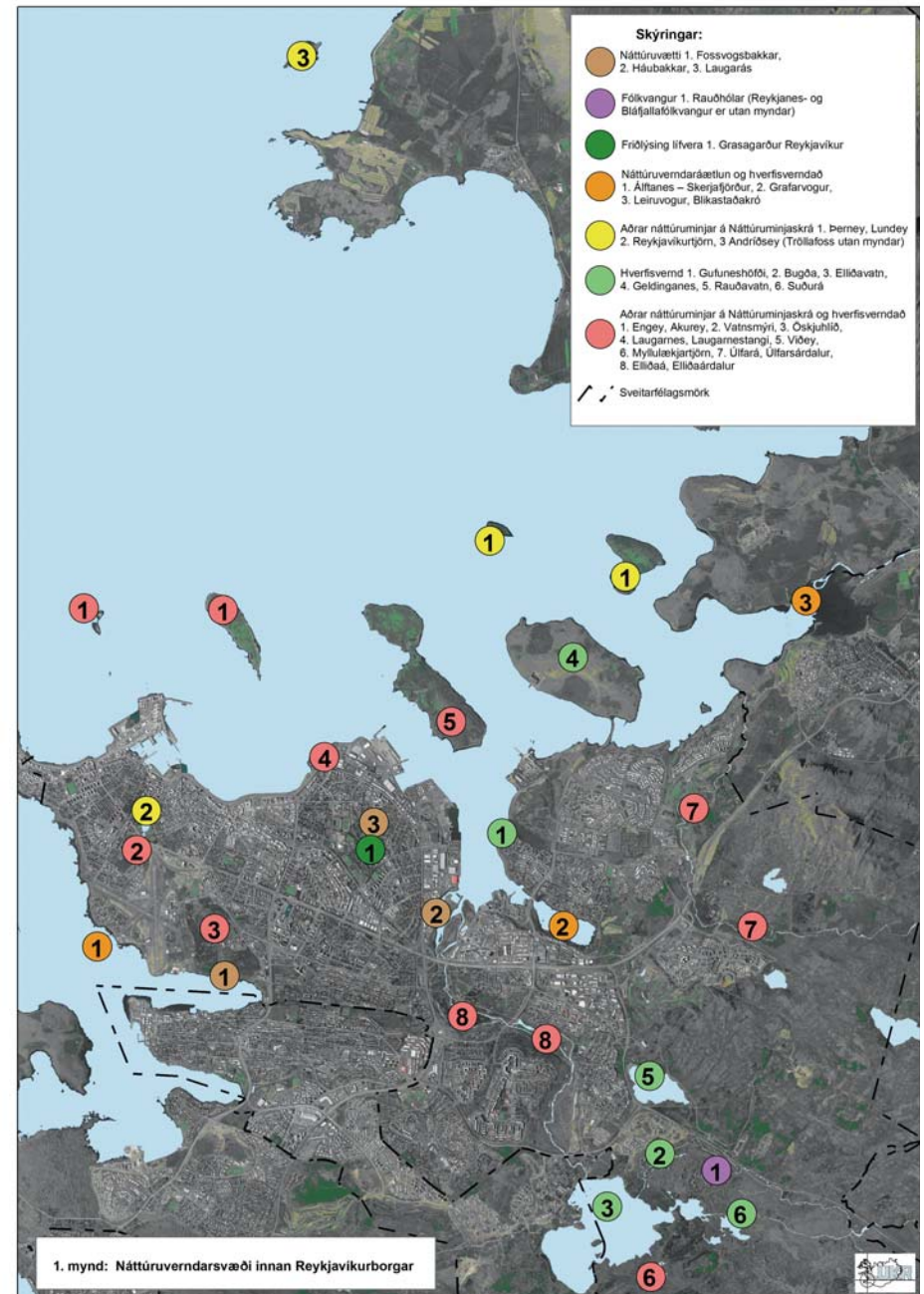
Nature Conservation Register

The Nature Conservation Register is a register of areas or organisms which have conservation status, areas on the Nature Conservation Schedule, and other areas which will ideally be protected by conservation orders in the future. Local conservation provisions in Iceland are based on IUCN categories. Three kinds of conservation designation under Icelandic law are within the territory of the City of Reykjavík: natural monuments, Country parks and protected organisms (see figure 5.1). Few areas within Reykjavík are mentioned as Other Natural Monuments in the Nature Conservation Register.

Figure 5.1

See nature conservation areas in the Reykjavík. Areas are numbered, and colour-coded by category of conservation.

- Brown (natural monuments): 1. Fossvogsbakkar, 2. Háubakkar, 3. Laugarás.
- Purple (country parks) 1. Rauðhólar (The Reykjanes and Bláfjöll parks lie outside the boundaries of the map).
- Green (species conservation): 1. Reykjavík Botanical Garden.
- Orange (Nature Conservation Schedule and local conservation provision): 1. Álftanes – Skerjafjörður, 2. Grafarvogur, 3. Leiruvogur, Blikastaðakró.
- Yellow (other natural monuments on Nature Conservation Register): 1. Perney and Lundey islands, 2. Reykjavík Lake, 3. Andriðsey island (Tröllafoss waterfall lies outside the boundaries of the map).
- Light green (local conservation provision): 1. Gufuneshöfði, 2. Bugða river, 3. Elliðavatn lake, 4. Geldinganes, 5. Rauðavatn lake, 6. Suðurá river.
- Red (other natural monuments on Nature Conservation Register and local conservation provision): 1. Engey and Akurey islands, 2. Vatnsmýri, 3. Óskjuhlíð, 4. Laugarnes, Laugarnestangi, 5. Viðey island, 6. Myllulækjartjörn pond, 7. Úlfará river, Úlfarsárdalur valley, 8. Elliðaá river and Elliðaárdalur valley.
- (Black lines) Municipal boundaries.



5 Nature and biodiversity

- Reykjavík has three conserved natural monuments. These monuments cover a total area of 4 hectares. Natural monuments on land and in the sea are natural formations whose conservation is, under the law, deemed desirable on scholarly or aesthetic grounds. All the natural monuments in Reykjavík are conserved on scholarly grounds, as they provide important information on the end of the Ice Age, and hence on Icelandic geological history. All three are adjacent to popular recreational areas. In addition, all stalactites in caves are protected by national laws and many are found in the lava field surrounding Reykjavík.
- Three country parks belong wholly or partly to Reykjavík, totalling 38.445 hectares (see figure 5.1). The country parks were designated more than a decade ago. Under Icelandic law the objective of designating country parks is to ensure public access to recreational areas. The Reykjanes Country Park is the largest in Iceland, about 300 km². It is unique in terms of its geology, and it has been called a showcase of the genesis of Iceland, as it includes important volcanic features. The Bláfjöll Country Park includes Iceland's largest skiing facility. The third country park, at Rauðhólar, includes about 80 red pumice pseudo-craters.
- The only organisms designated for conservation by law in Iceland are 31 species of vascular plants, protected since 1978. The Reykjavík Botanical Garden, founded in 1961 and owned by the City of

Reykjavík, plays an important role in the conservation of protected species of flora in Iceland. Fifteen protected plant species are kept in the Botanical Garden of Reykjavík on display and for educational purposes. Four protected plant species are found growing in the City's territory, in wild or semi-wild natural habitats (see table 5.1).

- Other natural monuments are areas where it is deemed desirable to designate for conservation under Icelandic law, but which have not yet been so designated. Within Reykjavík, eleven areas are in this category (see table 5.2).

Table 5.1

Nature conservation areas in the Reykjavík area.

Natural monument or feature, land or sea (IUCN Category III)			
Location	Character	Size ha.	Year
Fossvogsbakkar	Marine sediment with fossilised shells from the end of the Pleistocene	1	1999
Háubakkar	Sediment with fossilised shells and seeds from the Pleistocene.	2	1983
Laugarás	Rock with glacial striations	1	1982
Country Park (IUCN Category V)			
Location	Character	Size ha	Year
Reykjanes Country Park	Recreation, volcanism	30,000	1975
Bláfjöll Country Park	Recreation, volcanism	8,400	1973
Rauðhólar	Recreation, volcanism	45	1961
Species conservation (IUCN category V)			
Location	No. of vascular plant species		
Reykjavík Botanical Garden	15		
Territory of the City of Reykjavík	4		

Table 5.2

Other natural monuments of the Nature Conservation Register and Local conservation provisions in the Reykjavík area.

Location	Character	Other natural monuments on Register since:	Local conservation in municipal plan
Engey, Akurey	Birdlife	1975	2001-24
Perney, Lundey	Birdlife	1975	
Tröllafoss	Geology, recreation	1978	
Reykjavík Lake	Birdlife, recreation	1981	
Vatnsmýri	Birdlife, nesting area	1981	2001-24
Óskjuhlíð and Leyniryri	Recreation, geological formations showing highest sea level after the Ice Age, cultural heritage.	1981	2001-2024
Laugarnes and Laugarnestangi	Untouched seashore, recreation, cultural heritage	1981	2001-24
Viðey	Cultural heritage, verdant island, diverse landscape, birdlife	1981	2001-2024
Myllulækjartjörn	Water protection area, diverse vegetation, abundant birdlife	1984	2001-24
Ulfarsá, Ulfarsárdalur	Vegetation, angling, birdlife, recreation	1984	2001-24
Elliðaá, Elliðaárdalur	Salmon fishing, vegetation, landscape, recreation	1984	2001-24
Andriðsey	Birdlife	1988	
Gufuneshófi	Geological formations, recreation		2001-24
Bugða	Vegetation, birdlife		2001-24
Elliðavatn	Vegetation, birdlife, recreation		2001-24
Geldinganes	Geological formations, recreation		2001-24
Rauðavatn	Vegetation, birdlife, recreation		2001-24
Suðurá	Vegetation, birdlife		2001-24

Nature Conservation Schedule

Every five years the national government produces a Nature Conservation Schedule, on natural monuments and areas which should be designated for conservation in the future. The Nature Conservation Schedule 2004-2008 lists three areas which belong wholly or partly to Reykjavik (see table 5.3).

The Schedule provides for all the areas to be designated for conservation as habitats (i.e. IUCN Category IV), a new conservation category in Iceland. The government recently approved a Nature Conservation Schedule for 2009-2013, but no areas in Reykjavik are on that Schedule.

Table 5.3
Areas of Reykjavik on the Nature Conservation Schedule.

Nature Conservation Schedule 2004-8			Local conservation in municipal plan
Location	Character	Proposed conservation	
Alftanes – Skerjafjörður	Geological formations, flora, fauna, habitat, cultural heritage	Habitat (IUCN category IV)	2001-2024
Grafarvogur	Geological formations, fauna, habitat, cultural heritage. One of the most important ports of call of migratory birds in the capital area.	Habitat (IUCN category IV)	2001-2024
Leiruvogur – Blikastaðakró	Flora, fauna, habitat, cultural heritage. Diverse shore with rich ecosystem.	Habitat (IUCN category IV)	2001-2024

Local Conservation Provisions

In 1997 local conservation provisions were introduced into Icelandic law. By local conservation, areas can be protected for their natural or cultural heritage value within a municipal or local planning framework. In the Municipal Plan for Reykjavik 2001-2024, sixteen areas are designated for local conservation. These areas overlap to some extent with areas on the Nature Conservation Register (see table 5.2). Areas which are covered by local conservation provisions for their natural heritage value are prioritised in local planning and must be based upon scientific assessment and be accurately defined. Development in such an area is to be kept to a minimum. Locally-designated conservation areas in Reykjavik are to be accessible to the public, for instance with simple footpaths and information signs.

Regulations regarding strategy in the preservation of water

The EU Water Framework Directive is now being implemented in Iceland. Although this Directive has not yet been transposed into Icelandic law, the City of Reykjavik began monitoring lakes and rivers in the water protection area at the beginning of 2009 and the coastline in 2003 in accordance with regulation act no. 796/1999 on the prevention of water pollution. A resolution on the protection of the groundwater catchment zone for the capital area from 1997 was an important step towards protecting the drinking water of the residents of the capital. The City's emphasis on monitoring water quality actuates proper actions to secure water quality for the future (see figure 5.2).



Figure 5.2
A city of Reykjavik employee taking water samples.

A strategy for rivers and lakes was approved in the Executive City Council in 2001 with the aim of ensuring preservation of the natural resources of the water catchment areas and appropriate use of their environment. All the water catchment areas have now been so examined and classified and are subject to monitoring by the City. Planning of new suburban localities has taken into account the proposed 100 m no-build zone.

Present situation and developments in relation to the light pollution of the city's illumination during the night

Research has shown that light pollution can have various effects on organisms both in the sea and on land. Research has not been done regarding what effect, for example, light pollution has on the migration of fish in Elliðaár and Úlfarsá. The City reacts to recommendations of the Institute of Freshwater Fisheries about possible consequences of light pollution from information on lit paths at Elliðaár and Úlfarsá. When viewing an aerial

map of Reykjavík during the night, it is possible to see the light rays emanating from the city (see figure 5.3). Analysis which has been undergone on light pollution points out that street lamps caused about 30% of light pollution. As a means of counterbalance to light pollution, lighting from streets and roads from Reykjavík Energy is designed to fulfil the minimum standards of ÍST CEN /TR 13201-1-4 2004. It is worth mentioning that in 2009 the lighting time of the street lights was reduced, and the lights now go on when daylight has decreased to 20 lux, compared to 50 lux before.

Figure 5.3
A night map of the Reykjavík area.



5.2 Measures implemented over the past five to ten years

A. Manage the areas designated for nature protection and biodiversity

Local conservation provisions were first introduced in Reykjavík's urban planning in 1997, and were first defined in the Reykjavík Municipal Plan 2001-2024. Subsequently, changes were made to local planning procedures, especially in areas of conservation provision. The following list demonstrates examples of management or monitoring of areas designated for nature protection and biodiversity:

- The Lake Tjörnin, in central Reykjavík and the adjacent Vatnsmýri wetlands are covered by local conservation provisions (see table 5.2). This is one of the most intensively monitored areas. Since 1973 the birdlife of Tjörnin has been monitored. In 2003 the City had a study done of the flora and vegetation of Vatnsmýri. In order to conserve the variety of birdlife, improvements have been placed on duck paths to facilitate the crossing of birds between areas.
- The Elliðaárdalur valley and its river are covered by local conservation provisions (see table 5.2). In 2002 a consultation group on Elliðaárdalur was established with the aim to protect the valley and the salmon in the river. Action was taken and migrating fish, salmon and sea trout, now get around all over the network of water in spite of blockades. Sedimentation ponds have been set up to cleanse surface water from traffic streets. The protection by the City even includes countermeasures and initial results show that actions taken have proved to better the wildlife of the rivers. Various reports have been published; on the benthic species of the river, on habitats of salmonids in the river, and on observations of water flow (1929-1995) and on the flora of the valley. The Elliðaár river is monitored by the City and by the Institute of Freshwater Fisheries, since 1988. Data on salmon migrating up the river are among the environmental indicators of Reykjavík.
- The Elliðaár river, Blikastaðakró, Tjörnin, Leirvogsa, Kiðafellsá and Úlfarsá is monitored by the City. In 2009, regular measurements were gathered and analysed for fecal matter, nutrients and heavy metals. In 2010 certain vulnerable areas will be monitored. The coastline of Reykjavík is monitored annually and the results are made available on Reykjavík's webpage and is apart of Reykjavík Environmental Indicators.
- Úlfarsárdalur local plan, 2005. Recreational and conservation areas underwent a special local planning procedure based on documentation of the nature of the area.
- Invasive alien plant species are found in some areas which are designated for conservation. The main example is the Nootka lupin (*Lupinus nootkatensis*). Action has been taken e.g. in Laugarás, where the lupin was cut down for three consecutive years, but with relatively little result. In Laugarnes peninsula *Heracleum* species are being eradicated.

- Within some areas covered by local conservation provisions, invasive bird species have settled. Some have occasionally been culled, while in the case of other species efforts have been made to reduce their impact; for instance discouraging feeding and installing fences on the banks of Tjörnin. Invasive animal species are also found in some areas of the city: rabbits are common on Öskjuhlíð, and mink can be found near water areas and the City consistently takes actions to restrain their proliferation.

B. Protect nature in other open spaces

Many extensive open spaces within the city are recreational, and are not formally subject to nature conservation. The largest is the Heiðmörk Nature Reserve, documented in the Municipal Plan 2001-2024, and is to be connected to the Green Scarf, where the urban boundaries to the east of Reykjavik are drawn. Thus, many residential areas in Reykjavik are bordered by open spaces, where nature has been left unspoiled or forested and in some cases integrated into the residential area, thus reducing horizontal pollution. A documented example of this is the local plan for Úlfarsárdalur and a similar local plan for the Heiðmörk nature reserve is in preparation where the planning procedure is based on the nature of the area.

C. Promote public knowledge and understanding of nature and biodiversity

A variety of educational activity on nature and the environment is carried out in Reykjavik. In recent years there has been an awakening among the people of Reykjavik with regard to participation in such activities and many projects have been launched by the City in recent years (see appendix 8), all of which are flourishing.

Examples:

- The Reykjavik Nature School was founded in the autumn of 2005 (see appendix 5). It has two objectives: to increase outdoor education in the city's preschools and primary/lower-secondary schools; and to create a forum for consistent environmental work in schools. The areas used by schools for outdoor education were mapped, and it transpired that many green spaces in the city are used for diverse educational purposes. The courses provided by the school have increased significantly in popularity (see figures 5.4 and 5.5).
- The Reykjavik Municipal Work School provides summer employment for youngsters in garden work, in the City's open spaces and providing gardening service to senior citizens (see appendix 4). Each summer the School employs nearly 70% of 14-16 year-olds in Reykjavik. The school is an eco-school, awarded in 2009, the Green Flag in acknowledgment of its excellent achievements in environmental matters and education.
- In many areas of the city educational signs have been erected for public information, and on-line educational material has been made available.

- A hidden lookout for bird watching has been installed in an area of local conservation provisions.
- Special emphasis has been placed on installing informational signs along the sea shore. Maps showing footpaths and other information have been installed in the principal recreational areas.
- To mark the Year of Biodiversity in 2010, courses dealing with biodiversity will be given special prominence in the educational programme of the Nature School, in the Guardian of the Environment project competition, and in educational activities of the Reykjavik Botanic Garden.
- The City of Reykjavik is a sponsor of Global Action Plan for the Earth in Iceland, which aims to encourage families to adopt a green lifestyle with sustainable use of natural resources.

Figure 5.4

The increase in teachers participating in courses of the Reykjavik Nature School. The dark bar showing the true number of participants and the lighter showing the planned number.

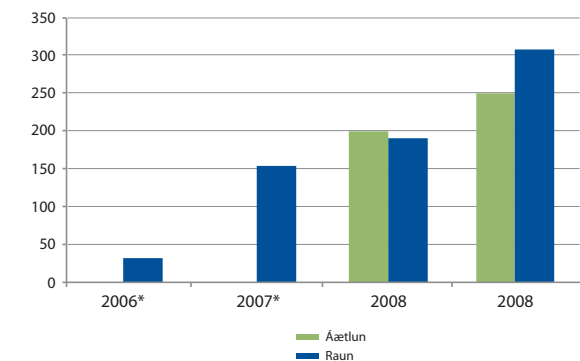
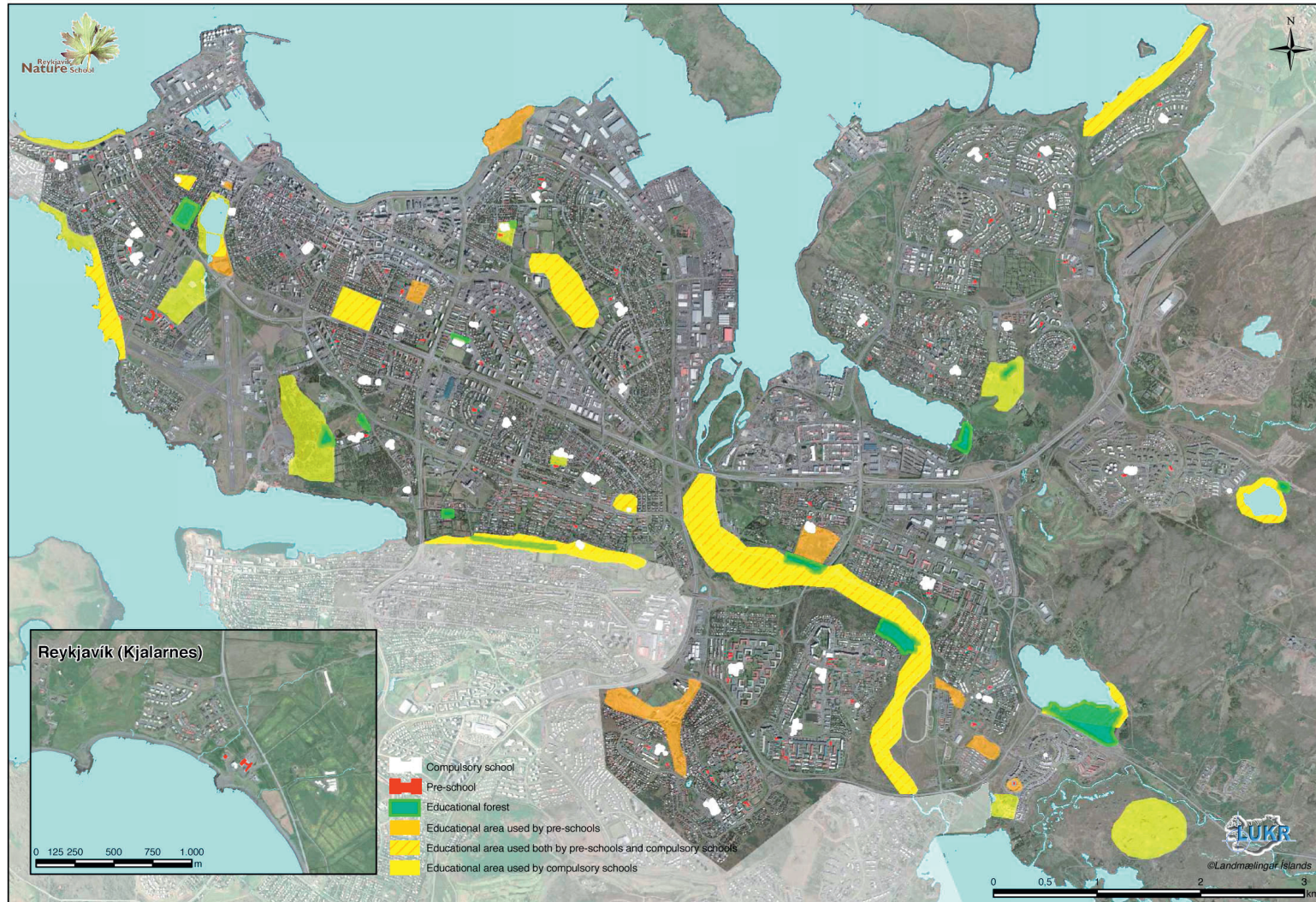


Figure 5.5
Green spaces used for outdoor education.



5.3 Short and long term measures to protect urban nature and biodiversity

Short term measures

The City of Reykjavik is one of seven Capitals of the Nordic Countries who cooperated in developing Environmental Indicators and Reykjavik has from 2002 annually evaluated indicators on global warming, usage of resources, water quality, transportation, biodiversity and quality of the environment (see appendix 3). The estimated cost in 2010 for the department's operations, policy planning and development within the City of Reykjavik, where projects involve the Environmental Indicators as the main tasks, is in total about 110.000 EUR. Based on these environmental indicators, Reykjavik launched an action plan, Green Steps for Reykjavik in 2007. The results were positive; at the end of 2008 90% of projects were finished or their execution commenced and therefore it was decided to re-examine them annually.

In the ongoing revision of the plan for 2010, the emphasis is on climate issues. An estimated 1,4 million EUR will be allocated to structural projects relating to the Green Steps in 2010. Costs of changed services, publicity, education and other Green Steps tasks are not included in that sum.

Examples of projects in 2010

- It is endeavoured to improve the reserve in Vatnsmýri, in which it is intended to recover marshes in the downtown area with a systematic approach. The project is a collaborative one involving the University of Iceland, Nordic House and the City of Reykjavik. Support for the project has already reached up to a total of 15.500 EUR.

- A plan has been made to enhance the water quality of the Lake Tjörnin by for example reintroducing the Alternate Water Milfoil (*Myriophyllum alterniflorum*) to the Lake. About 12.400 EUR are allocated to the project for 2010.
- The Green steps 2010 also increases the participation of Reykjavik's residents in using green areas and nature by increasing the supply of land for vegetable gardens and defining natural spaces in every district for outdoor and environmental education. The municipal plan is under revision and its work is guided by the concept of sustainability.
- In 2010 155.000 EUR is allocated to the Summer School vegetable gardens. Through that project the City offers facility for the public and primary school children to grow their own vegetables during the summer.
- In 2010 373.000 EUR have been allocated for operations of the Reykjavik Botanical Garden which e.g. maintains Icelandic plant types in danger of extinction.
- Environmental monitoring (air quality and rivers, lakes and coastal beaches) is in progress continually in Reykjavik and annually costs is about 93.000 EUR, not including costs associated with housing and administration.
- Exterminators work for the city and e.g. monitor mink and fox encroachment for 11.750 EUR in 2010.
- In 2010 9.400 EUR will be allocated for monitoring and education purposes by the Lake Tjörnin, i.e. to create better conditions for ducks and impede imposition from scavenging birds.

Long term measures

Shaping Reykjavik, is the City's Local Agenda 21. It includes policy aims, objectives and means to be applied within the city until 2015. Approved by the City Council in May 2006, it contains long-term environmental plans. The objectives for nature conservation and outdoor life are that the city's recreational areas are accessible and diverse, so that city dwellers can enjoy a variety of outdoor activity all year. Some ways to fulfil its objectives mentioned in Shaping Reykjavik:

- Further research is required on recreational areas and the nature there, in order to ensure that further development of them is based on scientific data.
- Careful consideration must be given to the special status of new recreational areas, e.g. at Úlfarsfell, Leirvogsa and the slopes of Mt. Esja.
- More use of recreational areas for educational and school activities, with emphasis on working with nature.
- Harmony to be ensured between nature conservation and outdoor recreational use, by education and good organisation, and access to such areas.
- Possibilities to be presented of reducing/abolishing outdoor use of toxic substances in horticulture.
- The City of Reykjavik is to resist further encroachment on natural areas within the territory of the city, and also to work for further conservation of valuable natural areas in the future.

The City will act upon a newly published report of The Ministry for the Environment made by the Icelandic Institute of Natural History and the Soil Conservation Service of Iceland on the distribution, use and control of Lupin and Sweet Cicely. The report recommends that acts should be taken to limit the distribution of these species in other areas than of soil erosion and should be eradicated in Natural Monuments, Country Parks and in areas above 400 m.a.s.

The Reykjavík Botanical Garden is in excellent cooperation with the Icelandic Institute of Natural History and has participated in monitoring red-listed plants in Iceland, thereof few in the vicinity of Reykjavík. The Icelandic Institute of Natural History will decide upon the working procedure for further monitoring and has contacted the Reykjavík Botanic Garden for further cooperation.

5.4 Documents, websites and documented decisions

Decisions

- Úlfarsárdalur local plan for recreational area, 2008. (ice)
- Reykjavík Municipal Plan 2001-2024, 2008. (ice)
- Memorandum of Ellidaár consultation group, 2007. (ice)

Documents

- Nature Conservation Schedule 2004-2008. (ice)
- Nature Conservation Register, 2006. (ice)
- Birdlife of the Tjörninn, 2007. (ice)
- Birdlife of the Tjörninn, 2009. (ice)
- Reduction of population of lesser blackbacked gull mink and arctic fox in the capital area, 2006. (ice)
- Flora of the Elliðaardalur valley, 2004. (ice)
- Vatnsmýri nature reserve flora and vegetation, 2003. (ice)
- Classification of pollution in Tjörninn, 2008. (ice)
- Benthic species in the Ellidaár river, 1998. (ice)
- Habitats of salmonids in the Ellidaár river, 1998. (ice)
- Observations of water flow of Ellidaár river 1929 -1995. (ice)
- Strategy for rivers and lakes, 2001. (ice)
- Shaping Reykjavík, Reykjavík's Local Agenda 21, 2006. (eng)
- The Contribution of Street Lighting to Light Pollution. 2010. (eng)
- Organization chart for the City of Reykjavík. (eng)

Websites

- Reykjavík Municipal Work School website: www.vinnuskoli.is
- Reykjavík Nature School website: www.natturuskoli.is/
- Reykjavík Botanical Garden website: <http://grasagardur.is>
- The Eco-School project at Landvernd: www.landvernd.is/graenfaninn

5.5 Disadvantages resulting from historical and/or geographical factors which may have influenced this indicator area negatively

Historically, Iceland has experienced massive deforestation and soil erosion. Today Icelanders are keenly interested in land restoration and afforestation, but opinions differ on the advisability on using foreign species. Today Reykjavík is one of Iceland's major cultivated woodlands. The Icelandic landscape is changing: increased afforestation obscures the unimpeded views to which Icelanders are accustomed, and in many locations invasive alien species such as the Nootka lupin and sweet cicely are encroaching upon native species.

6 Quality of Local Ambient Air

- 6.1 The present situation and the development over the last five to ten years
- 6.2 Measures implemented in the last five to ten years to improve air quality
- 6.3 Short and long term measures for improvement of air quality
- 6.4 Documents, websites and documented decisions
- 6.5 Disadvantages resulting from historical and/or geographical factors



6.1 The present situation and the development over the last five to ten years

The City of Reykjavik has for many years been in the lead among local governments in Iceland with respect to air quality. City authorities played a pioneering role, for instance, in the introduction of monitoring of air quality in Iceland in 1990, and in dissemination of information to the public on matters of air quality. The City has had a positive impact on the minds of its inhabitants regarding the importance of good air quality and ways to improve it, but at the same time has had an impact nationwide. The state, along with various municipalities, have sought assistance from the city for monitoring of air quality due to, e.g., traffic pollution and now recently, the volcano on Eyjafjallajökull glacier (see figure 6.1).

Monitoring of air quality

Since 2002, three air quality monitoring stations have been operated by the City of Reykjavik (see figure 6.2). One is located close to a busy junction (traffic hotspot) which is believed to provide data where the highest concentrations of air pollution occur in the city, while another is used to measure urban background levels, in order to provide data which are representative of exposure of the general population. The third monitoring station, a mobile one, is used to make measurements of air quality in various locations, e.g. at schools and preschools, by busy roads and at construction sites. Since 2006 the City has also monitored levels of hydrogen sulphide (H₂S), as increased pollution had been experienced as a consequence of a new geothermal power plant about 20km inland from the uppermost districts of the city. Levels of H₂S are monitored in the city centre, and another monitoring station has now been installed in the uppermost district of Reykjavik, closest to the power plant.

Air quality status

The quality of ambient air in Reykjavik is generally good. The pollutants most likely to exceed health value limits are nitrogen dioxide (NO₂) and particulate matter (PM10). Other air pollutants such as ozone (O₃), sulphur dioxide (SO₂), carbon monoxide (CO) and benzene (C₆H₆) are generally measured far below EC limit values in Reykjavik. No EC limit values exist for hydrogen sulphide, but the World Health Organization (WHO) has introduced guidelines on levels. H₂S measurements in Reykjavik have not exceeded that level. The Icelandic government has submitted draft regulations on H₂S levels, which are now at the consultation stage. Particulate matter (PM10) is the air pollutant which most often exceeds health limit values. The maximum number of occasions on which PM10 may exceed daily health limit values under Icelandic regulations has been reduced in stages since 2002. In 2010 it is permissible for PM10 to exceed the limit only seven times (see figure 6.3). The EC daily limit is stated as 50 µg/m³. However, the EC has issued a new Direc-



Figure 6.1.
Eruption started in Eyjafjallajökull Volcano in May 2010, east of Reykjavik City (see picture to the left). The City of Reykjavik lent a mobile air quality station to the national government to monitor particulate matter (PM10) in Hvolsvellir only 32 km west of the eruption place (see picture to the right). City of Reykjavik has already sent two warnings to the public in Reykjavik because of the eruption.

6 Quality of Local Ambient Air

Figure 6.2
Locations of three air quality monitoring stations in City of Reykjavik in 2008.
 (a) Red square; traffic hotspot / traffic station.
 (b) Blue triangle; urban background station.
 (c) Green circles; mobile station.

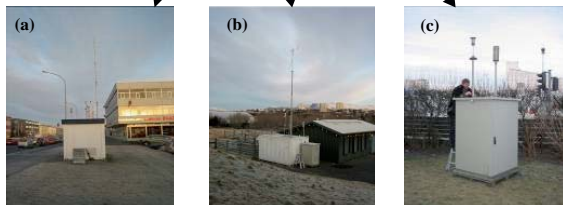
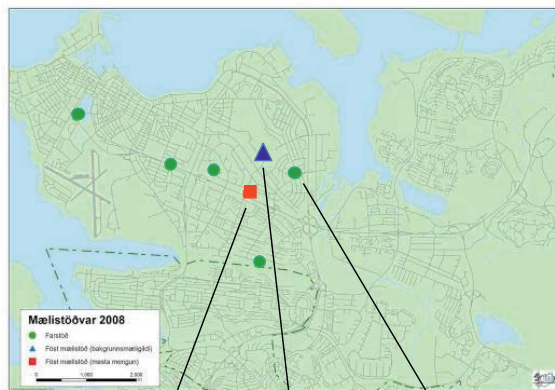
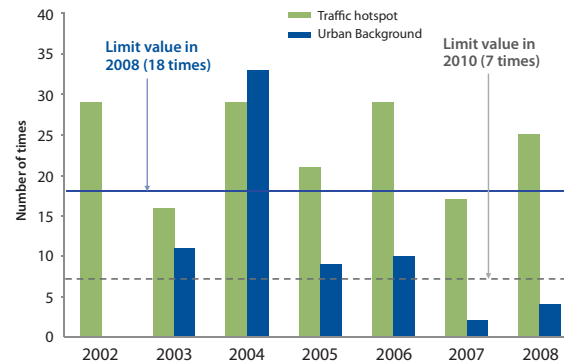


Figure 6.3
Number of days per year, on which EC limit values were exceeded for PM10, for the period 2002 - 2008.

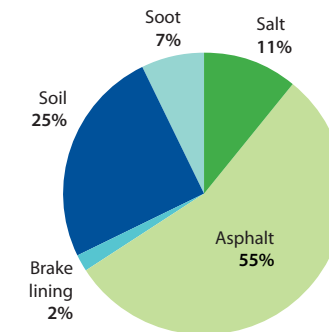


tive (no. 2008 / 50 / EC) Ambient air quality and cleaner air for Europe which takes effect in 2010. This increases the number of occasions when PM10 may exceed health limit values, to 35 occasions. It is not clear how or when the provisions of this Directive will be transposed into Icelandic law.

Sources of particulate-matter pollution

The City of Reykjavik differs from most other cities, in that PM10 pollution does not arise from heating systems or the use of wood-burning stoves or fireplaces; all heating in Reykjavik is from low- and high-temperature geothermal areas in and around the city.

Figure 6.4
Combination of Particulate matter (PM10) in City Reykjavik.



Pollution by particulate matter in Reykjavik arises from a number of sources, of which transport is believed to be the most important. According to a study carried out on the composition of PM10 in Reykjavik in winter, about 70% of PM10 pollution is attributable to motor vehicles. The use of studded tyres in winter is a large factor, as these tyres wear away asphalt surfaces. Asphalt is believed to account for about 55% of all PM10 pollution in Reykjavik (see figure 6.4).

Table 6.1
Number of days when particulate matter (PM10) exceeded health limit values (daily mean 50 µg/m³).

Year	Traffic hotspot	Urban background
2002	29	*
2003	16	11
2004	29	33
2005	21	9
2006	29	10
2007	17	1
2008	25	4

* Monitoring station operated for only part of the year.

Table 6.2
Annual mean concentration of nitrogen dioxide (NO₂).

Year	Traffic hotspot µg/m ³	Urban background µg/m ³
1998	32.3	*
1999	37.2	*
2000	**	*
2001	28.4	*
2002	21.2	**
2003	23.7	14.8
2004	26.5	15.0
2005	21.7	12.7
2006	25.5	8.4
2007	19.6	6.7
2008	20.5	7.9

* No background-level monitoring station.

** Monitoring station operated for only part of the year.

A. Number of days per year on which EC limit values were exceeded for PM10 (daily mean of 50 µg/m³)

In general, PM10 exceeds the daily EC health limit values far more often at the traffic hotspot monitoring station than at the monitoring station which measures urban background values (see table 6.1 and figure 6.3). In 2004 there was an exception to this rule, as the number of occasions when levels were exceeded was higher at the background-level monitoring location, due to construction work in the vicinity.

Table 6.3
Annual mean concentration of particulate matter (PM10).

Year	Traffic hotspot µg/m ³	Urban background µg/m ³
1998	34.7	*
1999	33.8	*
2000	37.4	*
2001	**	*
2002	26.1	**
2003	19.5	21.1
2004	22.8	27.9
2005	22.2	19.6
2006	24.6	20.2
2007	22.1	11.5
2008	22.9	13.1

* No background-level monitoring station.

** Monitoring station operated for only part of the year.

B. Number of days per year on which EC limit value/long term objectives were exceeded for ozone (8h mean of 120 µg/m³)

Since the introduction in Iceland of new regulations on ozone in 2003, ozone has not exceeded the 8h mean of 120 µg/m³.

C. Annual mean concentration of NO₂ and PM10

Mean annual levels of nitrogen dioxide (NO₂) (see table 6.2, figures 6.4 and 6.5) and particulate matter (PM10) (see table 6.3, figures 6.6 and 6.7) have been falling since 2000. Increased precipitation since the turn of the century is believed to be an important factor. Over the same period the number of vehicles on the streets of the city has risen, but technological advances, such as catalytic converters in all vehicles and improved particulate filters in diesel-powered vehicles, are believed to have contributed to the reduction. In addition, fewer vehicles are now fitted with studded tyres in winter. Nonetheless, the annual mean level of PM10 exceeds the annual limit levels provided in Regulations.

Figure 6.4
Annual mean concentration for Nitrogen dioxide (NO₂) for the traffic hotspot (NO₂), for the period 1998–2008.

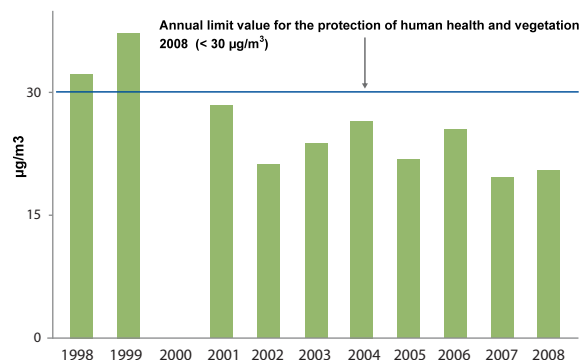


Figure 6.5
Annual mean concentration for nitrogen dioxide (NO₂) for the traffic hotspot (NO₂) and for the urban background station for the period 2003–2008.

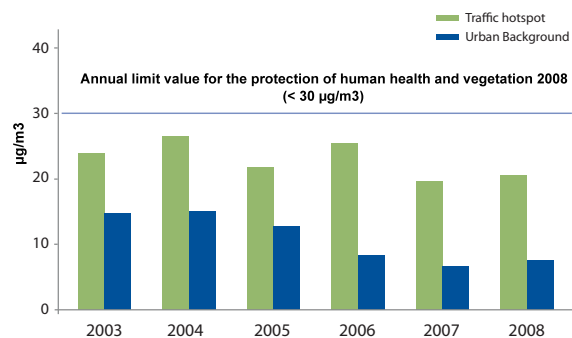


Figure 6.6
Annual mean concentration for particulate matter (PM10) for the traffic hotspot (NO₂) for the period 1998–2008.

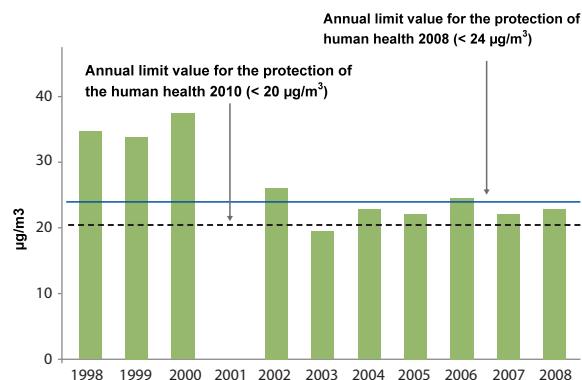
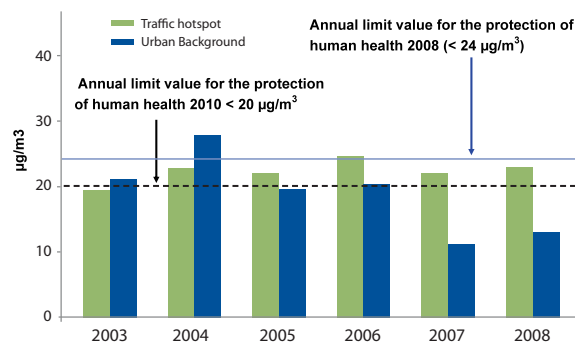


Figure 6.7
Annual mean concentration for particulate matter (PM10) for the traffic hotspot (NO₂) and for the urban background, for the period 2003–2008.



6.2 Measures implemented in the last five to ten years to improve air quality

A. Existence and implementation of an air quality management plan

In March 2009 the City of Reykjavík was the first local authority in Iceland to approve an air quality action plan. The plan provides for short-term measures to prevent health limit values being exceeded. In connection with the action plan a response team in the city decides when announcements are to be made, forecasts air quality, and issues public warnings when pollutants exceed, or are expected to exceed, health limit levels. The response team also decides whether, and if so what, mitigating measures are to be applied. Along with the preparation of the air quality action plan for Reykjavík, a Climate and Air Quality Policy was formulated for Reykjavík, which was approved by the Executive City Council in September 2009.

The policy deals with long-term measures. A number of other important plans have been approved by the City government in recent years, such as the City's Transport Policy and Green Steps on transport matters. Air quality also plays an important part in the Local Agenda 21, Shaping Reykjavík. A summary follows of the principal measures for which the plans make provision, classified by source:

Transport

- The City of Reykjavik has campaigned vigorously against the use of studded tyres. This has yielded results, and the use of studded tyres has decreased considerably. The proportion of vehicles fitted with studded tyres has dropped from 67% in 2002 to 42% in 2009 (see figure 6.8). Municipal buses are not fitted with studded tyres.
- In recent years experiments have been carried out with dust-binding the road surface using magnesium chloride, when levels of PM10 have been predicted to exceed health limit values. Experiments have also been carried out in sweeping and washing streets in winter. The dust-binding process is deemed to have been proved effective.
- Under the City of Reykjavik Transport Policy, the objective is that all vehicles operated by the City are to use domestic green energy such as methane and

electricity. Today the majority of the City's refuse collection vehicles run on methane. Parking is free of charge for eco-friendly vehicles in the city, and electric recharging points have been installed in a number of locations.

- In order to reduce bus travel time, the length of designated bus lanes on major roads has been increased. City buses do not use studded tyres, and experiments have been made with special catalytic converters which enhance fuel efficiency by about 5%. All new buses put into service by the bus company must meet the strictest European emission standards.
- The City of Reykjavik has urged citizens to make less use of private cars, and to walk, cycle or take the bus. The Local Agenda 21 programme Green Steps aims for less use of cars, and cutting numbers of parking spaces at municipal offices. The City is working with businesses towards these objectives. The City has also

campaigned against children being driven to school: instead they should be helped to plan a safe walking route.

- Emphasis has been placed upon meeting the diverse travel needs of Reykjavik people on a basis of equality. Denser urban development plays an important role in reducing distances travelled within the city. The number of areas with a 30 km/h speed limit has steadily increased. Part of Reykjavik's traffic-lights system is now centrally controlled by a Green wave system, which reduces traffic speed and tailbacks at traffic lights, and thus reduces exhaust emissions.

Construction sites

- Through the licence process for developers, the City of Reykjavik compels developers to dampen and secure material from demolished structures immediately, in order to prevent pollution by particulate matter.
- For large construction sites, licence and tender documents require lorry tyres to be washed, to prevent dirt and sand being transferred to the city streets.
- The City has taken action to minimise pollution from its own construction sites.

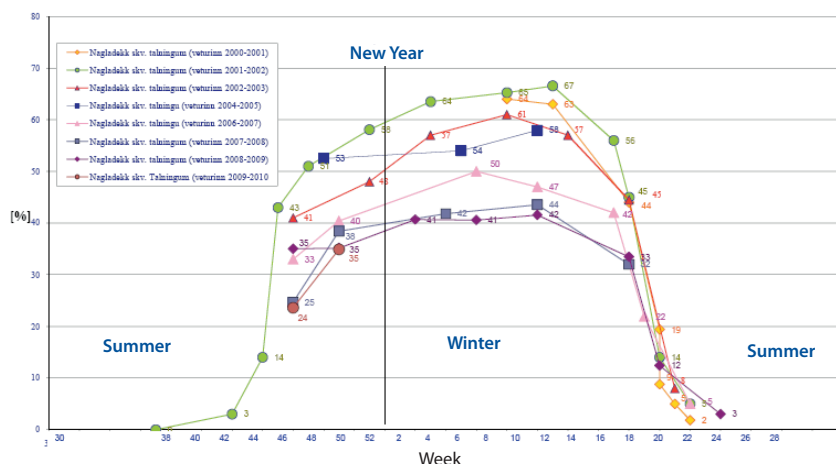


Figure 6.8
Mean distribution of studded tire usage in Reykjavik for winter seasons starting from 2001 until 2008 - 2009. Horizontal axis show weeks. Vertical axis shows percentage of vehicles using studded tyres. Winter seasons are shown as plotted series.

6 Quality of Local Ambient Air

B. Information to the public (both inhabitants and tourists) on air quality levels (e.g. web pages, information screens) in order to increase public awareness and change behaviour

- On the City of Reykjavik website, the public have access to statistics on levels of all air pollutants: both real-time data and graphic material (see www.loft.rvk.is). Various other documents and reports on pollution levels are also accessible on the website. Figures for PM10 appear on the homepage of the City of Reykjavik website, and in one of Iceland's leading on-line news sites (see www.mbl.is/mm/frettir/vedur/). Information is presented clearly in easily-understood traffic-light form (see figure 6.9).



Figure 6.9
An example of traffic light form for particulate matter (PM10) published on homepage of the City of Reykjavik, see www.reykjavik.is. On the left side it presents an hour value for PM10 but on the right side it presents mean concentration from midnight.

- When the air quality response team issues a warning, it is sent to all major media, to all preschools and schools in Reykjavik, and to all municipal agencies. The warning explains why the level of a certain air pollutant is expected to exceed health limit levels, and advice is provided on how to reduce pollution, if possible. The City of Reykjavik also regularly issues updates on air quality to a large number of recipients. These state how often health limit levels have been exceeded, and what the source of pollution was. These updates also reach the media.
- The City of Reykjavik has in recent years organised an annual publicity campaign urging less use of studded tyres: "Dust Free Reykjavik". Posters drawing attention to the damage caused by studded tyres, and pointing out better alternatives, have been distributed to tyre workshops (see figure 6.10). The City of Reykjavik has also held an advertising campaign to urge people to switch off their car engines, instead of leaving them idling when not driving (see figure 6.11).
- The City of Reykjavik has taken part in organising seminars and meetings on air quality for various parties, and has invited the media to courses on air quality and climate change, in order to draw media attention to these matters. This has all yielded results. The number of studded tyres used in the city has dropped considerably, and media coverage of matters of air quality is frequent and informative.

Figure 6.10
Two posters used in annual advertising campaign against studded tyres, called "Dust Free Reykjavik" (in Icelandic: "RYKLAUS REYKJAVÍK").



Figure 6.11
A poster used in advertising campaign to urge people to shut off their car engines, instead of leaving them idling when not driving.

6.3 Short and long term commitments for improvement of air quality

The City of Reykjavik Climate and Air Quality Policy emphasises that the air shall always be healthy, and that efforts will be made to enhance air quality in Reykjavik. The policy states long-term targets for air quality, and emphasis is placed inter alia on the use of domestic green energy. Many of the planned measures concern both long- and short term objectives, such as:

- The City of Reykjavik aims to purchase an Urban Air Quality Management System, together with other authorities in the capital area. Such a system will facilitate collation of data of air quality, weather and traffic in one place, which will be useful in mapping the distribution of air pollutants in the city. The system will be useful in environmental impact assessments, in urban planning, and in predicting what strategies will be most fruitful in the long and the short term to reduce pollution. The model will also be used for forecasting, and possibly in epidemiological research, as it will be possible to map residence areas of people whose health is adversely affected. The City of Reykjavik will contribute an estimated 87.500 EUR to the system in the years 2011 or 2012.
- Health research is an important factor here, in connection with both long- and short-term measures. The City of Reykjavik has supported such research, and the first findings of studies on the health effects of pollution in Reykjavik have recently been produced. Such research will help pinpoint where it is most important to strive to reduce pollution. The City is also collaborating with parties at the National Hospital and

the University of Iceland on research into air quality in Reykjavik.

- The City of Reykjavik is launching a new study on the composition of particulate matter (PM10). The last such study was carried out in 2002. Since then the use of studded tires has been considerably reduced, and it is important to ascertain whether asphalt particles now constitute a smaller proportion of the content of PM10. These findings will also help to indicate future measures by the City in both the long and the short term. The estimated cost of the study is about 12.500 EUR in the year 2011 and 9.375 EUR in the year 2012.
- The City of Reykjavik has requested authority from the national government to impose a fee for use of studded tires, or even to prohibit their use entirely. Such a ban would not at present be lawful.
- At least one more mobile monitoring station is to be acquired. Levels of nitrogen dioxide (NO₂), particulate matter (PM10), sulphur dioxide (SO₂) and hydrogen sulphide (H₂S) are to be monitored. It is important to gather more information about e.g. experiments with dust-binding, regarding the dispersion of hydrogen sulphide (H₂S) and the impact of seaborne traffic on air quality. The number of cruise ships visiting Iceland has been increasing in Reykjavik in recent years. A new mobile monitoring station is estimated to cost around 125.000 EUR. It is the three-year plan of the City of Reykjavik to invest in a new measurement station.
- Information flow to the public is to be enhanced, for instance by offering a text-messaging service when pollutants are expected to exceed permitted levels, and by making information even more accessible on the City's website. Foreign residents' and tourists'

access to information on air quality in Reykjavik is also to be improved.

Clearly, stricter requirements for better air quality will lead to lower emissions of greenhouse gases.

Short term measures

- In connection with the City of Reykjavik Action Plan on Air Quality, a request has been submitted to the national government for authority to reduce traffic speed if deemed necessary, and to close busy roads when PM10 levels are likely to exceed health limit values.
- Dust-binding the road surface with magnesium chloride, and street-sweeping and -washing, are at the experimental stage in Reykjavik. Tests will continue, and effective methods will be developed further. These tests are estimated to cost about 37.500 EUR in 2010.
- Under the City of Reykjavik Action Plan on Air Quality, pollution by dust from construction sites is to be reduced, by such means as dampening gravel sites and work areas. The estimated cost for the year 2010 is between 187.000 - 250.000 EUR.
- The City of Reykjavik Policy on Climate and Air Quality aims to reduce the risk of soil erosion and dust storms from the countryside around the city. The estimated cost for the year 2010 is 6.000 EUR.
- The City of Reykjavik Policy on Climate and Air Quality aims to reduce the public health impact of air pollution caused by fireworks on New Year's Eve.

Long-term measures

The City of Reykjavik Policy on Climate and Air Quality states the following long-term measures:

- All vehicles in the city are to use domestic green energy sources. The City of Reykjavik aims to be a world leader in the conversion to electric vehicles in the city, and a group of specialists has been appointed to formulate measures to achieve this target.
- The City of Reykjavik has the unique advantage of having abundant sustainable primary energy sources, i.e. geothermal energy, some of which has been harnessed to generate electricity. The aim is to develop a sophisticated system for recharging electrical vehicles, at homes and all over the city.
- Proportion of public transport is to double in next 20 years and the number of designated bus lanes is to be increased still further. The aim is that pedestrian/cycle traffic should comprise 30% of total traffic in 2020.
- Particulate matter (PM10) pollution from surface road wear is to be reduced by further decreasing use of studded tyres. By 2012 the aim is that under 20% of vehicles be fitted with studded tyres. The estimated cost for the advertising campaign against studded tyres next winter is 6.000 EUR.

6.4 Documents, websites and documented decisions

Regulations

- Regulations on Air Quality no. 787/1999. (ice)
- Regulations on sulphur dioxide, nitrogen dioxide and nitrogen oxide, benzene, particulate matter and lead in the atmosphere and information to the public no. 251/2002. (ice)
- Regulations on monitoring of levels of ozone at ground level and warnings to the public no. 791/1999. (ice)
- Draft regulations on hydrogen sulphide. (ice)

Decisions

- Reykjavik Health Committee Action Plan on Air Quality, 2009. (ice)
- The City of Reykjavik Climate and Air Quality Policy, 2009. (ice)
- Reykjavik Transport Plan – Analysis of status quo and direction, 2006. (ice)
- Green Steps in Transport, 2009. (ice)
- Shaping Reykjavik, Reykjavik's Local Agenda 21, 2006. (eng)
- Reykjavik electric car city, 2009. (ice)
- Licence requirement for temporary operations in demolition of buildings and other structures, 2007. (ice)
- Request from the City of Reykjavik to the national government for authority to impose fee for use of studded tyres and reduce traffic speed, 2009. (ice)

Documents

- Air Quality Report 2008 for Reykjavik. (ice)
- Air Quality Report 2007 for Reykjavik. (ice)
- Air Quality Report 2006 for Reykjavik. (ice)
- Air Quality Report 2005 for Reykjavik. (ice)
- Air Quality Report 2004 for Reykjavik. (ice)
- Air Quality Report 2003 for Reykjavik. (ice)
- Air Quality Report 2002 for Reykjavik. (ice)
- Method for determining the composition of airborne particle pollution. Composition of particle air pollution in Reykjavik, 2003. (eng)
- Particulate Matter Pollution in Reykjavik 1995 -2005. (ice)

Websites

- Real-time air quality data: www.loft.rvk.is
- Presentation and abstract from an MSc. thesis by Hanne Krage Carlsen: Air pollution and dispensing of asthma medication in Iceland's capital region (eng): [www.vegagerdin.is/vefur2.nsf/Files/AhrifLoftmengun_SalaAstmalyf-fyrirlestur/\\$file/Hanne_Krage_Carlsen.pdf](http://www.vegagerdin.is/vefur2.nsf/Files/AhrifLoftmengun_SalaAstmalyf-fyrirlestur/$file/Hanne_Krage_Carlsen.pdf) and [www.vegagerdin.is/vefur2.nsf/Files/AhrifLoftmengun_SalaAstmalyf-agrip/\\$file/Ahrif%20loftmengunar%20a%20solu%20astmalyfja](http://www.vegagerdin.is/vefur2.nsf/Files/AhrifLoftmengun_SalaAstmalyf-agrip/$file/Ahrif%20loftmengunar%20a%20solu%20astmalyfja)
- Annual advertising campaign against studded tyres website: www.rvk.is/desktopdefault.aspx/tabid-2664
- Information on particulate matter (PM10) pollution (traffic-light indicator on the bottom right side „Loftgæði í Reykjavik“): www.reykjavik.is
- Information concerning Air Quality impact on health and general information: www.rvk.is/desktopdefault.aspx/tabid-1007

6.5 Disadvantages resulting from historical and/or geographical factors which may have influenced this indicator area negatively

As the city is spread over a wide area, it may be necessary for residents in certain districts to travel some distance to access services resulting in wide private car use affecting the air quality in the city. Pollution may spread from other areas; a good example of this are for e.g. sandstorms from southeast coast of Iceland and the volcanic eruption in the Eyjafjallajökull glacier. There are even cases of particulate matter pollution, for instance, reaching Iceland from mainland Europe. The City authorities may thus in certain cases experience difficulty in managing air quality. On New Year's Eve, Icelanders set off huge quantities of fireworks, stemming from an old-established tradition. This has led to the maximum levels of particulate matter pollution in Reykjavik. Adjacent to the city are geothermal fields which have been harnessed in recent years, releasing into the atmosphere higher levels of hydrogen sulphide than are emitted by the hot springs in their natural state.

7 Noise pollution

- 7.1 The present situation and developments over the past five to ten years
- 7.2 Measures implemented over the past five to ten years to reduce noise including i.a. the existence, quality and level of implementation of a noise management plan
- 7.3 Long and short term measures aimed at reducing noise pollution
- 7.4 Documents, websites and documented decisions
- 7.5 Disadvantages resulting from historical and/or geographical factors



7.1 The present situation and developments over the past five to ten years

Noises issues have received particular attention starting in 1980. In comparison to other heavily populated European cities, the scale of noise problems in Reykjavik is considerably smaller, mainly due to its population size and also because there are no trains or trams. Thus, the main source of noise in Reykjavik is motor traffic. Noise arising from activities relating to sections of the harbour is confined to those areas and has little impact on residents. Businesses and industry in Reykjavik must comply with regulations on noise, in addition to the city authority's monitor compliance. The City of Reykjavik has used a Nordic model, Nordic1996, for calculating traffic noise while using SoundPlan software. Traffic noise is calculated as a 24-hour L_{eq} (Equivalent Sound Level), see figure 7.1. Under Icelandic rules the L_{eq} from traffic must not exceed 55dB(A) outside buildings in new residential housing.

Noise levels (L_{den} day-evening-night assessment sound level) have been charted for all Reykjavik major traffic streets in accordance to EU Directive no. 2002/49/EC. Work is under way to formulate an action plan based on the noise charting. A draft has already been presented within the City administration, see figure 7.2.

A similar charting exercise was carried out in 1996 to chart homes adjacent to noise sources over 65dB(A), see figure 7.3. The L_{eq} was calculated using the Nordic model. The outcome was that of a total of 42.000 homes, 2.200 (or 5,2%) experienced noise levels of 65dB(A) outside buildings, which exceeds acceptable levels.

Figure 7.1
Calculated traffic noise L_{eq} . The black line shows the 65 dB(A) border.

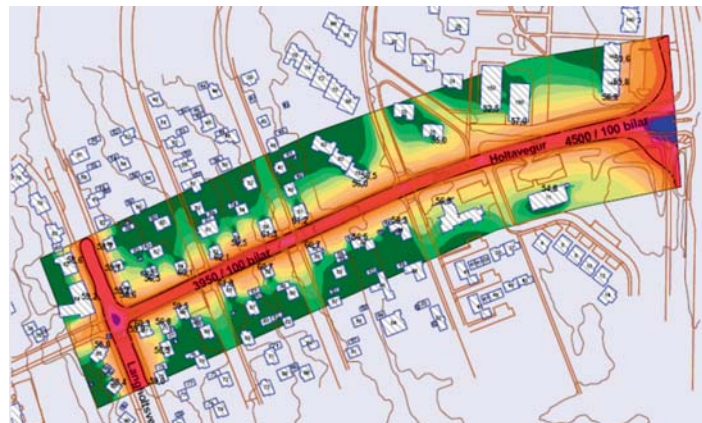


Figure 7.2
Charted L_{den} according to 2002/49/EC for the main roads in Reykjavik. The figure shows the center of Reykjavik.

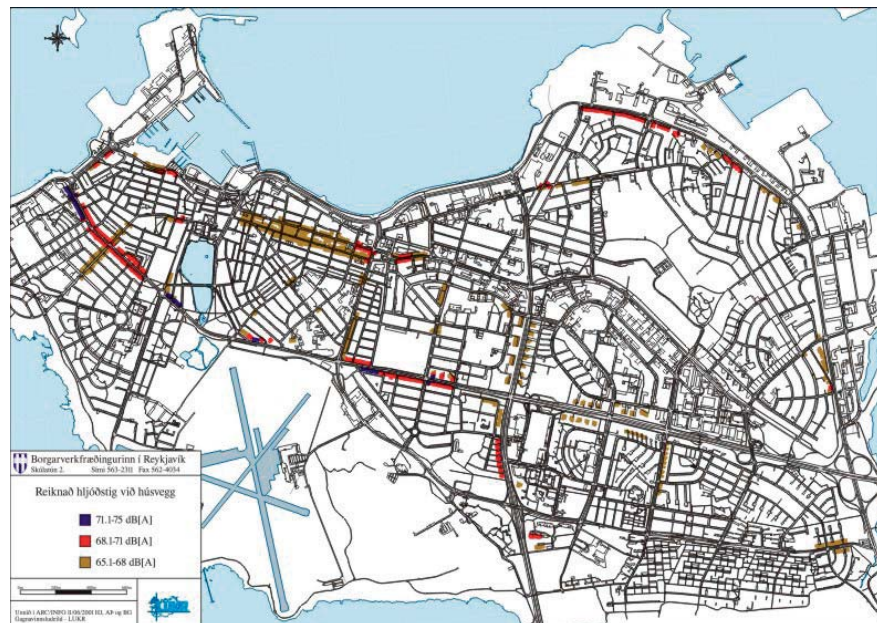


Figure 7.3
Chart of homes adjacent to noise sources over 65dB(A).

Figure 7.4
Share of population exposed to noise values above 55dB(A) L (day)

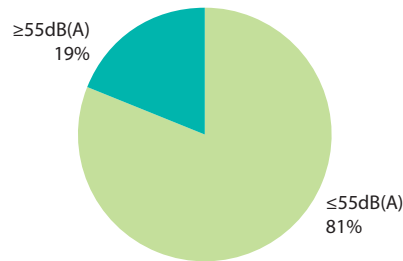
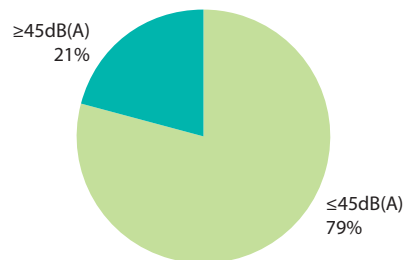


Figure 7.5
Share of population exposed to noise values above 45dB(A) L (night)



A. Share of population exposed to noise values of L (day) above 55 dB(A):

The number of inhabitants living in homes where the noise level outside the building L(day) exceeds 55 dB(A) is about 23.000, or 19% of the population, see figure 7.4.

B. Share of population exposed to noise values of L (night) above 45 dB(A):

The number of inhabitants living in homes where the noise level outside the building L(night) exceeds 45 dB(A) is about 24.000, or 21% of the population (see figure 7.5).

The figures 7.4 and 7.5 are based on calculations made in 2007 following charting of all the major traffic routes in the city in accordance to Directive no. 2002/49/EC, and calculated on the basis of L_{den} noise values.

7.2 Measures implemented over the past five to ten years to reduce noise including i.a. the existence, quality and level of implementation of a noise management plan

The City of Reykjavik has introduced various measures, large and small, in order to counteract traffic noise. As well as new traffic structures and alterations to existing ones, special arrangements have been made to mitigate noise levels and to ensure that noise will not exceed 55dB(a) outside buildings, as provided in Icelandic regulations. Special measures have been implemented in many places around the city to reduce traffic noise in locations where increased traffic has had a considerable impact on noise levels. The City responds to all complaints about traffic noise in one way or another. Noise levels are calculated or measured at the relevant location and efforts are made to mitigate the situation as much as possible.

The following are the principal measures implemented by the City of Reykjavik in recent years:

Grants to home owners

In 1997 the City of Reykjavik started allocating grants to home owners in order to carry out work to reduce noise levels for cases in which the noise level outside the building was 65dB(A) or higher. These measures aim to reduce the number of inhabitants who live with unacceptable noise levels on busy streets, as well as to ensure that indoor noise levels will never exceed 30

Table 7.1
Homes with Leq exceeding 65 dB(A) are divided into three categories, with differing entitlement to grant payments. Higher noise level gives larger grant.

Category	Noise level
1	>71 dB(A)
2	68-71 dB(A)
3	65-68 dB(A)

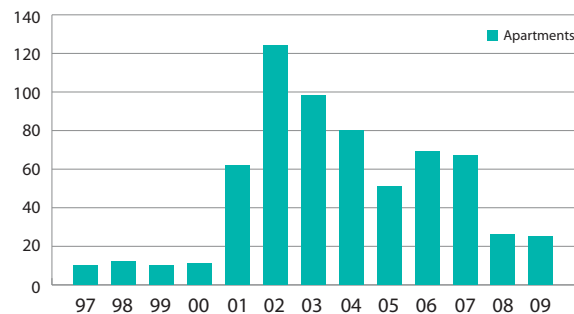


Figure 7.6
Number of grants pr. year.

dB(A). Homes with Leq exceeding 65 dB(A) are divided into three categories, with differing entitlement to grant payments. A higher noise level gives a larger grant (see table 7.1).

By 1999, 317 households had applied for City grants and 173 grants had been allocated, see figure 7.6. By 2009 about 1.100 applications had been received, of which about 650 met the criteria. The City has spent 1,1 million EUR on this project in the period of 1997-2009.

Restriction of noise from development sites

A growing proportion of noise complaints received by the Public Health Authority in recent years relates to noise originating at construction sites. When the noise regulations were revised in 2008, rules were introduced to limit the time when noisy and especially noisy work is permitted, in order to reduce noise from building sites. After the new regulations were introduced, more success has been achieved in reducing noise from construction and noise nuisance in residential areas.

Promotion of green transport

The City of Reykjavik has given priority to green transport in recent years, with the Local Agenda 21 and other programmes and has been encouraging the people of the city to use other modes of transport than private cars, i.e. to walk, cycle or take the bus more than is currently the case. This is conducive to reducing noise pollution from traffic. The City has also placed emphasis on development and use of green vehicles, powered by hydrogen, methane or electricity, which lead to reduced

noise levels. The City has already introduced many quiet green vehicles for its operations, such as buses and waste collection vehicles (see chapter 2, Local transport).

Encouraging use of green transport

Major effort has been put into developing the city's network of cycling and footpaths, in order to encourage green travel even more and to counteract use of private cars, which is a source of noise pollution. In recent years, much has been done to improve conditions for buses by designating priority bus lanes with the aim of achieving increased use of public transport in the future, which will also mean less use of private cars and decreased traffic noise. (see chapter 2 of Local transport).

Reducing aircraft noise

As Iceland's largest domestic airport is located within the City of Reykjavik, there is considerable air traffic over the city. In June 1999 the City of Reykjavik reached an agreement with the Ministry of Transport that touchdowns practised in flight instruction and training should be transferred to another airfield at an appropriate distance from Reykjavik. This led to a reduction in noise and inconvenience from that type of air traffic in the vicinity of Reykjavik Airport. The operating licence for the airport is issued by the Public Health Authority which sets strict requirements for noise levels, including restrictions of operating hours, "touch-and-go" landings, and noise on the ground. ISAVIA (Flugstoðir ohf.), which manages the airport, as well as the City of Reykjavik jointly examined the flight paths of all smaller aircraft over the city and designed them to minimise inconvenience caused by

landings and take-offs. Unusually noisy models of aircraft have been banned from using the airport except in emergencies. Furthermore, under the current Municipal Plan 2024, the airport is to be moved to the periphery of the city. In the ongoing revision of the Plan this policy is assumed to be readopted.

Reducing traffic speed in residential districts

Another measure which has an impact on traffic noise is to reduce speed limits. Since 1995, systematic efforts have been made to reduce speeds within residential districts from 50km/h to 30km/h, and now the vast majority of neighbourhoods containing schools have this speed limit. The people of Reykjavik are also being discouraged from using studded tyres. Ever since 1980, the City authorities have campaigned against the use of studded tyres in winter in order to reduce wear and tear on tarmac which leads to particulate-matter pollution. These efforts are increasingly successful and have also led to reduced traffic noise in winter.

7.3 Describe planned long and short term measures aimed at reducing noise pollution

The focus will continue to be on improving noise levels in residential districts, so that noise levels do not exceed the prescribed limits. The following are the principal objectives which the City aims to achieve:

Short term measures

By 2012 charting of noise levels is to be completed for all streets in Reykjavik with a traffic load of more than three million vehicles per year, as provided by Directive no. 2002/49/EC.

- In new districts of the city which are at the construction stage, measures will be applied in order to ensure acceptable noise levels, i.e. that noise should preferably not exceed 55dB(A) at exterior walls, as provided in Icelandic regulations. In existing districts where noise exceeds these limits, noise abatement techniques will be applied, e.g. construction of sound beams or barriers, or introduction of stricter requirements for construction materials that mitigate noise.
- The City will continue to offer grants to residents on major roads to improve window fittings in order to ensure acceptable noise levels indoors.
- A further reduction in speed limit is planned for arterial and collector roads (linking residential areas), from 50 km/h to 40 km/h, especially in locations where such routes pass through school districts; it is also intended to peg speed limits in residential

districts at 30 km/h.

- Take-offs and landings at the domestic airport will continue to be restricted as much as possible in the evening and at night in an effort to minimise unnecessary noise nuisance. The Public Health Authority reviews the operating licence for Reykjavik Airport every four years and introduces stricter requirements if deemed necessary. The airport is subject to regular annual monitoring and the Public Health Authority intervenes in order to reduce noise pollution if it fails to comply with the conditions of its licence.
- The City of Reykjavik continues its educational and information campaign to persuade the people of Reykjavik to use other types of tyres than studded tyres in winter.

Long term measures

Under the Local Agenda 21, the City of Reykjavik's vision for the future is that noise levels will be acceptable throughout the city and that systematic efforts to reduce noise levels in residential districts will continue. The City's objective is that transport is to be efficient, safe and green and also to strive to minimise noise pollution. Recreational areas are to be separated off by noise beams, glass screens, tree barriers etc. in order to reduce noise pollution from traffic and enhance the safety of these areas.

According to Directive no. 2002/49/EC on environmental noise, which has been implemented in Iceland, it is required to designate quiet areas (noise below 45dB(A))

in municipal and regional plans. No such areas have been designated as of yet as work on a strategic noise map for Reykjavík City is not finished; however, in the ongoing revision of the Municipal plan and other future planning work, quiet areas will be included.

The City of Reykjavík has formulated ambitious targets for continuing to develop a good system of cycling- and footpaths. Measures to promote walking and cycling as modes of transport are discussed in the City's Bike Plan and Transport Plan along with e.g. providing better conditions for bus transport with priority lanes, and thus reducing car traffic in the city as much as possible. The City of Reykjavík has set itself the objective of replacing a large proportion of its vehicles with electric vehicles and hereby setting a good example for other cities in the use of such vehicles. Increased use of green vehicles will greatly reduce traffic noise in the city.

7.4 Documents, websites and documented decisions

Decisions

- Shaping Reykjavík, Reykjavík's Local Agenda 21, 2006. (eng)
- Reykjavík Transport Plan – Analysis of status quo and direction, 2006. (ice)
- Municipal Plan 2024: The existing Municipal Plan 2001-2024 is currently under revision and a new Plan is expected to be agreed this year. (ice)
- The Reykjavík Bike Plan, 2010. (ice)

Documents

- Licence issued in 2008 by Public Health Authority for Flugstoðir/Isavia for Reykjavík Airport, 2008. (eng)
- Reykjavik City rules of grant allocation, 2001. (ice)

Websites

- City of Reykjavík Environment Website:
www.umhverfisvefurinn.is/default.asp?sid_id=1343&tre_rod=005|&tId=1

7.5 Disadvantages resulting from historical and/or geographical factors which may have influenced this indicator area negatively

Reykjavík Airport originated during World War II as a military airfield, constructed by occupying British forces. The location at Vatnsmýri, then at the edge of the town, was selected on strategic and aeronautical grounds. The city has grown to surround the airport, and this has led to noise pollution due to air traffic over the city. In collaboration with aviation authorities, measures have been introduced to reduce noise pollution from air traffic and in the future the intention is to transfer the airport to the periphery of the city.

The City of Reykjavík was constructed in the nineteenth century, at the time when cars were introduced so that the design was aimed at automobiles, which has later been the main course of increasing noise in the city. Starting at the turn of the century in 2000 there has been much change of heart in issues surrounding the design of the city in order to reverse its development and increase emphasis on other forms of transport than cars; attempts have been systematically made to reduce the need for people to own a car in order to go about the city.

8 Waste production and management

- 8.1** The present situation and developments over the past five to ten years
- 8.2** Measures implemented over the past five to ten years aimed at reducing the amount of waste produced, the amount of waste sent to landfills, particularly biodegradable waste, and measures which have promoted awareness raising programmes
- 8.3** Long and short term measures to reduce of the amount of waste produced and minimise the amount of waste sent to landfills, particularly biodegradable waste
- 8.4** Documents, websites and documented decisions
- 8.5** Disadvantages resulting from historical and/or geographical factors which may have influenced this indicator area negatively



8.1 The present situation and developments over the past five to ten years

The City of Reykjavik is a party to a municipal waste management company named Sorpa (63%). Sorpa is jointly operated by seven municipalities in the capital area and coordinates waste management for these municipalities. The City is responsible for the collection of household waste in the city collected directly from households and it supervises local drop-off centres for sorted household waste. Businesses are responsible for the collection and disposal of their own waste. Private waste companies offer collection of commercial waste and offer households bins for sorted waste.

Municipal waste is defined under Icelandic law as household waste, e.g. food waste, paper, plastics, garden waste, glass, timber, metals, etc, and waste of the same kind from businesses. In the bylaw of the City of Reykjavik it is stated that waste shall be sorted and recycled or reused as much as possible. Production of municipal and household waste decreased considerably in the past three years, with a 36% decrease since 2007. Handling of municipal waste has been such that ca. 60% is landfilled and ca. 40% goes into material recycling and biological treatment. Hazardous waste from health care facilities is incinerated thus an insignificant portion is used in energy recovery. Mechanical biological treatment is 0%. Handling of household waste is done in a manner that ca. 50% is landfilled and 50% goes into material recycling and biological treatment and incineration is 0%.

A. Amount of waste per capita

Municipal waste

The total amount of municipal waste in Reykjavik in 2009 was 465 kg per capita. In assessing of the amount of municipal waste in Reykjavik, the total amount handled by Sorpa and the private waste companies was calculated on a per capita basis. Trends in recent years show that the amount of waste produced decreased by slightly more than 7% from 2002 to 2004, but increased by approximately 15% from 2004 to 2007. The amount of municipal waste peaked in 2007, and then decreased by 13% the following year. Waste production decreased by 23% between 2008 and 2009 (see figure 8.1).

Household waste

The total amount of household waste in Reykjavik in 2009 was 315 kg per capita. The production of household waste increased from 2005 to 2007 when waste production peaked and from the year 2007 the amount of household waste decreased by 24% (see figure 8.2).

Production of waste has decreased considerably in the past three years; this can be attributed to radical changes in the economic situation. The amount of waste is dependent on the economic position of the residents, and the economic recession in Iceland has naturally had an impact on the economic position of individuals and businesses in Reykjavik. The waste production in November 2009 was for example equal to the waste production in November 1996.

Figure 8.1
Total amount of municipal waste (kg per capita).

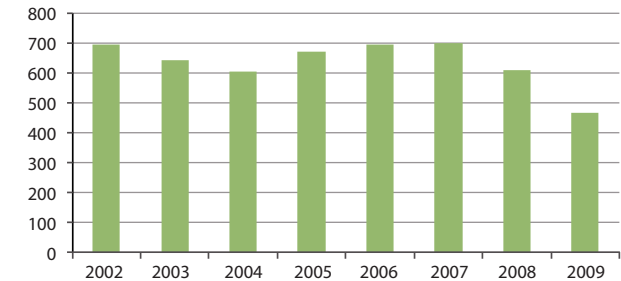


Figure 8.2
Total amount of household waste (kg per capita).

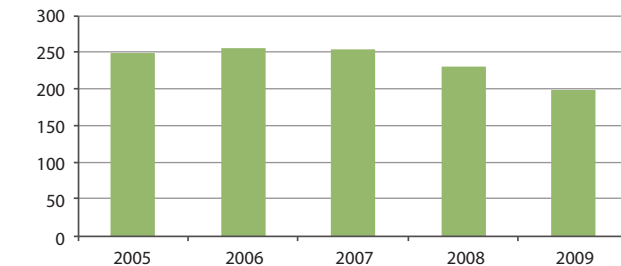


Figure 8.3
Percentage of total municipal waste sent to a landfill.

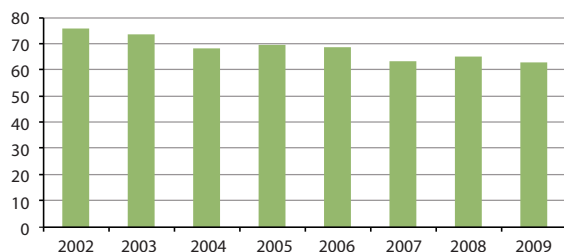


Figure 8.4
Percentage of recycled municipal waste.

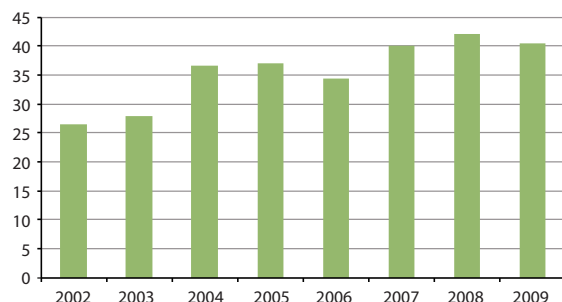
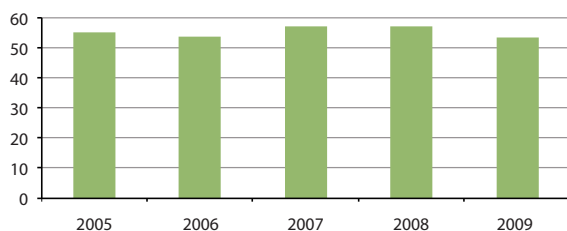


Figure 8.5
Percentage of recycled household waste.



B. Proportion of total/biodegradable waste sent to landfill

Municipal waste

In 2009, 63% of all municipal waste was sent to a landfill. The proportion of total municipal waste sent to a landfill has decreased by 13% since 2002. In recent years this proportion has been between 63% and 65% (see figure 8.3).

Biodegradable waste

In a Common Regional Waste Management Plan for 2009-2020, total waste figures for 2006 were examined for the municipalities in the capital area. Quantities of certain categories of waste were assessed and no attempt was made to estimate the quantities which are handled by private waste companies. This study revealed that the amount of biodegradable waste produced in the capital area was 151.000 tonnes, of which 82.000 tonnes went to a landfill. Approximately 54% of biodegradable waste collected in the capital area thus went to a landfill in 2006.

In the Regional Waste Management Plan for 2005-2020 a similar assessment was made, which revealed that 67% of biodegradable waste went to a landfill in 2002. The proportion of biodegradable waste going to landfill has thus decreased.

All biodegradable waste which goes to a landfill is utilised for gas adsorption: the landfill site has a gas adsorption system which collects landfill gas in a refining plant, to produce methane. The methane is used as fuel, mainly for vehicles. Today the majority of the City's refuse collection vehicles run on methane. Since methane is a powerful greenhouse gas, this gas adsorption and utilisation reduces the landfill site's impact on the environment and reduces the use of fossil fuels.

C. Percentage of recycled municipal waste

Municipal waste

In 2009 40% of municipal waste was recycled. The proportion of recycled municipal waste has increased by 13% since 2002. Recycling has been around 40% the last three years. The trend since 2002 is shown in figure 8.4.

Household waste

In 2009 53% of household waste was recycled. The proportion of recycled household waste has not changed much in the last five years. It has been between 53% and 57% (see figure 8.5).

Percentage of packaging recycled of municipal waste and percentage of packaging recovery (incineration) of municipal waste

The Icelandic Recycling Fund is responsible for meeting targets for recycling and recovery of packaging waste in Iceland. The following numbers are from The Icelandic Recycling Fund and are valid for the entire country, though in Reykjavik 40% of the population resides.

In 2009 68% of paper and cardboard packaging was recovered from municipal waste, 60% of which was recycled and 8% was incinerated with energy recovery. The percentage of plastic packaging recovered was 44%, 26% of which was recycled and 12% was incinerated with energy recovery. This recovery proportion meets the targets of the EU for recovery of packaging, as well as those of the National Waste Management Plan for Iceland. Data on metal, glass and timber packaging recovery are not available.

8 Waste production and management

European Green Capital Application 2012-2013 Reykjavik, Iceland

8.2 Measures implemented over the past five to ten years aimed at reducing the amount of waste produced, the amount of waste sent to landfills, particularly biodegradable waste, and measures which have promoted awareness raising programmes

The City of Reykjavik has had an impact on the production and management of waste, largely by operating an effective and easily-understood system of collection and reception of waste, which makes it easy for each individual to dispose of waste appropriately.

Regional Waste Management Plan

The City of Reykjavik is a party to the municipal waste management company Sorpa, which together with three other municipal waste management companies has created a Regional Waste Management Plan (RWMP) in accordance with Directive 75/442/EEC. The RWMP was first issued in 2005 and revised in 2009 and has provided overview of the situation of waste management in the region. Predictions have been made for possible development to 2020 and a plan for actions which will be undertaken to prepare municipalities to meet the demands which are in place for handling of waste.

Recycling centres

Reykjavik has four recycling centres where individuals and smaller businesses can bring sorted waste for recycling and disposal. The centres are within 4 km of most homes in the city. Individuals pay no fee for dis-



Figure 8.6
Recycling centre in Reykjavik.

posal of household waste at recycling centres, but a fee is charged for items not classified as normal household waste. The recycling centres receive all types of waste except vehicles. Waste is classified there into 26 categories.

Drop-off centres

The City has operated drop-off centres for about 15 years adjacent to shops and public places. A drop-off centre is within 500 m from every household in Reykjavik, in total 53 centres. At every drop-off centre there are two containers for sorted waste: one for paper and non-corrugated cardboard, the other for plastic packaging.

Household waste bins

The City of Reykjavik provides a waste collection service from households. The fee paid for this service is based upon the number and size of bins, and frequency of collection. City residents can reduce their fee by producing less waste and sort it. By doing that the households can have fewer or smaller bins or have the frequency of



Figure 8.7
Drop-off centre in Reykjavik.



Figure 8.8
Colour coded bins from the City of Reykjavik.

waste collection reduced. The city of Reykjavik also offers a blue recycling bin for paper and non-corrugated cardboard. When the decision was made in 2006 to introduce the blue bin, newspapers and magazines accounted for about 27% of mixed household waste. By 2009 this proportion had decreased to 17%.

Recycling bins are also available to Reykjavik residents from private waste companies. These bins facilitate sorting: most categories of recyclable waste can be placed in the bins: newspapers, magazines, office stationery, non-corrugated cardboard, plastic containers and metals.

The Good Shepherd

Sorpa runs an open market for used household goods. The main aim of the market is prolonging the life of household goods, promoting reuse and reducing what goes to the landfill site. There are special containers for household goods destined for The Good Shepherd at the recycling centres. In 2008 approximately 800 tonnes of items went to reuse in that manner with all proceeds going to charity organizations.

Garden waste composting and reuse of garden waste

According to waste management bylaw in Reykjavik, it is not permitted to set yard and garden waste into containers for household waste. Households can bring waste from gardening activities to the recycling centres. Since 1994, Sorpa has composted garden waste and the compost is sold at the recycling centres and at the landfill site.

For the past five years, youngsters in the Reykjavik Work School summer employment programme (see appendix 4) have spread grass cuttings from open spaces in Reykjavik on areas of soil erosion at the periphery of the city, with good results.

Recycling fee and deposit system

According to the act no 162/2002 on Recycling Fees, a recycling fee is imposed on 20 product categories in Iceland e.g. plastic and paper packaging, vehicles, tyres and hazardous waste. The fee pays for the recovery cost on any waste remaining when the object's service life is over. Those paying are domestic manufacturers and importers bringing goods subject to the fee to Iceland. The fee has had an impact on production and manage-

ment of waste, through economic incentives which are conducive to more re-use and recycling. Sorpa has played an important role in implementation of the recycling fee act.

A deposit system is operated for beverage containers (bottles and cans). This system has been a resounding success: about 80% of deposit-paid bottles and cans come in for recycling. Sorpa immediately became one of the most robust reception entities in Iceland and a reception for beverage containers became available at all Sorpa's recycling centres.

Management system for Hazardous waste

The management system for hazardous waste in Iceland is in compliance with EU Hazardous Waste Directive. Recycling fee is imposed on certain hazardous substances so the holder of the waste can return it free of charge. Both individuals and commercial enterprises are required by regulation and the city's bylaw to deliver hazardous waste to a licensed hazardous waste reception. Individuals and small businesses can dispose of hazardous waste at the recycling centres without paying a fee. Commercial enterprises deliver this waste to a licensed hazardous waste management company, or have it delivered there by private contractors.

Management system to comply with EU Batteries Directive

The EU batteries directive 2006/66 is now being implemented in Iceland. Even though this Directive has not yet been transposed into Icelandic law the management system is in compliance with the Directive. Batteries are subjected to the recycling fee and they are managed in

the same way as other hazardous waste, plus they can be delivered to petrol stations. Households and commercial enterprises are provided with special containers for batteries.

Management system to comply with EU End-of-Life Vehicles Directive

The management system in Iceland is in all essentials in compliance with EU End-of-life Vehicles Directive. According to the act on Recycling Fee no. 162/2002 the last owner of a vehicle can turn it in to a collecting station for recycling or final disposal and a payment for the vehicle is available. The Icelandic Recycling Fund pays for the removal and disposal of hazardous substances and recycling of vehicles.

Management system to comply with EU WEEE Directive

The Directive was implemented into Icelandic law as a producer's responsibility but local authorities must provide facilities to receive such waste. Sorpa's recycling centres receive electrical and electronic waste but producers and local dealers pay the cost of collection containers, transport and recycling of the waste.

Awareness-raising programmes

Reduction of the amount of waste produced is the first priority of waste management in the City of Reykjavik. The City has nevertheless limited instruments to impact directly the production of waste therefore emphasizes has been on education and rising awareness. An integral part of Sorpa's service is informational and educational activities, for such diverse groups as business employees

8 Waste production and management

and pupils and teachers in schools all over the capital area. Sorpa publishes a range of information and educational material, and also holds seminars and conferences. In recent years this educational activity has flourished: for instance, the number of people visiting Sorpa's website has risen every year, and new material is constantly added. Sorpa is the country's leading provider of informational and educational activities. Educational activities aim to enhance awareness of sorting, recycling and reuse of waste and to motivate people to become responsible and green consumers. In 2007 a marketing campaign was launched to raise the credibility of recycling. Advertisements appeared in all the leading media, addressing the value of recycling and urging the public to sort for recycling: the slogan Sort and Drop Off, has become familiar nationwide. The City of Reykjavik is sponsor of Global Action Plan for the Earth in Iceland (GAP).

Examples of waste awareness publications:

- Sorpa gives out sorting tables for households. The tables indicate in a clear-cut manner how waste can be sorted, where to deposit it and general instructions for people regarding sorting and depositing. In addition, labels at recycling centres and the operating hours of Sorpa's facilities are mentioned: http://sorpa.is/resources/Files/Ymis-skjol/2009.10.1.flokkunartafla_net_2.pdf
- Sorpa also publishes a sorting table for commercial enterprises: http://sorpa.is/resources/Files/Ymis-skjol/flokkunartafla_fyrirtaeki_jan2008_00151.pdf
- Television, radio and newspaper advertisements have been produced on the process of recycling of paper, packages and other waste materials e.g. <http://sorpa.is/Fjolmidlarasin/Auglysingar/Pappir/>



Figure 8.9
Pupils learning how to sort in Sorpa's educational programme.

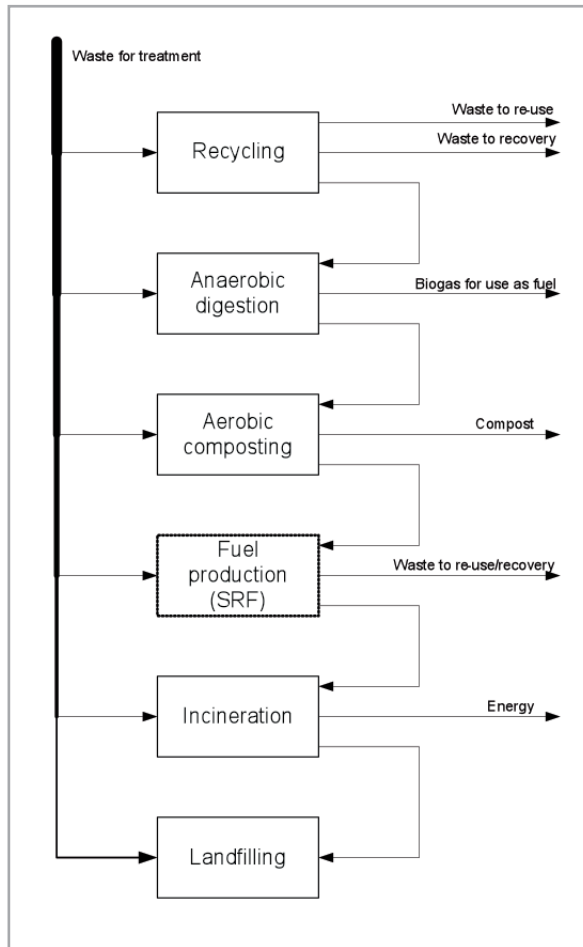


Figure 8.10
Waste hierarchy.

8.3 Planned long and short term measures to reduce of the amount of waste produced and minimise the amount of waste sent to landfills, particularly biodegradable waste

Waste management in The City of Reykjavik aims at reducing waste production and encourage recycling and reuse. This is done through education, by rising awareness and operating an effective and easily-understood system of collection and reception of waste. The City has also legally adopted a Regional Waste Management Plan, jointly with other municipalities in southwest Iceland.

Under the Regional Waste Management Plan a waste treatment hierarchy has been set up based on the European waste hierarchy and a life cycle assessment (LCA) for different waste treatment. Figure 8.10 shows the waste hierarchy.

The following processing of waste is to be introduced in order to attain targets for reducing waste disposal in landfills, particularly biodegradable waste:

Short term measures

• More sorting and recycling in 2010-2011

In order to achieve more sorting and recycling of waste, the intention is to introduce collection of sorted waste from every home in Reykjavik. Such sorting has hitherto been optional, but recycling bins will now be made compulsory. The various costs associated with collecting sorted waste from households have been examined in Reykjavik; changes may be expected in relation to waste collection methods in the city at the end of 2010, beginning of 2011.

• Gas-harvesting and composting plant 2012-13

Almost all electricity and space heating in the city is provided from green sources: hydro and geothermal. Heat energy from waste incineration would therefore be neither a competitive nor a green option in Reykjavik. Hence the intention is to install a combined anaerobic digester and composting plant, using the methane gas produced as fuel for vehicles, as an alternative to fossil fuel. This is an especially important project in Reykjavik, as transport is the main source of emissions of greenhouse gases in the city. Work is scheduled to commence on the facility in 2010, and it is to open in 2012 or 2013.

Long term measures

• Production of solid residue fuel (SRD) 2015

A feasibility study is intended for the possible production of SRD. If feasible, production of SRD is scheduled to commence in 2015. SRD will be used in Iceland or exported. Possible feedstock for SRD are plastics, tyres, cardboard and white painted or laminated timber.

• Waste incineration plant 2018-20

An assessment is to be made of the cost-effectiveness of incinerating waste, when the gas/composting plant is up and running, production of SRD has commenced, and clearer data will be available on the amount of waste to be incinerated. Incinerator size and the feasibility of different options will be evaluated on the basis of an overall examination of certain factors, and evaluation of mixed treatment.

- **Landfill**

Due to EU and Icelandic regulation requirements, landfilling of biodegradable waste has to be reduced. According to the Waste Management Plan, landfilling of biodegradable waste is planned to reduce to 50% of what was produced in 1995, by the year 2013. Disposal of biodegradable and combustible waste in landfills is scheduled to cease not later than 2020 which is stricter than both EU and Icelandic legislation requirements. Methane will continue to be processed from the present landfill site for as long as it remains harvestable.

- **Measures to reduce waste production**

Work will begin on defining the resources and limitations that municipalities have to work with in order to participate in tasks that are designed to reduce waste production.

Sustainability and climate change aspects of the regional waste management plan

During the planning process of the Regional Waste Management Plan, the environmental impact of handling methods were compared with a life cycle assessment. Calculations were made, for example, on greenhouse gas emissions and an assessment was performed on land usage for each handling method, i.e. for maximum recycling, handling with emphasis on solid residue fuel, building of incineration plant, handling with gas emission at the forefront. It became apparent that recycling has the least environmental impact both in regard to greenhouse gas emissions and land usage. The Regional

Waste Management Plan is subjected to Strategic Environmental assessment (SEA) where policy regarding projects that require Environmental Impact Assessment is formulated. SEA is included in the plan and with that environmental considerations such as sustainability and climate change are incorporated in to the plan.

Other methods applied by the City of Reykjavik for systematic reduction of waste quantities

In its sustainability policy Local Agenda 21 – Shaping Reykjavik, the City of Reykjavik states the objective of working systematically to reduce quantities of waste produced by institutions, businesses and residents in the city.

The following strategies have been formulated:

- The City of Reykjavik is to set a good example and be a role model in all environmental fields, e.g. with respect to waste management, cleanliness, reuse and recycling, and environmentally-friendly purchasing.
- Monitoring of waste statistics must be improved, and the standards which are to be achieved must be promoted, e.g. for recycling or re-use of waste packaging.
- The City of Reykjavik is to launch a campaign to promote recycled products, and the possibilities for businesses, institutions and individuals to make use of them.
- Systematic work to reduce paper use, with emphasis on use of electronic media.

- Examination of possibility of enhancing consumer consciousness of city dwellers, by presenting information on lifetime of commodities and service.
- Businesses in secondary production to be encouraged to utilise raw materials that become available, e.g. when buildings are demolished.
- The City of Reykjavik is to encourage businesses and institutions to design structures and carry out product development with environmental principles in mind.
- The City of Reykjavik is to create incentives for more utilisation of abattoir by-products and other waste from the food industry which is reusable or recyclable.
- Economic incentives to be applied for better waste sorting.
- Possibilities to be explored for imposing fines for behaviour such as littering in the street or in the open country.
- Community service for environmental purposes to be available as a form of penalty in criminal cases.

The above objective and strategies are in the spirit of the fourth of the Aalborg Commitments, to which the City of Reykjavik is a party: That Commitment refers to responsible consumption and lifestyle choices.

8.4 Documents, websites and documented decisions

Decisions

- Regional Waste Management Plan 2009 – 2020, 2009. (ice)
- Regional Waste Management Plan 2005 – 2020, 2005. (ice)
- Strategic Planning for the Management of Waste 2009–2020, English Summary, 2009. (eng)

Documents

- Shaping Reykjavik, Reykjavik's Local Agenda 21, 2006. (eng)
- Annual Report Icelandic Recycling Fund, 2009. (ice)
- Annual Report SORPA, 2009. (ice)
- Annual Report SORPA, 2008. (ice)
- Annual Report SORPA, 2007. (ice)
- Annual Report SORPA, 2006. (ice)
- Annual Report SORPA, 2005. (ice)
- Annual Report SORPA, 2004. (ice)
- Annual Report SORPA, 2003. (ice)
- Annual Report SORPA, 2002. (ice)

Websites

- Sorpa website (english content): <http://sorpa.is/en/>

8.5 Disadvantages resulting from historical and/or geographical factors which may have influenced this indicator area negatively

Iceland is an island in the North Atlantic Ocean with no more than 320.000 inhabitants. The domestic market for solutions in recycling and recycling materials is small, which makes recycling domestically more uneconomical and less profitable. At the same time, the supply of recycling materials is unsecure. Due to the location of Iceland the distance to foreign markets are great which effects the cost benefit of recycling. The location of the country and its low population size has therefore an effect on the development and speed of recycling. The energy consumption of Icelanders differs from that of most European nations: Iceland has abundant sustainable energy sources, and hence there has been little incentive to utilise waste as a source of electricity and district heating.

9 Water consumption

- 9.1 The present situation and development over the past five to ten years
- 9.2 The measures implemented over the past five to ten years to reduce water consumption and water loss in pipelines
- 9.3 Long and short term measures to reduce water loss
- 9.4 Documents, websites and documented decisions
- 9.5 Disadvantages resulting from historical and/or geographical factors



9.1 The present situation and development over the past five to ten years

Reykjavík's citizens are fortunate to have access to an abundance of quality water, both cold water from groundwater reservoirs for consumption and other use, and natural geothermal hot water. Sustainability has been nested in Reykjavík's water resource policies, securing sustainable harvesting of the cold water and geothermal hot water resources. Population increase the last years has been easy to supply with quality water, and on the basis of the current sustainability policies, there are no constraints to meet the water demands for future generations.

Reykjavík Energy

Reykjavík Energy (RE), an independent utility service owned 93,5% by the City of Reykjavík operates a water work. This is the country's largest water utility, which supplies both Reykjavík and other municipalities in the great Reykjavík area with drinking water. RE also extracts and distributes hot water from geothermal fields to Reykjavík and surrounding municipalities. All electricity used in the operations is from renewable sources.

RE was the first water work in the Nordic Countries to gain ISO 9001 certification, in 1999 and the first in the world to gain HACCP certification (Hazard Analysis, Critical Control Points, an International Food and Safety Monitoring System). Furthermore, it has an ISO 14001 certified environmental management system.

Cold water

The drinking water used by Reykjavík's population is entirely from groundwater reservoirs and does not need any treatment before consumption. The reservoirs are under strict quality control, enforced by RE in compliance with their monitoring systems and by the Reykjavík Public Health Authority. Reykjavík groundwater reservoirs are in the Heiðmörk nature reserve in areas set aside and governed for water protection. The reservoirs are located in extensive voluminous lava fields where plentiful water is naturally filtrated and purified in the porous lava. These unique geological conditions are therefore extremely conducive for water extraction, where clean and cold water can be tapped sustainably in huge quantities throughout the year from wells deep in the lava fields and is used without depleting the groundwater reservoirs. Regular monitoring of the water level shows that the level has never gone below the criterion the last decade (see figure 9.1).

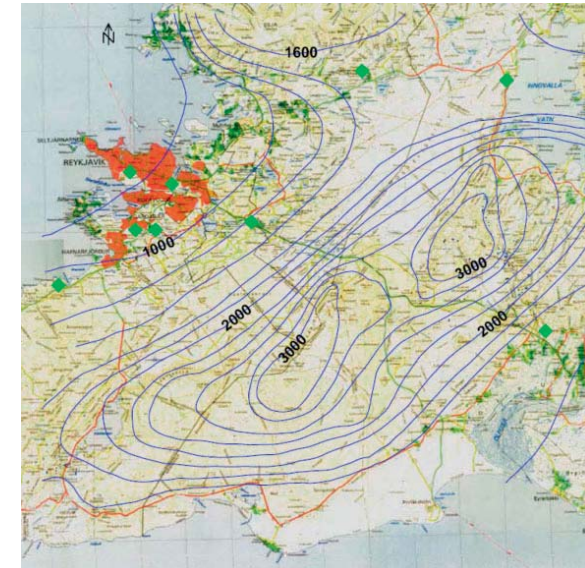


Figure 9.1

Precipitation map, annual average precipitation (mm). Average precipitation in Reykjavik is about 800 mm annually but in the Bláfjöll mountains which is the main impact area of the water springs precipitation is about 3.000 mm annually.

Geothermal water

Unlike most cities, a large proportion of Reykjavik citizens' consumption of water comes from neighbouring geothermal areas and utilisation of geothermal heat count for a great share of the entire energy regime in whole Iceland (see figure 9.2).

The geothermal water is used in multiple ways that contributes greatly to improved environmental performance, public health and quality of life in the world's northernmost capital. It is in a way used for central heating in all houses in Reykjavik, as the hot water from the high-temperature geothermal areas at Nesjavellir geothermal plant is used to warm up cold groundwater, and has totally replaced coal and oil as a source of energy for house heating.

This has a positive effect on the quality of air in Reykjavik, reduces pollution and mitigates climate change. The residents are comfortably able to heat their houses and ventilate, resulting in generally good indoor air quality (IAQ) and rare sick building syndrome. The geothermal heat is also used for highly popular, inexpensive and widely accessible outdoor swimming pools in most of the city's districts (see figure 9.3). In addition the geothermal heat is used for tap water, snow-melting systems and industrial manufacturing. In Nauthólsvík, Reykjavik's geothermal bathing beach, the lagoon and nearby pool are heated with run-off water from the city's geothermal heating system.



Figure 9.2
Geothermal fields comprise low-temperature and high-temperature geothermal areas. The geothermal hot water from the low-temperature geothermal areas is passed directly into the distribution systems as the high-temperature geothermal areas at Nesjavellir geothermal plant is used to warm up cold groundwater.

Photo: Sigfús Már Pétursson

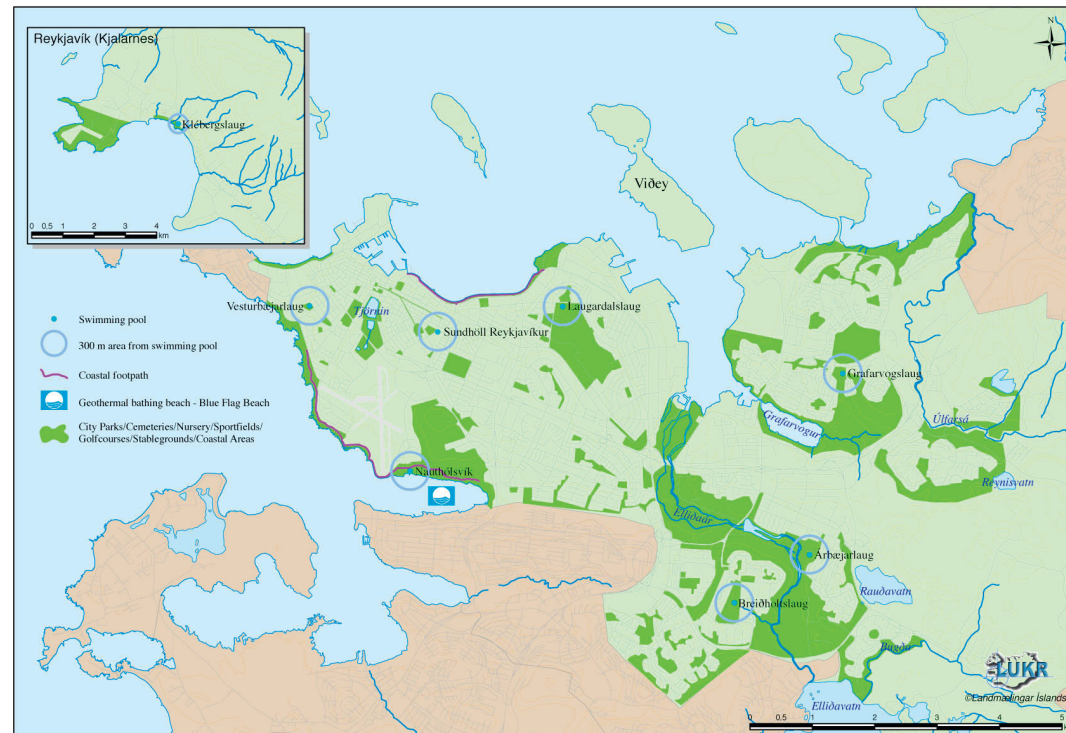


Figure 9.3
Location of swimming pools and green areas in Reykjavik.

A. Proportion of urban water supply subject to water metering

In 2009 the proportion of cold water supply subject to water metering was 0% in domestic households and 90% in business/public buildings. This has remained unchanged in recent years. Metering domestic cold-water consumption on household basis has not been considered necessary due to the enormous sustainable quantities of water available, relative to the total population in Reykjavik. Much more emphasis has been on strict water quality control and secure delivery. The proportion of metering hot water, on the other hand, was 100% in 2009, in households as well as in business/public buildings.

B. Water consumption per capita

Households consume of cold water per capita in Reykjavik is around 150 litres per citizen per 24 hours (see tables 9.1 – 9.4).

In 2009 the total consumption of cold water amounted to around 26 million m³ for a population of around 120.000. In 2007 35% of the total cold water supplied was to business activities, but the ratio has increased and was 52% in 2009. The indicators show that annual average precipitation in Reykjavik is approximately 800 mm whereas in the Bláfjöll mountains, the main impact place of the water springs, it is 3.000 mm (see figure 9.1).

Reykjavik city along with few Capitals of the Nordic Countries cooperated in developing environmental indicators and Reykjavik has from 2002 annually published

Consume of cold water in Reykjavik.

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of inhabitants	108,362	109,795	111,342	112,268	112,490	113,387	113,730	114,800	116,446	117,721	119,848	119,547
Total consumption (thousand m3)	15,5	16,0	16,5	16,8	16,4	17,1	18,5	19,5	19,5	19,6	20,0	20,4
Total production (l/s)	491	506	523	532	521	543	585	619	618	621	633	648

Table 9.1. Total consumption of cold water in Reykjavik from the year 1998 to 2009. It can be included that in year 1986 the total consumption of cold water was 26.533,000 m³ (number of inhabitants 91.497) and total production 841 l/s. Estimated consumption of cold water is 150 liters per inhabitant per day.

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of inhabitants	108,362	109,795	111,342	112,268	112,490	113,387	113,730	114,800	116,446	117,721	119,848	119,547
Total consumption (thousand m3)	8,1	9,0	8,8	9,6	9,6	9,8	10,3	10,6	11,5	11,4	11,7	12,0
Total production (l/s)	256	284	279	306	303	311	326	335	364	361	372	382

Table 9.2. Total consumption of cold water in business/public buildings in Reykjavik from the year 1998 to 2009. 90% of the water is metered, 10% is estimated. Estimated consumption of cold water is 150 liters per inhabitant per day.

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of inhabitants	108,362	109,795	111,342	112,268	112,490	113,387	113,730	114,800	116,446	117,721	119,848	119,547
Total consumption (thousand m3)	7,4	7,0	7,7	7,1	6,9	7,3	8,2	9,0	8,0	8,2	8,2	8,4
Total production (l/s)	235	222	245	226	218	232	259	285	255	260	261	265

Table 9.3. Total consumption of cold water by household including estimated leaks in the systems from the year 1998 to 2009. Estimated consumption of cold water is 150 liters per inhabitant per day.

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of inhabitants	108,362	109,795	111,342	112,268	112,490	113,387	113,730	114,800	116,446	117,721	119,848	119,547
Total consumption (thousand m3)	5,8	5,9	6,0	6,1	6,1	6,2	6,2	6,2	6,3	6,4	6,4	6,5
Total production (l/s)	185	188	191	193	195	195	197	197	199	202	204	208

Table 9.4. Total consumption of cold water by household, excluding leaks in the systems from the year 1998 to 2009. Estimated consumption of cold water is 150 liters per inhabitant per day.

the Reykjavik City Environmental Indicators on e.g. water quality and usage (see appendix 3). The results of this monitoring is among other things used in the process of making the annual plan of implementation in environmental affairs, Green steps for Reykjavik (see appendix 2).

Average total hot water consumption in Reykjavik per day amounts to 1.005 litres per capita. This amount is the total use, i.e. industrial and household use in the city. Use of hot water is, therefore, much greater than consumption of cold water per capita and here it is necessary to mention that a large part of it is used in house heating. Between December 2008 and November 2009 a total of 47 million m³ of hot water was used in Reykjavik, of which 43,5 million m³ was for general consumption, primarily for heating of houses, while 3,5 million m³ was used in swimming pools, industry, snow-melting systems and other specially-metered usage.

C. Water loss in pipelines

Total length of potable water pipelines and geothermal pipelines in Reykjavik was 2.359 km in 2008 (of which geothermal pipelines 1.343 km and potable water pipelines 1.016 km). Leakage is defined as total water production minus total water consumption. Table 9.5 shows findings about leakage rates in Reykjavik's potable water system from 1994. It demonstrates that leakage from the potable water system has greatly diminished in recent years, e.g. being 40% in 1994 and 9% in 2009.

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
40%	29%	17%	16%	10%	6%	10%	6%	4%	6%	11%	14%	9%	9%	8%	9%

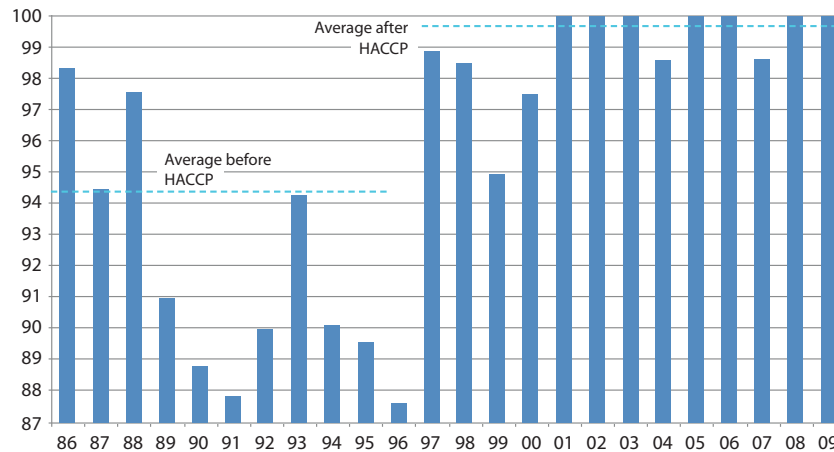


Figure 9.5 Percentage of samples that met quality standards 1986-2009.

D. Compliance with the EU Water Framework Directive

Inspection of drinking water safety as well as pollution control in the water protection area and external factors that may impact on Reykjavik's water protection area is based on Icelandic legislation. Although not an EU country, Iceland adopts the majority of EU environmental legislation under the auspices of the EEA (European Economic Area), to which Iceland is a contracting Party.

The EU Water Framework Directive is now being implemented in Iceland. Even though this Directive has not yet been transposed into Icelandic law, the Reykjavik Public Health Authority began monitoring lakes and rivers in the water protection area at the beginning of 2009. Drinking water fully (100%) meets the criteria of the European drinking water directive 98/83/EC: Over the last ten years only two samples, out of 120 samples taken every year, have exceeded guideline limits (see figure 9.5).

Table 9.5 The proportion of leakage from the potable water systems in Reykjavik from the year 1994 to 2009.

9.2 The measures implemented over the past five to ten years to reduce water consumption and water loss in pipelines

A. Proactive leakage management

Detecting and locating water leakage in the water work system is a continuous process at Reykjavik Energy. The company is responsible for the maintenance of the system as a whole, where leakage detection has high priority. The Reykjavik Public Health Authority is also responsible for monitoring the quality of drinking water and the condition of pipelines, as well as requiring that businesses and homeowners to repair damaged pipes. In many recent years active search for leakage in the cold water system has been in operation, to considerable effect as table 9.5 shows. Geothermal pipelines are usually situated around 80 cm beneath the surface while potable water pipelines are situated at 120 cm beneath the surface: below this depth they remain frost-free. Leakages in the hot water system are discovered very readily for various obvious reasons, such as melted snow, steam rising from the soil, etc. Therefore preventative leakage search does not take place in the hot supply system; action is taken when leakage becomes apparent.

B. Network rehabilitation

Rehabilitation and leakage management is conservative, i.e. to maintain the present status and to secure supply to customers with as few interruptions as possible. Table 9.6 shows the figures for replacement of potable water pipelines in Reykjavik during 1999-2009. All new potable water pipelines up to size 400mm are plastic pipelines PEH 100 as per standard EN 12201. Larger pipelines are Ductile.

C. Non-domestic metering

The company Iceland Spring bottles water for foreign markets from Reykjavik's water supply in the Heiðmörk nature reserve; production amounts to around 160.000 – 200.000 litres per day.

D. Byelaw implementation in relation to efficiency in water usage

Water rate is collected with property taxes and never exceeds 0,5% of rateable value. In Reykjavik sale of cold water is exempt from VAT. Water rate consists of a fixed rate per rateable value unit, plus a variable levy per square meter based on each rateable value unit ac-

ording to rateable value. Only commercial cold-water consumption is metered. It cannot, therefore, be said that billing creates specific pressure on homes to use less cold water as they only pay fixed rates, regardless of quantity used. There is, on the other hand, pressure on companies to use cold water in moderation, as their water supply is charged for according to usage. Hot water is, on the other hand, metered and priced by cubic metre. VAT levied on the sale of hot water for central heating and swimming pools is 7%. Having to pay for hot water according to usage acts as an impetus for all consumers to be economical. From the beginning of 2010 an additional 2% energy tax was levied on top of the price of hot water, creating a further incentive to be economical.

E. Awareness raising campaigns

When the topic of water in Reykjavik is debated the main emphasis has been on quality and reliability, rather than about limiting consumption. People have, however, always been encouraged to treat natural resources

Table 9.6
Renewal of potable water pipelines in Reykjavik during 1999-2009. Percentage of total length of pipelines.

1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1,26%	0,63%	0,94%	0,95%	1,1%	1,25%	0,84%	1,22%	0,77%	0,73%	0,26%

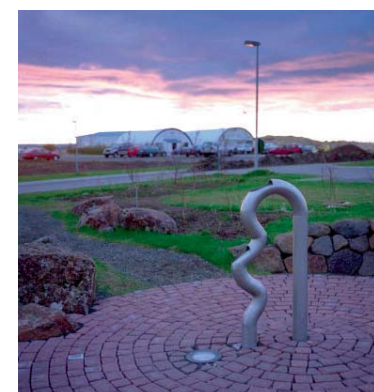


Figure 9.6
Drinking fountain in Reykjavik.

with respect. Various ways are deployed in Reykjavik to emphasize the importance of water for the community. Water Day is celebrated each year on March 22, in collaboration with UNICEF. In addition, October 2009 saw the centenary of Reykjavik's waterworks celebrated with amongst other things a special exhibition at the premises of Reykjavik Energy. Reykjavik Energy and the Reykjavik Nature School are also working in collaboration with schools to educate children and teachers about water (see appendix 5). Drinking fountains are to be found widely on the city's footpaths, encouraging people to think about water (see figure 9.6). Industrial companies have also been encouraged to increase the use of water for cooling instead of other cooling media.

F. Water conservation

Reykjavik's groundwater reservoir catchment area is situated in specific water protection areas in the Heiðmörk nature reserve. Because Heiðmörk is one of Reykjavik's main recreational areas the area is under strict control to ensure that recreation and water protection can co-exist. Protection of drinking water in Reykjavik is a joint responsibility of the municipalities in the capital area, and an Executive Board of the Municipal Public Health Authorities in the capital area has been established, with representatives from all the participating municipalities, to deal with issues relating to the water protection area. A resolution on the protection of the groundwater catchment zone for the capital area from 1997 was an important step towards protecting the drinking water of the residents of the capital; the resolution aimed among other things to ensure maximum healthfulness of drink-

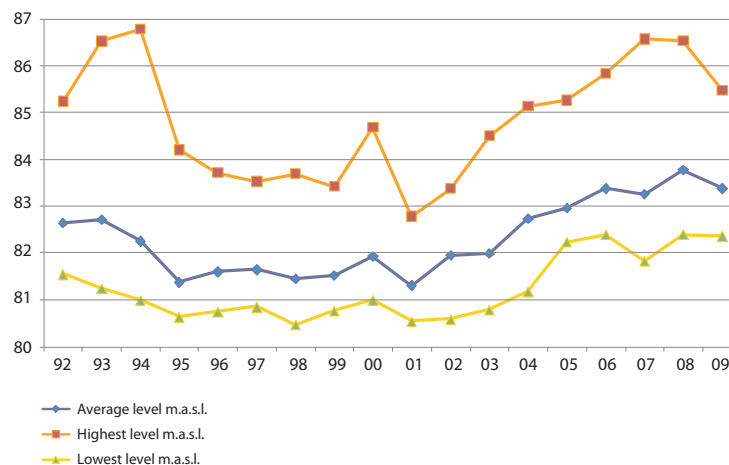
ing water in the capital area for the future by preventing undesirable effects caused by any activity, trade or business on the water protection areas of the catchment area.

G. Water level monitoring

In Reykjavik the importance of monitoring the water level is stressed as a part of sustainable utility.

- Monitoring of the groundwater level: The Gvendarbrunnar area serves as an example of how the cold water supply is monitored, but there the supply is assessed based on the water level in exploratory boreholes in Heiðmörk. Figure 9.7 shows the groundwater status in one hole well in Heiðmörk in 2009. Measurements are automatically taken every hour. The criterion level has been set at about 80 m above sea level. Nevertheless, this level is not decisive.

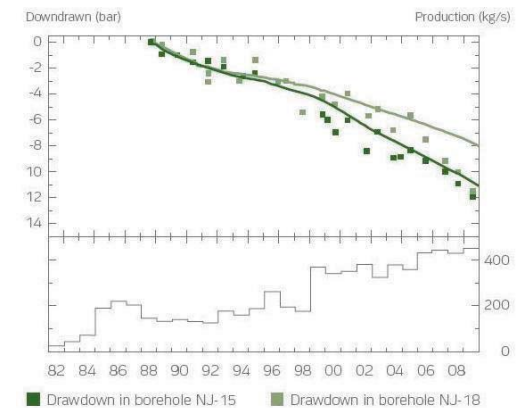
Figure 9.7
The groundwater level of well V18 1993-2009. The criterion is that the level shall never go below 80 m above sea level.



If the water level approaches this criterion, employees are prepared to take action, but the water level has not gone below this level during the last decade.

- Monitoring of the water level in low-temperature and high-temperature geothermal areas: Measurement for the drawdown in boreholes are used as a criterion for the utilisation of low- temperature areas. If the water level in particular boreholes approaches the pumping depth, there is reason to take action, whether pumps should be lowered or the use of the area should be suspended. In high temperature areas the impact of energy production is monitored by measuring drawdown in holes and compare to a model simulating the geothermal energy in a given place (see figure 9.8).

Figure 9.8
Drawdown in Nesjavellir's high-temperature boreholes. Solid-line curves are calculated according to the model, while dots show measured values.



9.3 Long and short term measures to reduce water loss

- The cold water is a resource for the future, and much is done to protect its quality. Water utilisation is, consequently, organised to ensure that the resource is treated in a responsible way with sustainable long-term security as a guiding principle. The local Public Health Authority executive in the capital area is responsible for inspection in the water protection area as per the resolution on water protection in the capital area, and ensures that contingency plans following pollution accidents are carried out.
- As mentioned, rehabilitation and leakage management is conservative, i.e. to maintain the present status and to secure supply to customers with as few interruptions as possible. In 2010 the planned cost for leaking searches is 62.000 EUR. In the coming years renewing of pipes will be continued according to the plans of Reykjavik.
- Environmental monitoring (air quality and water quality in rivers, lakes and by the ocean coast) is a project which is going on all year around at the City of Reykjavik, and the annual cost is approximately 93.000 EUR exclusive of costs for housing, master ship etc.
- The cost of water quality monitoring, i.e. quality of the groundwater, is estimated to be 14.500 EUR.
- There is a general awareness among Reykjavik's inhabitants regarding the significance of the cold-water resources endowment. It is further promoted and communicated by Reykjavik Energy, particular with its collaboration with primary schools bringing all school-children in Reykjavik at least once to the Gvendarbrunnar wells. In the next years it is planned to continue working in this way with the schools. Estimated cost for half of the training and introduction at RE in 2010 is around 455.000 EUR.
- The aim is to further consolidate this cooperation on water protection in the capital area going forward with security of drinking water as the guiding principle. A specific emergency plan deals with responses to volcanic eruptions and serious contamination accidents in Reykjavik's groundwater reservoirs. If the reservoirs are polluted (bearing in mind that Iceland is an active volcanic zone) it is possible to draw water from Lake Pingvallavatn: the pipeline which is normally used for piping hot water to Reykjavik from the geothermal plant at Nesjavellir near Lake Pingvallavatn would be temporarily used to pipe cold water from the lake to the city.
- Local Agenda 21 for Reykjavik which took effect in 2006 puts forward objectives that aim to secure top quality in all spheres of Reykjavik's water management and to secure the utmost vigilance over all activity around Reykjavik's groundwater reservoirs.
- A review of Reykjavik's municipal plan is currently taking place, where the emphasis is on reducing consumption of both hot and cold water by, among other things, recycling water for cooling spaces, machines and equipment and by utilising surplus energy from other spaces, equipment or operations in order to heat public and outdoor spaces such as bus shelters.
- There is an outstanding knowledge and capacity available in the field of geothermal energy and its utilization that has made Icelandic expertise and Iceland a key factor in geothermal issues worldwide. The aim is to further develop this expertise and share with others. Iceland is a leader in using the geothermal warmth worldwide, and our biggest contribution in the fight against global warming.
- In the review of Reykjavik's municipal plan adaption to Climate Change is accepted, but the City has already taken the policies of mitigation to Climate Change.

9.4 Documents, websites and documented decisions

Documents

- Regulation on Protection of water no. 796/1999. (ice)
- Regulation on Protection of groundwater no. 797/1999. (ice)
- A resolution on the protection of the groundwater catchment zone for the capital area no. 636/1997. (ice)
- Pollution classification of Hólmsá, Suðurá and Elliðaár rivers, 2004. (ice / eng)
- Observation of Biosphere of Elliðavatn: preliminary study and research proposals. Report produced for City of Reykjavík and Kópavogur municipal councils. 2004. (ice)
- Annual report of Iceland Geosurvey (ISOR), 2009. (ice / eng)
- Annual report of Iceland Geosurvey (ISOR), 2008. (ice / eng)
- Annual report of Iceland Geosurvey (ISOR), 2007. (ice / eng)
- Annual Report of Reykjavik Energy, 2008. (ice / eng)
- Annual Report of Reykjavik Energy, 2007. (ice / eng)
- Annual Report of Reykjavik Energy, 2006. (ice / eng)
- Environmental Report of Reykjavik Energy, 2009. [Draft] (ice / eng)
- Environmental Report of Reykjavik Energy, 2008. (ice / eng)
- Environmental Report of Reykjavik Energy, 2007. (ice / eng)
- Environment and resources. Are we on the way to sustainable development?, 2009. (ice)
- Water Resource Protection in Reykjavik and its Vicinity Implementation and Regulation, 2005. (ice / eng)
- Report on future impacts of climate change, 2008. (ice)

Decisions

- Shaping Reykjavík, Reykjavik's Local Agenda 21, 2006. (eng)

Websites

- City Webview is a tool for the public to access maps and information from the Reykjavík Geographical Information System: www.rvk.is/lukr, <http://www.borgarvefsja.is>
- Iceland Spring, company marketing water in foreign markets: <http://www.icelandspring.com>
- Iceland Geosurvey: <http://www.isor.is/>
- Reykjavik Energy: <http://www.or.is>
- International standards with which Reykjavík Energy complies: <http://www.or.is/English/About/Qualitycontrol/>
- Reykjavík Department of Environment and Transport. Survey conclusions from monitoring rivers and lakes in Reykjavík in 2009: www.rvk.is/desktopdefault.aspx/tabid-3822/6631/6631_view-3222/

9.5 Disadvantages resulting from historical and/or geographical factors which may have influenced this indicator area negatively

The abundance of pure cold water and hot water and the sustainable use of the resources has had the result that reducing water consumption has historically not been a priority in the City of Reykjavík.

10 Waste water treatment

- 10.1** The present situation and the development over the last five to ten years in relation to the proportion of total waste water treated in accordance with the Urban Waste Water Directive
- 10.2** Measures implemented in the last five to ten years to improve waste water treatment
- 10.3** Short and long term measures to improve waste water treatment
- 10.4** Documents, websites and documented decisions
- 10.5** Disadvantages resulting from historical and/or geographical factors which may have influenced this indicator area negatively



10.1 The present situation and the development over the last five to ten years in relation to the proportion of total waste water treated in accordance with the Urban Waste Water Directive

The City of Reykjavik has taken the lead in improvements to waste water treatment in Iceland. Favourable geographical conditions, sustainable energy and ambitious environmental goals have resulted in a clean shoreline and improved quality of life in the Reykjavik.

Background and history

During the past two decades much development has taken place in waste water treatment in the City of Reykjavik and a large part of the surrounding area. In 1992 the City signed an agreement with neighbouring communities to clean up the shoreline by developing the waste water treatment and collecting system. This is one of the most extensive environmental projects Iceland has undertaken, involving waste water from around 55% of the whole nation. Sewage from outlets which previously opened on to shores was now piped through pumping stations and from there into waste water treatment plants before being piped into the sea. In 1995 a targeted sewerage tax was imposed.

The first waste water treatment plant at Ánanaust was opened in 1998 and handles sewage from 57% of Reykjavik's population. In 2002 the waste water treatment plant in Klettagarðar was opened, so that 83% of Reykjavik's inhabitants were now connected to waste water treatment plants. In 2005 a pumping station was deployed in Gufunes linking sewage from Grafarvogur and Grafarholt to Klettagarðar, so that 99,5% of the city's inhabitants were now connected to a collecting system

with a waste water treatment plant. It is estimated that the waste water treatment plants at Ánanaust and Klettagarðar will be able to serve the increased number of inhabitants in the capital area until at least 2050. The operating cost for the system is around 4,4 million EUR per year.

Operation and certifications

Reykjavik Energy, owned by the city, operates the collecting system. The company meets the demands of three quality management standards: Quality management system - ISO 9001, Environmental management system - ISO 14001 and Occupational safety and health management system - OHSAS 18001. The Sewerage section has implemented an internal control system following HACCP (Hazard Analysis and Critical Control Points) methodology; this ensures a systematic and secure maintenance of the sewerage system as possible.

Description and compliance

The total length of the collecting system amounts to 1.018 km, including a single drain system of 227 km and a double system of 791 km. With a single drain system, mixed urban waste water can escape through overflows to the shore, causing temporary bacterial pollution. Reykjavik Energy has set itself a quality target restricting the incidence of mixed urban waste water escaping through overflows to a maximum of 5%, and that target has been met in all recent years. Storm water is usually not specifically treated before it is discharged into receiving water. Sand and oil separators have been fitted to some storm water pipelines, and in places on the Elliðaár and Úlfarsá rivers surface water is passed through sediment ponds before going into the rivers. Primary treatment of sewage takes place in the two waste water treatment plants under Icelandic regula-

tions based on Urban Waste Water Directive 91/271/EEC. After treatment the effluent is piped into Faxaflói bay, defined as a less sensitive area. Sludge from waste water treatment plants is landfilled at a controlled landfill (see tables 10.1 and 10.2).

Table 10.1
Solid waste from Ánanausta treatment plant and pumping stations.

Year	Screening waste	Grease and oils	Sand, grit and stones	Total waste
1998	168 t.	187 t.	110 t.	465 t.
1999	95 t.	223 t.	134 t.	452 t.
2000	154 t.	189 t.	167 t.	510 t.
2001	236 t.	257 t.	171 t.	664 t.
2002	207 t.	135 t.	159 t.	501 t.
2003	225 t.	146 t.	119 t.	490 t.
2004	277 t.	177 t.	74 t.	528 t.
2005	226 t.	141 t.	63 t.	430 t.
2006	283 t.	197 t.	88 t.	569 t.
2007	299 t.	83 t.	54 t.	436 t.
2008	368 t.	159 t.	21 t.	548 t.

Table 10.2
Solid waste from Klettagarðar treatment plant and pumping stations.

Year	Screening waste	Grease and oils	Sand, grit and stones	Total waste
2002	196 t.	152 t.	61 t.	409 t.
2003	432 t.	114 t.	89 t.	634 t.
2004	466 t.	54 t.	113 t.	633 t.
2005	514 t.	83 t.	91 t.	688 t.
2006	680 t.	75 t.	101 t.	856 t.
2007	710 t.	134 t.	20 t.	864 t.
2008	623 t.	114 t.	141 t.	878 t.

The plants have operating licences from Reykjavík’s Public Health Authority and are subject to regular inspections and monitoring. The operating licences include requirements regarding monitoring and defined quality targets. Effluent outlet sites from the waste water treatment plants and pumping stations at Ánanaust and Klettagarðar are situated at a depth of just over 30 metres in Faxaflói, 4,1-5,5 km north west from the plants (see figure 10.1).

Research and monitoring

Extensive research was carried out on the receiving water when the collecting system was designed, which

demonstrated the presence of favourable sea currents and ideal conditions for the natural dilution, dissolution and destruction of matter not removed by treatment from the effluent water and carried with it out to sea. The biosphere was examined, currents investigated, and ocean floor echo soundings and sediment movements studied. The Environment Agency declared the receiving water a less sensitive area, based on these conclusions. Monitoring of the biosphere, measurement of bacteria levels and measurement of heavy metal pollution using mussels have been carried out since the waste water treatment plants were brought into operation. The re-research has concluded that the environmental impact of

pumping waste water into Faxaflói is relatively small.

Since hot water used for heating buildings flows out into the collecting system, waste water dilution is particularly high. Waste water dilution at the sea surface above the outlets is up to 600 times. The City of Reykjavík has monitored the shoreline for bacterial pollution every year since 2002 and the results has been a part of Reykjavík Environmental Indicators from 2003. Samples are taken in 11 places where people are likely to be participating in outdoor activities (see figure 10.2).

The research has concluded that since the second waste water treatment plant became operational, shoreline bacterial pollution has been within guideline limits and that the area is fit for recreational use. The environmental targets in Regulations no. 798/1999 for sewage and waste water for seaside recreational areas provide the baseline, these targets being stricter than is common in Europe, and stricter than targets in Council Direc-

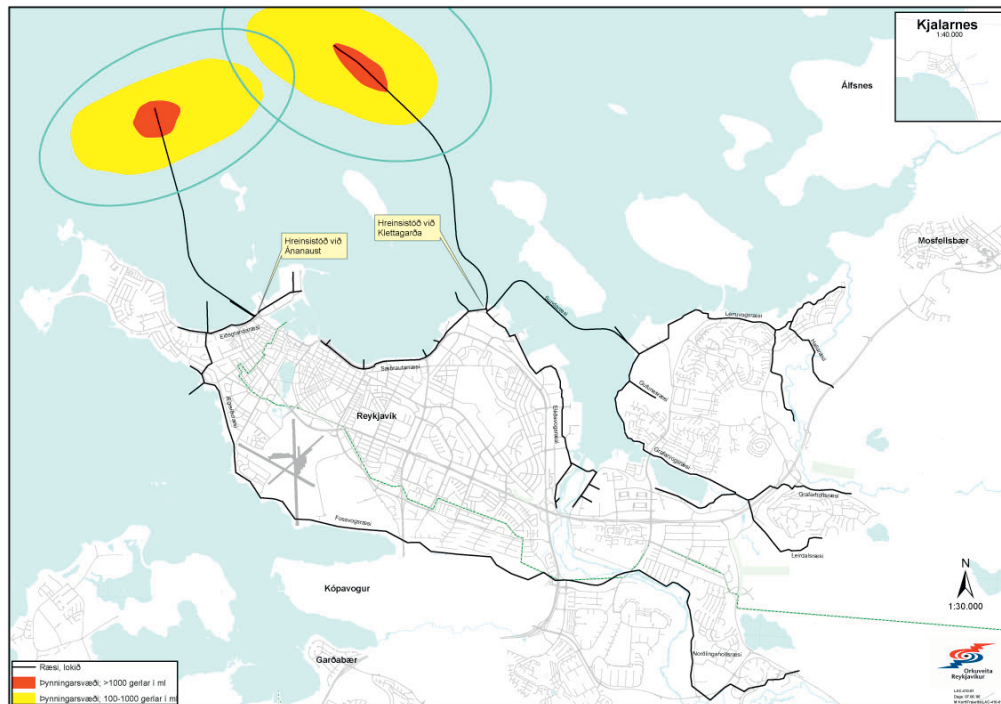


Figure 10.1
The outlets and their dilution area.



Figure 10.2
A City of Reykjavik employee taking shoreline samples.

tive 76/160/EEC concerning bathing water quality. The results will be used in the classification of the shoreline waters according to the Water Framework Directive.

New opportunities

After shoreline sewage outlets were closed it became possible to open the Geothermal Beach at Nauthólsvík, a popular small beach where hot water is piped into the sea to make it suitable for bathing. The Geothermal Beach has proved popular, with a yearly average of around 120.000 visitors. It is, consequently, safe to say that the beach has become a paradise of the north within the city boundaries, attracting Icelandic as well as foreign visitors. The Geothermal Beach has acquired Blue Flag status, a voluntary eco-label awarded to over 3.450 beaches and marinas in 41 countries worldwide. Tests on the microbiological quality of the bathing water are carried out by the Icelandic Blue Flag committee and Reykjavík's Public Health Authority and are within guideline limits.



Figure 10.3
A pumping station at Lauganes in Reykjavík.

(Photo: Mats Wibe Lund)

10.2 Measures implemented in the last five to ten years to improve waste water treatment

As described above, there have been many improvements to the waste water treatment and collecting system over the past two decades. As well as completing the connection of the collecting system to the waste water treatment plants, several further improvements have been carried out to the system:

- Older pipes have been lined with plastic in order to cure leaks and improve durability. All in all 85,2 km of pipes have been lined.
- A single pipe system has been changed into a double one wherever possible when maintenance is carried out.
- There has been a systematic search for incorrect connections where domestic waste water connects to storm water pipelines. Where these are found, the house owner is required to rectify the situation. These measures are intended to prevent microbiological contamination being carried with storm water into rivers and coastal waters.
- Using strict licensing preconditions and systematic monitoring Reykjavík's Public Health Authority has improved commercial and industrial waste water treatment and required that the best available technology (BAT) be used for treatment.
- Limits for grease and pH levels have been established for effluent water and these limits have been used as guidelines when selecting and installing equipment.
- Where storm water is discharged into rivers and waterways, sediment ponds have been created which trap dirt and contamination carried with storm water systems to the receptor, such as foreign bodies and rubbish, tarmac particles due to usage of studded tyres during winter, and paint flakes due to wear and tear on buildings and roof areas. The ponds are, additionally, designed so that any oil that may leak within their catchment area is trapped and can be removed. Most of the sediment ponds are adjacent to Elliðaár, a salmon fishing river within the city. This river is also harnessed to generate electricity. By the river's upper waters there are four ponds receiving storm water from residential areas, and towards its mouth there are four ponds receiving storm water from large parts of the industrial area at Ártúnshöfði. There is also a sediment pond next to Úlfarsá, a salmon fishing river on the outskirts of the city. More sediment ponds are proposed for that river, and have been incorporated into the municipal plan.
- Reykjavík Energy takes pride in building waste water facilities that blend well with the surrounding urban environment. Emphasis is on low-rise green buildings with grass on roofs and walls. The waste water facilities are thus a natural part of the green areas and lanes by the shoreline which are very popular for outdoor recreation by the people of Reykjavík (see figure 10.3).

10.3 Short and long term measures to improve waste water treatment

Short term measures

As is detailed below, a third waste water treatment plant is under construction but will not be completed until 2011. The opening of that plant will mean that Reykjavík's last residential area will be connected to the sewerage system through a waste water treatment plant. While 400 people reside in Grundarhverfi at the present moment, the waste water treatment plant is expected to be able to serve up to 2,500 people. The plant will provide primary treatment, as with the other two plants. All necessary research concerning the outflow from the waste water treatment plant has been carried out, and the receptor has been classified as a less sensitive area. Monitoring of the environment in Reykjavík will cost in total approximately 93.000 EUR in 2010.

Long term measures

Reykjavík Energy aims to continue to operate the waste water collecting system with the same quality standards and in compliance with current regulation on waste water treatment. The company is ready to meet further demands on improved treatment should they arise. It has also operates the waste water treatment system for some of the city's neighbouring communities and the future goal is to provide the same standard of treatment there as in Reykjavík.

10.4 Documents, websites and documented decisions

Key documents

- Summary and Evaluation of Environmental Impact Studies on the Recipient of Sewage from the STP at Ánanaust, 2006. (eng)
- Environmental Report Reykjavík Energy, 2008. (ice/eng)
- Environmental Report Reykjavík Energy [draft], 2009. (ice/eng)
- Reykjavík Public Health Authority's Conditions for Licence to Operate Waste Water Treatment Plants at Ánanaust and Klettagarðar, 2008. (ice)

Supplement documents

- Measurement of Faecal Contamination Outside the Effluent Dilution Area from the Ánanaust Waste Water Treatment Plant in May and June 2004. (ice)
- Seawater Condition in Sewage Disposal Areas Near Ánanaust in February 2000. (ice)
- Reykjavík Public Health Authority's Conditions for Licence to Operate Waste Water Treatment Plant at Kjalarnes 2009. (ice)
- Status of Waste Water Treatment in Iceland. Environment Agency Report cf. art. 28 Regulation no. 798/1999 on Sewage and Waste Water, 2003. (ice)
- Measurements of Microbiological Contamination caused by Sewage on the Periphery of Dilution Areas and on the Shoreline at Reykjavík, Summary of Conclusions, 2007. (ice)

Available on request

- Behaviour and Composition of Sewage in the Waste Water Treatment Plant at Ánanaust, 2000. (ice)
- Behaviour and Composition of Sewage in Skólpa, 2000 – 2001. (ice)
- Mussel Research near Klettagarðar 1998, (ice)
- Ocean Floor Biosphere at Planned Sewage Outflow Area near Ánanaust, 1996. (ice)
- Ocean Floor Biosphere at Planned Sewage Outflow Area near Klettagarðar, 2000. (ice)
- Ocean Floor Biosphere at Sewage Outflow Area near Ánanaust – Status After Opening of Sewage Outflow, 2002. (ice)
- Skólpa Waste Water Treatment Plant at Ánanaust. Overview of Measurements and Records 2003. (ice)
- Waste Water Treatment Plant Skólpa at Klettagarðar. Overview of Measurements and Records, 2003. (ice)

Websites

- Reykjavík Energy website: www.or.is
- City of Reykjavík website: www.visitreykjavik.is
- Environment Agency website: www.ust.is

10.5 Disadvantages resulting from historical and/or geographical factors which may have influenced this indicator area negatively

On account of the difficult financial situation in Iceland following the collapse of the banks in 2008, Reykjavík Energy had to temporarily halt construction of the third waste water treatment plant for the Grundarhverfi district in Kjalarnes. The plant's inauguration has been postponed until the end of 2011.

11

Environmental management of the municipality

- 11.1 The present situation and development over the past five to ten years
- 11.2 Measures implemented over the past five to ten years
- 11.3 Long and short term measures to improve municipal environmental management
- 11.4 Documents, websites and documented decisions
- 11.5 Disadvantages resulting from historical and/or geographical factors



The City of Reykjavík has set an ambitious goal in environmental management. Certified environmental management systems have been introduced and green procurement has shown good results. Good results have been attained in sustainable utilization of renewable energy sources, so environmental impact from electric utilities and heating of houses are peripheral.

11.1 The present situation and development over the past five to ten years

A. Number of municipal departments with certified environmental management systems (ISO 14001/EMAS)

ISO 14001

The waterworks utility, the geothermal and, electric utilities and the wastewater collection and treatment system are operated by Reykjavík Energy, a company owned by the City of Reykjavík. The company has had a certified ISO 14001 system since 2006. The city Department of Environment and Transport has had a certified ISO 14001 system since April 2010. The department is one of the City's eight administrative departments. The scope of the certificate is Public Health Inspection Authority, Office of Transport, Office of Waste Management and Consumption, Office of Nature and Urban Parks and Local agenda 21. Operation of Reykjavík Botanic Garden, Reykjavík City Plant Nursery, Reykjavík Nature School and Municipal Work School, City gardening, urban forestry and summer school vegetable gardens, operation of waste collection

and pest control. Work on the ISO 14001 environmental management system is at the preparatory stage at Strætó bs., a bus company owned by local authorities in the capital area, of which the City owns 60%. The administration of Strætó has agreed to aim at getting certification before the spring of 2012.

Eco-Schools

In Reykjavík the Eco-Schools programme has been applied in 17 primary/lower-secondary schools and 15 kindergartens; this represents about 40% of schools and 20% of kindergartens in the city, and the number is increasing fast. Nineteen of them have been awarded the Eco-Schools Green. The Reykjavík Municipal Work School received the Green Flag in the summer of 2009 (see appendix 4 for description of the Municipal Work School).

Blue Flag

Nauthólsvík, Reykjavík's geothermal bathing beach, has been awarded the eco-label Blue Flag. The Blue Flag works for sustainable development at beaches and marinas, through publicly awarding recognition to sites that meet strict criteria on water quality, environmental education and information, environmental management, safety and other services.

B. Percentage of consumed eco-labelled, organic and energy-efficient products by municipalities, measured as a share of the total product consumption within similar category/type

Green procurement by the City of Reykjavík

Under the City's procurement policy, environmental factors are to be taken into account in procurement of goods and services, in addition to cost. Under the Reykjavík Local Agenda 21, the City's policy is to increase its eco-friendly procurement.

Eco-labelled goods and services

The City of Reykjavík places emphasis on purchase of eco-labelled goods where possible. When cleaning services were put out to tender in 2009, applications from companies with an eco-label or environmental management system such as the Nordic Swan, ISO 14001 or similar, were given a favourable weighting. The entire City's kindergartens, and its largest office building, which houses the majority of the City's administration, are now cleaned by companies certified with the Nordic Swan Eco-label. The City's requirement for eco-labelling has contributed to a great increase in applications for the Nordic Swan Eco-label, which resulted in the doubling of eco-labelled Icelandic products and services last year. Environmental criteria have been applied in tenders for other categories of goods and service, such as purchase of furniture, printing service and waste collection lorries.

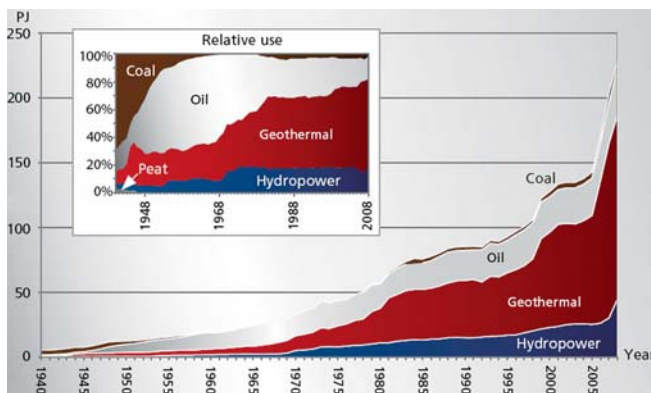
Organic products

The City has hitherto not placed much emphasis on organic products. Icelandic food production tends to be small-scale, not on an industrial basis as in larger countries. Fish is a big part of the Icelanders' nourishment and the Icelandic fisheries management system is known for its sustainable usage of natural resources. Because of the northern location of the country and restrictions on import of agricultural produce, the use of insect poison and other plant protection materials is significantly less than in most other places.

Energy-efficient products

About 82% of all primary energy use in Iceland derives from sustainable domestic energy sources. This includes approximately 15% hydro-electric power and 67% geothermal (see figure 11.1). The remaining 18%, comprises imported fuels, mainly petrol and diesel fuel for vehicles

Figure 11.1
Energy production from 1940 to 2008.



and fishing vessels. Energy-efficient electrical equipment and building energy efficiency has thus not been an environmental priority. The City has, however, placed emphasis on energy-efficiency of vehicles, and the use of sustainable domestic energy sources to power vehicles. Nine-tenths of the City's waste-collection vehicles are powered by methane gas, harvested from the municipal landfill site. The City of Reykjavik also has two buses and 23 cars powered by methane. The bus company, Strætó bs, recently participated in the ECTOS (Ecological City Transport System) project, which was supported by the EU's Fifth Framework Programme to experiment with the use of hydrogen to power buses. The City has defined eco-friendly vehicles in terms of fuel use and CO₂ emissions and such vehicles can park for free in central Reykjavik.

C. Energy consumption of municipal buildings per square meter

As stated above, energy use in buildings is not a significant environmental aspect of the City's activities. The electrical supply derives from sustainable utilisation of hydro and geothermal energy, and heating from sustainable use of geothermal energy. The carbon footprint of electrical production by a geothermal power plant in Iceland averages 38 tonnes CO₂-eq/GWh, and for hydro-power the footprint is 2 tonnes CO₂-eq/GWh. For comparison, the carbon footprint of solar power (PV cells) is about 105 tonnes CO₂-eq/GWh according to the World Energy Council (see figure 11.2). The carbon footprint of using geothermal energy for heating is negligible. As the energy performance index (EPI) by definition excludes

renewable sources then the EPI for buildings in Reykjavik is 0 kWh/m²/year.

In order to optimise use of energy resources and minimise costs, emphasis is placed upon effective insulation of buildings. Heating used in buildings in Reykjavik averages 179 kWh/m²/year, while it is about 20% lower in buildings less than 20 years old (about 140 kWh/m²/year). Utilisation of heat energy varies greatly depending on weather conditions. In this context it should be mentioned that the average outdoor temperature in Reykjavik 1949-2009 was 4,65°C, and average wind speed 5,7 m/s. The City of Reykjavik has installed a permanent monitoring system for energy consumption in several municipal buildings. This energy monitoring system measures consumption of electricity and hot water for heating as well as key efficient components, this data is logged every 15 minutes 24/7 and made available at an interactive web site for building operators and

Figure 11.2
CO₂eq/GWh from power production.

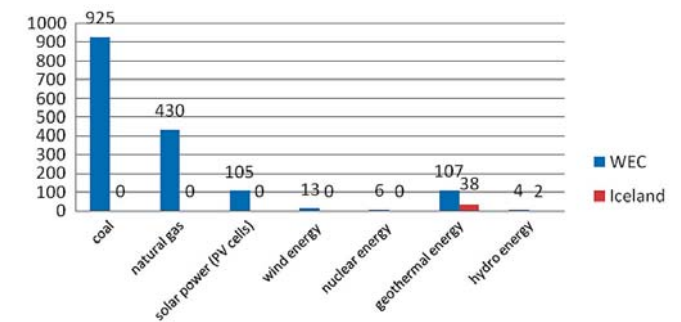


Figure 11.3
Example of monitoring of electrical energy usage in the Fellaskóli school, the chart displays usage for 2005.

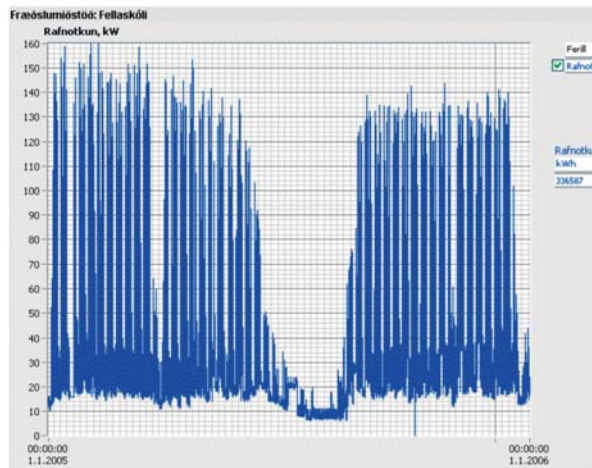
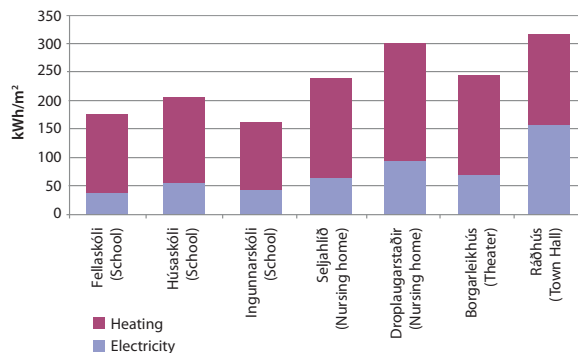


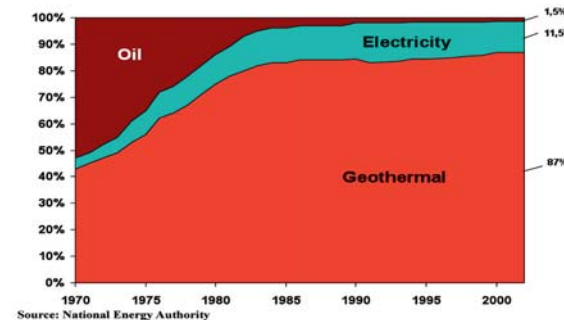
Figure 11.4
Energy consumption index for municipal buildings in Reykjavik.



energy consultants (see figure 11.3). In general, buildings equipped with such an energy monitoring system uses 10-20% less energy than equivalent buildings without energy monitoring system. Figure 11.4 shows an example of average energy consumption in few municipal buildings in Reykjavik the last five years.

The Icelandic authorities approached the European Commission with a request for derogation from the Directive on Building Energy Efficiency, on the grounds that its implementation in Iceland will not contribute to the achievement of the Directives overall goals. This is due to the specific features of the Icelandic energy situation. When considering that in Iceland around 99% of the electricity and around 98% of the heat for space heating (see figure 11.5) is produced from renewable sources, it is clear that any actions in this field will have little impact on the emissions of greenhouse gas. Therefore, the Directive will not be implemented into Icelandic legislation.

Figure 11.5
Space Heating Market in Iceland by Source.



11.2 Measures implemented over the past five to ten years

A. Developing an overall policy for environmental management of municipal activities

The City of Reykjavik has had an overall environmental policy for the city since the 1980s. In 2001 the policy was reviewed, and incorporated in the Reykjavik Local Agenda 21 (see appendix 1). After revision in 2006, the Local Agenda 21 was re-issued as Shaping Reykjavik. In the review of the policy, consultation with the people of the city and with experts outside the municipal administration was central. The project was nominated, along with Birmingham and Bristol, for the Eurocities award for participation (see www.eurocities.org awards 2006). Close consultation with the public, with state agencies and with experts outside the City administration has been adopted into the City's policy-making processes, and is one of the City's strengths.

Shaping Reykjavik comprises nine main themes:

- Transport
- Environment, public health and welfare
- Environmental quality
- Nature conservation and outdoor life
- Consumption and waste
- Land use and buildings of the future
- Green accounting and environmental management
- Democracy and public participation
- Environmental education

The City's policy is implemented through the environmental action plan Green Steps in Reykjavik, which is based upon Shaping Reykjavik and other related policies. The action plan is reviewed annually as part of the City's Work and Financial Plan, when funding is allocated to Green Steps projects. The review includes an evaluation of results and whether objectives have been achieved, and decisions on new projects to be undertaken. In order to evaluate the results of the City's environmental planning and action plan, the City administration carries out regular monitoring of specified environmental indicators, which are taken into consideration in reviewing the Green Steps, evaluating necessary measures, and prioritising projects. The indicators are accessible on the City's website. In addition to Local Agenda 21 and the Green Steps, the City has formulated a Climate and Air Quality Policy, a Transport Policy, a Bike Plan and Waste Handling Plan, appointed a work group on the introduction of electric vehicles, etc.

B. Increasing the share of the total consumption of eco-labelled, organic and energy-efficient products

City of Reykjavik procurement policy and rules

According to the city's procurement policy, environmental factors are to be taken into account by employees undertaking purchasing on behalf of the City. The City's procurement rules were revised in 2009. One of the main objectives of the revisions was to make green procurement a principle in the entire City's procurement. In revision of the rules, it was not deemed wise to make

green procurement an absolute requirement due to the risk of legal action arising from tenders. In revision of the rules they were framed in such a way that the purchasing party must evaluate the environmental impact of the purchase; if the City's policy of green procurement is not followed, this decision must be supported by reasoned argument. Purchasers fill out a checklist, which must be submitted with the tender documents to the City's Procurement Office. This process facilitates monitoring of green procurement; the Procurement Office is able to pinpoint obstacles to green procurement, and can press for compliance with the City's green procurement policy.

International collaboration

The City of Reykjavik is a member of the ICLEI Procura+ project. Procura+ is an initiative designed to help support public authorities in implementing sustainable procurement – and help promote their achievements. The campaign was established in 2004 by ICLEI to help drive the mainstreaming of sustainable public procurement. In March 2009 the City of Reykjavik hosted an international conference on green procurement in collaboration with ICLEI. The EcoProcura conference has been held regularly since 1998. EcoProcura is a European conference to provide a platform to promote exchange and dialogue amongst purchasers from all levels of governments, suppliers, policy-makers and multipliers on strategies and the latest practical solutions for implementing sustainable procurement. The conference in Reykjavik was attended by 220 participants from 41 countries. The City of Reykjavik saw the EcoProcura conference as an opportunity to engender greater interest and understand-

ing of green procurement within Iceland. The conference indeed had an impact, as purchasers, suppliers and consultants in Iceland showed increased interest in eco-friendly procurement.

Domestic collaboration

The City of Reykjavik has been collaborating since 2003 with the State Trading Centre and the Ministry for the Environment to introduce green public procurement in Iceland. The City participated, for instance, in the formulation of a new purchasing policy for the Government, in which green procurement is one of the three main pillars, and also in the National Action Plan for Green Public Procurement. The City of Reykjavik has representative on the steering committee on green procurement in Iceland. The steering committee has e.g. set up a website on green public procurement in Iceland (see www.vinn.is), criteria documents for green procurement and held conference on green public procurement.

C. Increasing the energy efficiency of municipal buildings

As stated above, use of heating and electricity is not an important environmental issue in Reykjavik, as all electric power and heating derive from sustainable utilisation of renewable energy sources. Nonetheless, efforts are being made to enhance energy efficiency in various ways, such as improved insulation of buildings, see above.

11.3 Planned long and short term measures to improve municipal environmental management

The City of Reykjavik sets itself a high standard on environmental issues and much has been achieved in recent years. In 2005 the City's Department of the Environment was moved to be administrated directly under the mayor, and in 2008 Transport was placed under the Department, as it was seen as an important environmental issue. Policies have been formulated and plans made for the principal environmental issues.

Local Agenda 21

The City of Reykjavik's Local Agenda 21 is the principal policy statement on environmental issues (appendix 1). Under the policy, the City's aim is that the City administration and businesses in Reykjavik are to set an international example in the use of environmental management tools. The policy has led to increased environmental awareness and continuous rise in number of certified environmental management systems by the City, even though targets to increase the percentage of the number certifications have not been set.

Environmental Action Plan 2010 (Green Steps 2010)

The City of Reykjavik's environmental action plan, Green Steps, is based upon its Local Agenda 21 and other City policies on environmental issues (see appendix 2). The Green Steps are reviewed annually as part of work and financial planning, as stated in the answer to question 11.2. In the ongoing revision of the plan for 2010, the emphasis is on climate issues. An estimated 1,4 million

EUR will be allocated to structural projects relating to the Green Steps in 2010. Costs of altered services, publicity, education and other Green Steps tasks are not included in that sum.

Green Steps in the work of the City of Reykjavik

In order to set an example for the public and businesses in Reykjavik, the City administration has introduced Green Steps within its own system of workplaces. The City's divisions, offices and agencies can take Green Steps, which will be verified and certified. Provision is made for four defined environmental phases, each of which includes actions in nine fields, including transport, waste production, procurement etc. The Green Steps and supporting information, guidelines etc. are now mostly completed. The presentation of the project is now in preparation, before the system is implemented. An environmental officer will be appointed within each division, who will liaise with individual workplaces.

Climate and air-quality policy

The City of Reykjavik has formulated a policy on climate and air quality. The City's policy is that overall emission of greenhouse gases is to be reduced by 35% by 2020 and by 73% by 2050, compared to 2007 emission levels. It also states that the air in Reykjavik shall be healthy, and shall at least meet the standards of the EU Directive. Constant efforts shall be made to improve air quality in the city. The policy also states objectives in eight fields including transport, urban planning, green operations and industry, in order to pursue the City's policy. The policy will be implemented inter alia through the Green Steps; as stated above the Green Steps for 2010 will focus on climate issues.

Waste management

The City of Reykjavik has set up a strategic plan for the management of waste 2009-2020 in accordance with Directive 75/442/EEC of the Council of the European Communities. The hierarchy of waste treatment was decided based on the European waste hierarchy and life cycle assessment. According to the plan, recycling will be increased in 2010-2011 by collection of recyclable waste from every household. An anaerobic digestion and composting plant will be built in 2012-2013, and methane gas yielded by the plant will be used as vehicle fuel to replace imported fossil fuel. Solid recovered fuel (SRF) will be produced from plastic, rubber, wood etc. in 2015. An incineration plant will be constructed in 2020 to incinerate combustible waste not suitable for SRF or digestion/composting. The plan takes account of conditions on the energy market in Iceland. The aim is to achieve the maximum environmental benefit by harvesting methane to fuel vehicles. The plan goes farther than the EU Directive regarding disposal of organic waste in landfill. The City intends to cease all disposal of organic waste into landfills in 2020, while under the EU Directive in 2020 it will still be permissible to dispose of 35% of 1995 levels of organic waste in landfills.

Transport policy

The City of Reykjavik has agreed to a transport policy and actions have been taken e.g. to improve public transport. Bike Plan with ambitious quantitative goals has been formulated for the City of Reykjavik, which was made public in January 2010. A transport policy has also been formulated for the City administration, based

upon the City's transport policy and Local Agenda 21. The policy aims to make the City's own transport eco-friendly, to reduce the need for travel, and to contribute to improving the city environment and public health. The introduction of the policy favours more eco-friendly transport during working hours, and reduces travel time and expenses. Cycling, public transport and use of eco-friendly vehicles are among the features of eco-friendly transport.

Green procurement

By becoming a member of the Procura+ project at the end of 2009 (see above), the City of Reykjavik undertook to formulate objectives regarding green procurement. These objectives have not yet been formulated, but they will refer to the product groups covered by the campaign (electricity, construction, food, IT products, cleaning products, buses).

Municipal Plan and Green Communities

A review of the City of Reykjavik Municipal Plan is in progress. In that context a policy on green districts has been drafted. The policy aims to create a framework for the design of green districts, focussing on waste management, energy efficiency, choice of building materials, outdoor activities etc.

Aalborg Commitments

The City of Reykjavik decided in the autumn of 2005 to take part in the Aalborg +10 agreement; prior to that the Aalborg Commitments had been ratified. The Aalborg Commitments are a target-setting process in dialogue

with local stakeholders and incorporating existing Local Agenda 21 or other sustainability action plans (for further information see <http://www.aalborgplus10.dk/default.aspx>). Each item on the Local Agenda 21 relates to the Aalborg Commitments. Measures in each field are introduced by the City of Reykjavik's Green Steps. The City's environmental indicators are under review with respect to the priorities of the Aalborg Commitments.

Covenant of Mayors

Covenant of Mayors is a covenant organised by the European Commission in 2007. The Covenant of Mayors is a commitment by signatory towns and cities to go beyond the objectives of EU energy policy in terms of reduction in CO₂ emissions through enhanced energy efficiency and cleaner energy production and use. Municipals that become members in the covenant commit themselves to cut down greenhouse gas emission by at least 20% by 2020. The Executive Committee of the Reykjavik City Council agreed that the city should become a member in the covenant on its meeting on May 1st 2010.

11.4 Documents, websites and documented decisions

Environmental certifications

- Department of Environment and Transport, ISO 14001. (ice/eng)
- Reykjavik Energy, ISO 14001. (ice/eng)
- Green and Blue Flag certification. (eng)

Documents

- Energy statistics in Iceland 2009. (eng)
- The ECTOS project, 2006. (eng)
- Carbon footprint of geothermal and hydro power plants and energy efficiency of houses in Reykjavik. (ice)
- Energy efficiency of municipal buildings in Reykjavik. (ice)
- Explanatory memorandum – Directive 2002/91/EC on the energy performance of buildings. (eng)
- Shaping Reykjavik, Reykjavik's Local Agenda 21, 2006. (eng)
- Environmental indicators in Reykjavik 2008. (ice)
- Reykjavik procurement policy. (ice)
- Checklist for green procurement. (ice)
- Green Steps in the City system. (ice)
- The City of Reykjavik Climate and Air Quality Policy, 2009. (ice)
- Strategic Planning for the Management of Waste 2009 – 2020, English Summary, 2009. (eng)
- Reykjavik Transport Policy. (ice)
- Reykjavik Bike Plan. (ice)

Websites

- Methane company Metan Ltd.: www.metan.is (eng/ice)
- Green cars in Reykjavik: DesktopDefault.aspx/tabid-39/351_read-7666
- Published material on Green Steps in Reykjavik: <http://www.Reykjavik.is/desktopdefault.aspx/tabid-2229>
- Procura+ website: www.procuraplus.org (eng)
- EcoProcura 2009 website: <http://www.iclei-europe.org/index.php?id=6337>
- Website on green procurement in Iceland: www.vinn.is, a joint project of the State Trading Centre, the Ministry for the Environment and the City of Reykjavik
- Aalborg Commitments website: <http://www.aalborgplus10.dk/>

11.5 Disadvantages resulting from historical and/or geographical factors

Two geographical factors affect the answers under this environmental indicator:

- Easy access to inexpensive green energy, and the harsh climate, influence energy consumption and efficiency of buildings.
- Distance from EU markets and the smallness of the Icelandic market have an impact upon green procurement. The availability of green goods and services is less than in many other countries, and hence the City is subject to certain limitations in its tenders, to avoid discrimination between bidders.

12

Disseminating programme of Reykjavík as European Green Capital

- 12.1 Introduction
- 12.2 Key elements of the programme
- 12.3 Experience and best practice to be disseminated
- 12.4 Programme implementation
- 12.5 Highlights of the programme



12.1 Introduction

The following is Reykjavík's dissemination programme as European Green Capital 2012/13. The Department of Environment and Transport has prepared this programme in collaboration with Visit Reykjavík (www.visitreykjavik.is), which will be responsible for events and festivals and interaction with visitors from abroad. Voluntary organisations and businesses with an interest in environmental issues were also consulted in the preparation of the program.

The aim of applying for the European Green Capital Award is primarily to make Reykjavík a better place and to have a positive influence on others. We have now been striving for self-improvement for many years; and we wish now, more than ever before, to step forward and to show other local governments in Iceland, and other European cities, what can be achieved.

The City of Reykjavík looks forward to presenting its projects as a European Green Capital, in order to encourage others, develop innovation and achieve results.



Figure 12.1

The use of environmentally friendly energy sources is one of the main features of the City of Reykjavík. This is one of the city's strengths and appropriate knowledge can be channelled to other cities.

12.2 Key elements of the programme

Motto: Reykjavík - European Green Capital – Naturally urban.

Focus: Sustainable and creative use of water and energy, beautiful and diverse green areas accessible for everyone, improved public health, active public consultation and cooperation as well as successful environmental education and communication. These are our keys towards a successful bid to improve the quality of life of citizens and simultaneously reduce their impact on the environment.

Principal objective: Through cooperation and with creativity, share our experience and best practices to inspire others to create a better and healthier environment. Target groups: Other cities in Europe, other communities in Iceland, and all the inhabitants of Reykjavík, regardless of age, social status, gender or ethnicity and domestic and foreign visitors alike.

Key message: Reykjavík is the European Green Capital. Reykjavík is the northernmost capital of the world, located in the middle of the Atlantic Ocean. Reykjavík is an exemplary city in its drive towards sustainability

and we want to share our vision, experience and best practice to inspire others. Reykjavík offers its inhabitants many accessible opportunities to improve their quality of life while reducing their impact on the environment. Reykjavík is a diverse, healthy and creative city where life is good.

12.3 Experience and best practice to be disseminated

Environmental issues have been given prominence in Reykjavík in recent years. The City has played a leadership role in Iceland, and set a good example to other local municipalities. Ambitious targets have been formulated, which have been pursued, and a good example has been set. The state of environmental issues within the City of Reykjavík administration is strong and integrated with transportation issues. In addition, emphasis is placed on inter-disciplinary work procedures.



Figure 12.2

A clean coastline is one of the factors that the City of Reykjavík is proud of.

As European Green Capital we want to disseminate the following experience and best practice:

- **Water:** One of the most important natural resources of the city is the water. Clean and cold groundwater for drinking and geothermal hot water for heating. The water is used in a sustainable and creative way to improve public health and quality of life. Examples include the geothermal beach at Nauthólsvík, widely accessible and inexpensive swimming pools with hot tubs, and drinking fountains by footpaths along the shoreline. The water is our pride and the City strives to preserve this important resource through protection and management, whilst at the same time exploiting it to increase the life quality of residents.
- **Green areas:** Nature is a striking aspect of the city and access to it is easy. Diverse and beautiful green areas are widely used by Reykjavík residents for outdoor recreation. All areas have access to green spaces, and good planning has ensured that these spaces are well connected. A concerted effort is being made to preserve and develop these green areas, with a special focus on biodiversity. The people of Reykjavík and visitors like walking, running and biking along the coastal path or in the many recreational areas. They also enjoy fishing in the salmon river in the middle of the city, as well as going on horse riding trips and whale watching cruises or swimming in one of the many city swimming pools.



Figure 12.3

The access and abundance of electricity from renewable energy sources motivated the City to establish the aim of changing over to electric vehicles and taking the lead in this field.

- **Energy:** In Reykjavík, the use of renewable energy is the main energy source. Reykjavík's buildings are heated using geothermal energy, and its electricity derives from hydropower and geothermal energy. Our innovative and sustainable use of these energy sources is something we willingly share with others for inspiration. Transport is the main source of greenhouse gas emissions and pollution in Reykjavík. Many successful projects have been undertaken in making transportation and travel habits greener, projects that also improve public health.

- **Education:** The City of Reykjavík has focused on education and communication and therefore promoted steadily increasing environmental awareness. The City of Reykjavík operates the Reykjavík Municipal Work School in the summer and the Reykjavík Nature School in the winter, where children are taught to understand their surroundings and to respect nature (see appendix 4 and 5). The schools are extremely popular among young people and children. In Reykjavík, the Eco-Schools programme has been applied in many schools and kindergartens. In addition, the City has emphasised a dynamic flow of information about environmental issues to city residents through various means, e.g. the media and internet.
- **Cooperation:** The City of Reykjavík has successfully emphasized active public participation and stakeholder engagement regarding environmental issues. The city has twice been nominated by Eurocities for successful and innovative public consultation in projects. The City of Reykjavík works together with neighbouring municipalities and various organisations on environmental issues, e.g. water protection, public transport, refuse collection and green procurement. The City is also involved in international collaboration and has, amongst other things, been an active member of ICLEI.

12.4 Programme implementation

In implementing the program we will apply with expertise all the approaches generally used for promotion, and we will especially strive to achieve clarity and simplicity of presentation, in order to reach our target groups.

A Green City Council will commence operations when Reykjavik is chosen to be the Green City of Europe. The council will include environmental representatives from the City and from the culture and tourism sectors. The council will work closely with interest groups and have oversight of all events that fall under the auspices of the Green City. The council will have financial flexibility and be able to hire advisors and marketing companies for temporary projects.

The principal points of emphasis in the implementation of the programme are as follows:

- Announcement that Reykjavik is the European Green Capital: this will be given a high profile among the people of Reykjavik, Icelanders in general, and visitors from abroad. A tourist brochure will be published about Reykjavik - Green Capital. Regular news releases in European media on environmental solutions in Reykjavik.
- A clear protocol will be developed to ensure that in Reykjavik, the European Green Capital, possibilities will always be examined for making municipal projects greener, and presenting them as such.

- The City of Reykjavik will elicit the collaboration of the Ministry for the Environment, so that national projects relating to the city will invariably take account of the European Green Capital and its green solutions.
- Promote Reykjavik as a Green Capital to visiting politicians and officials from elsewhere in Europe, and encourage them to participate in green projects.
- Encourage Reykjavik residents to participate and contribute to environmental matters.
- Demonstrate in a tangible way that it makes a difference to adopt green thinking and green conduct. Raise consciousness among the people of the city of opportunities to make a difference and counteract global warming. Encourage them to safeguard their own natural resources in the city.
- Ensure that the City of Reykjavik continues what it has started, by showing the world what has been achieved.
- Influence management of businesses and agencies in Reykjavik by encouraging them to choose green solutions, such as green procurement and eco-friendly travel habits of their employees.
- The City of Reykjavik will present a company or institution with an award of recognition for positive work during the year that the city was the European Green Capital. The Department of Environment and Transport is responsible for carrying out the selection.
- Introduce yet more systematic and ambitious environmental management in the city

administration, and encourage employees to work and cycle to work and make other decisions aimed at minimizing the impact of the city activities.

- The City of Reykjavik initiates a simple reward programme that could act as model for private businesses to encourage employees to cycle, car pool or use public transport. Visit Reykjavik will be responsible for this programme.
- Make a basis for businesses for sharing of green solutions, experiences, know-how and management.
- Have good relations with voluntary organisations, and support them in their efforts to share knowledge with Reykjavik residents and enhance the city environment.



Figure 12.4

The City of Reykjavik approved the new Cycling Plan in 2010, which will significantly improve cycling conditions within the city.

- Influence the academic community through research agreements and encourage the sharing of environmental knowledge and cooperation amongst scientists.
- City of Reykjavík events to be invariably linked to the European Green Capital once they have met the requirements for eco-friendly events.
- Draw attention to the city's small carbon footprint, and disseminate information on how we can do better. Companies will be encouraged to incorporate Green Steps, in the same way that the City of Reykjavík is now doing.
- The City administration's Green Steps to become known as a model in the operation of agencies and businesses in the city.
- Preschool, primary and secondary schools to receive special presentations on the city's projects, and to be encouraged to do their bit.
- Emphasis on collaboration with the tourism sector, both in the lead-up to the Green Capital year, and during the year. Consultation with tourism providers in the capital area is already under way. The City of Reykjavík's application to be European Green Capital is to be presented at the AGM of the Capital Area Tourism Organisation in February.
- Iceland has applied to join the European Union. Plans are in place to present Reykjavík as the European Green Capital before key European decision makers and to present positive environmental solutions.

12.5 Highlights of the programme

A. Website

- The Green Capital website will be interactive and both in Icelandic and English. It will comprise several categories: News, Events of the year and a Calendar.
- A portal will be opened on the website, where residents can send in their ideas on environmental issues. This has proved successful in the past, and the City has implemented ideas that have been submitted in this way. Ideas will be classified and submitted to the City's Environmental and Transport Committee for consideration.
- The City runs the city's primary/lower-secondary schools (for pupils of compulsory school age, 6 to 16 years). The website will include a portal with projects which teachers can use in environmental teaching. The website will be linked to the Reykjavík Nature School, whose task it is, amongst other things, to promote outdoor education in Reykjavík and to hold courses for teachers.
- General education from the City for the general public about sustainable development will be accessible on the website.
- Practical tips on environmental issues and on environmentally friendly lifestyles will be posted on the website, along with links to similar material provided by voluntary organisations and businesses in the environmental sector.

- Attention will be drawn to Reykjavík as a child-friendly city: information on outdoor games and places to visit such as the seashore, local woods etc. Data bank on entertaining and educational games will be accessible on the website.
- Weekly environmental tips sent by text message from the website.
- Green Capital page on Facebook, Twitter etc. – regularly updated.
- Green information on the City websites aimed for tourists, such as Visit Reykjavík and Pure Energy.
- Green Reykjavík Map to be available in collaboration with www.nature.is, which is a Green Map® System, an international classification system which aims to help people participate in creating a sustainable community.



Figure 12.5
Öskjuhlíð area is one of Reykjavík's most popular recreational outdoor areas.



Figure 12.6
The opening ceremony will take place on the historic island of Viðey, where, amongst other sights, Yoko Ono's Imagine Peace Tower is located.

B. Conferences

Opening ceremony: Will take place on Viðey, an island just off Reykjavík's coast with a long and eventful history. Among sights on the island are Yoko Ono's Imagine Peace Tower in memory of John Lennon, and Áfangar/ Stages by Richard Serra, an installation erected in 1990, which attracts many visitors every year. Participants will travel out to the island by boat from Reykjavík Harbour (15 minutes). The ceremony will highlight the relationship between peace and the environment. The President of Iceland will give the opening address.

Conference and Seminar Calendar: Environmental conferences and seminars will be held in Reykjavík during the year, with emphasis on various different themes. Each conference will be a close collaborative effort between domestic and foreign representatives that are associated with the conference theme, e.g. municipalities, official institutions or organisations. Conferences will be broadcast on the internet and available all year round.

The conferences will be targeted at various focus groups. On the one hand they will be international in scope and target organisations from foreign cities, and on the other they will have a domestic agenda, targeting municipalities, companies and Reykjavík residents. The goals will revolve around disseminating knowledge acquired by the City of Reykjavík, but also on ways to increase discussion on environmental issues, sharing of experiences and the finding of ways to improve results. Particular emphasis will be placed on opportunity, cooperation and innovation.

The Mayor of Reykjavík presents the programme and objectives. Presentation of themes for the year. At least five of the following themes to be chosen.

- Theme 1: Sustainable Transport. Change over to electrical vehicles, experience and best practice. International conference.
- Theme 2: Reykjavík – The Cyclist's City. Operations of the City of Reykjavík and other organisations

in encouraging cycling around Reykjavík. Various strategies for improvement will be reviewed. A conference with active public participations for all those who are interested in strengthening the cycling environment of Reykjavík.

- Theme 3: The future is in the air: Climate and air quality issues. Operations of the City of Reykjavík that relate to climate and air quality issues. The focus will be how to better take advantage of opportunities and achieve even better results in this field, e.g. through cooperation between companies and Icelandic municipalities.
- Theme 4: The value of pure water. Educating the public and the decisionmakers. Implementing the Water Framework Directive.
- Theme 5: Waste – from plan to practice. Methods for employing environmentally friendly waste processing procedures introduced to the public and municipalities, with a focus on experience and results. A status report will be presented of how we are faring in meeting Icelandic legal requirements and nationwide plans.
- Theme 6: Green spaces, nature, and biodiversity in collaboration with city residents and organizations. The value of environmental quality, nature pursuits for improving health, health parks, recreation and spiritual health.

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- Theme 7: Environmental monitoring. A report on how the Icelandic environment is monitored, who is involved and how it compares with other countries in Europe. What does the Icelandic legal framework say about monitoring? Levels of access to collected data will also be considered.
- Theme 8: Public participation and the environment. A review of why it matters that the public have a say on their environment and that the public receives information on environmental quality. Also under consideration will be how the public should be involved in the environmental decision making process and whether such collaboration delivers increased environmental quality.
- Theme 9: Environment in the shade of an economic crisis. The effects of economic hardship on the environment.
- Theme 10. Sustainable tourism and ecotourism. The introduction of environmental markers in the tourism industry and the value of pursuing tourism in harmony with the environment. Ecotourism and the environment as an attraction.

C. Events

A large number of major events take place in Reykjavik every year. Reykjavik Culture Night, which has become an essential part of cultural life in Iceland, sees thousands of people strolling the streets of the city on this exciting and eventful night. International festivals include, for instance, the Reykjavik International Film Festival and the Reykjavik Arts Festival. Numerous smaller events have also become fixed occurrences and prove popular with residents and tourists. In the year that Reykjavik becomes the European Green Capital, a range of green themes will be incorporated into these events, and artists and designers will undertake projects for the European Green Capital in connection to the events.

- Culture Night: green theme at Iceland's biggest annual arts event.
- Winter Lights Festival: green theme, one-week programme all over the city.
- Reykjavik International Film Festival: environmental theme.
- International Water Week in Reykjavik. The City will seek to host the World Water Week.
- European Mobility Week – participation.
- European Green Week– participation.
- Green Days in preschool and primary/lower-secondary schools reinforced with educational programme.
- Theatrical performance on water and its value performed in Reykjavik schools.

- Young people's performance art on the theme of sustainability, with the objective of changing perception of the concept.
- Workshops of creative work focussing on renewal and renewability. Open workshops in beautiful surroundings, on themes such as growing one's own vegetables.
- Children's Art Festival with focus on being green.
- Sea Festival and Seamen's Day: green theme.
- Theatre Festival Reykjavik – green theme.
- Young Arts Festival: youth arts festival.
- Photographic Poems, November 2012: competition for short documentaries held every autumn in Reykjavik. Young people aged 15-25 are encouraged to submit films. In cooperation with the Reykjavik International film festival (www.riff.is).



Figure 12.7

The Reykjavik Concert and Conference Centre will open in 2011. The closing ceremony for the EGC will take place there.

- Green Christmas in Reykjavík: focus on a modest festive season, and economical use of electricity
- Climate Camp: exhibition, workshop and education on climate issues.
- SMS text-message competition for young people: tips to counteract climate change.
- Internationally renowned Icelandic musicians Björk and Sigurrós hold Nature Concert in Laugardalur park.
- Green Capital programme in Reykjavík Botanical Gardens, a popular attraction.
- Study visits to leading green businesses and homes in Reykjavík.
- Presentation on green tourism in collaboration with the University of Iceland.
- The City will offer courses for the tourist sector in Reykjavík, on how to organise green events.
- DesignMarch: A wealth of events, interesting lectures and exhibitions reflect the diversity of Icelandic design.
- Event related to the United Nations General Assembly decision on International theme of the year.
- Environmental protection in practice: A course over several weeks that emphasises eco-friendly lifestyles, thought and behaviour. In cooperation with the Icelandic Environment Association.

- Green museum days. The Reykjavík museums would, in collaboration, present green days over one weekend, with a view to each museum raising environmental awareness. This would involve a range of museums.

D. Finale

The finale will be held in Reykjavík's new Concert and Conference Centre. The Mayor of Reykjavík will look back over the year, and present awards to businesses and young people who have contributed. The lessons and achievements of the year will be summed up, and the mayor of the next European Green Capital will be presented with a portfolio of key information on the City of Reykjavík's experience of its year as European Green Capital.

E. Shows on the road

- Exhibition of Reykjavík children's photographs: starting with teaching in workshop, after which children go out and take pictures.
- Exhibition presenting young people's ideas about sustainable development and climate change.
- Water, a fascinating exhibition on Reykjavík's water resources, travels to various European venues in collaboration with Reykjavík Energy.

F. Information, news, publishing

- News releases from City authorities will be informed by the Green Capital project. News releases on the progress of the project would be regularly issued. Special efforts to reach broadcast media. The City of Reykjavík promulgates news via its Reykjavík.is website, which is used by the public and media.
- Information Centre to be set up in Reykjavík on Green Options in the City: businesses and individuals will also have the opportunity to show green projects.
- Information officer of the Information Centre to promote the Green Capital. Direct access to tourists.

G. Articles in international periodicals

- Information officers of the City of Reykjavík seek out international perspectives on their news releases, and establish links with international news media.
- The City of Reykjavík will encourage publication in peer-reviewed periodicals of academic studies on environmental issues in Iceland, in collaboration with universities in the capital area.

H. Film and TV

- A film to be made about Reykjavík as European Green Capital. Discussions are underway, in collaboration with the Reykjavík International Film Festival (www.riff.is), about the making of the film. A video about Reykjavík in the semi-final of the European Green Capital will be shown during the summer of 2010 and aimed at tourists.
- Regular TV coverage of the European Green Capital project will be sought, and reports will be broadcast on radio.
- Competition for young filmmakers for short films on green projects in the city.

I. Green City Tours Reykjavík is a popular tourist destination

In 2009 a total of 566,000 tourists visited Iceland.

It may be possible to utilise numerous city pools, as the city is so water-rich. Swimming pools are an important source of health for city residents.

On the agenda:

- Tourist operators will be encouraged to offer tours of Reykjavík as the Green Capital for tourists from abroad. Tour operators in Reykjavík can temporarily apply for a license to use the European Green Capital logo. A checklist will be used that companies can fill in to show that they fulfil criteria to appear in brochures and for advertising.
- The European Green Capital project has already been introduced to the tourism industry and considerable interest has been expressed. Reykjavík, as the European Green Capital, will therefore have positive environmental impacts within the industry. The City of Reykjavík is currently shaping its tourism policy for 2011-2020 and a City representative, involved in the European Green Capital application, will contribute to shaping the green guidelines.
- New Green Reykjavík Study Visits will be made available, where green event management, drinking water and the green areas of Reykjavík will be in focus.
- Hydrogen-powered bus available for Green Sightseeing tours.
- Information on ecotourism to be promulgated to tourism businesses in Reykjavík. Collaboration on green issues with the Capital Area Tourism Organisation.
- Presentation of the Green Path to visitors: the Path is a 50 kilometre route through interesting places of natural beauty, recreational areas, and growing woods surrounding Reykjavík. The Green Path is classified as an environmental and tourism project.
- The Blue Path, a footpath that follows the coastline of the capital area, to be presented to visitors.
- Reykjavík on Two Wheels: cycle tours for tourists to be launched.
- Presentation for tourists on Reykjavík's allotment gardens and children's vegetable gardens.
- Presentations on geothermal and hydropower stations. Visits to geothermal power plant on Hellisheiði heath, adjacent to the city.
- Presentation of the Heiðmörk Nature Reserve for recreational use – for healthy walks and horse riding.
- Viðey island: idyllic natural environment, birdlife and history, Yoko Ono's Imagine Peace Tower, Richard Serra's Áfangar/Stages.
- Elliðaárdalur valley with salmon river.
- Whale watching from Reykjavík harbour.
- Mt. Esja, spectacular views of Reykjavík, ocean and mountain scenery.
- Promotion to tourists of the Geothermal Beach, which has been awarded the Blue Flag.
- The Tourist Information Centre will present Reykjavík - Green Capital to all visiting journalists and reporters from aboard.
- The VisitReykjavik.is website will be used to present the ideology of Green Reykjavík to visitors.
- The City of Reykjavík encourages tourism businesses in the city to become sustainable, by offering activities such as skiing, cycling, walking, boat trips, horse riding, sea-bathing, running, etc. and also by adopting their own green customs.



Figure 12.8

Reykjavík is sometimes called the city of pools.

12.6. Websites

On-line information:

- Homepage of the City of Reykjavík: www.reykjavik.is
- Reykjavík - Pure Energy: www.visitreykjavik.is
- The Reykjavík Botanic Garden: www.grasagardur.is
- An information and culture centre for young people: www.hitthusid.is
- Reykjavík Culture Night: <http://asp.reykjavik.is/menningarnott/pdf/EnPrint.pdf>
- Reykjavík winter lights festival: www.vetrarhatid.is/PortalData/11/Resources/vh2009/Grapevine_ens_2009_OK.pdf
- Reykjavík International Film Festival: www.riff.is
- Ocean Festival: www.hatidhafsins.is
- Theatre Festival Reykjavík: www.lokal.is/Home.html
- Nature School: www.natturuskoli.is
- Reykjavík Annual Events: www.visitreykjavik.is/desktopdefault.aspx/tabid-2/22_view-118
- GreenMap – Reykjavík: www.natturan.is/greenmap/reykjavik
- Nauthólfsvík: www.nautholsvik.is/desktopdefault.aspx
- Geothermal beach: www.nautholsvik.is/desktopdefault.aspx/tabid-123
- Reykjavík Energy: www.or.is/English
- Concert and Conference Centre - Harpa: www.austurhofn.is/austurhofn/
- The Icelandic Environment Association is an NGO: www.landvernd.is
- Nature.is - an eco-conscious network: www.natturan.is
- Green Steps for Reykjavík: www.rvk.is/desktopdefault.aspx/tabid-2229
- Viðey: www.reykjavik.is/Desktopdefault.aspx/tabid-3026
- Museums in Reykjavík: www.visitreykjavik.is/desktopdefault.aspx/tabid-42
- Welcome to Reykjavík: http://reykjavik.is/desktopdefault.aspx/tabid-714/4402_view-257/
- Whale watching: www.elding.is
- Reykjavík Study Visits: www.visitreykjavik.is/desktopdefault.aspx/tabid-4/
- Elliðaárdalur in Reykjavík: <http://web.rvk.is/ellidaardalur/>
- The University of Iceland: www2.hi.is/id/1002800
- The Icelandic Ministry for the Environment: <http://eng.umhverfissraduneyti.is/>
- Electric Cars: www.mbl.is/mm/frettir/innlent/2010/05/12/idnarradherra_kominn_a_rafbil/

Appendix



Appendix 1.

Shaping Reykjavik, the City Local Agenda 21

The city environmental management strategy is based on the Local Agenda 21 (LA21) ideology. Reykjavik city confirmed the Aalborg Commitments in 1998 which marked the formal beginning of LA21 in the municipality. This was followed up by establishing the first LA21, which was based on political and official views and on a survey, in 2001 and confirming the Aalborg +10 Commitments in 2005. This was the city's plan for a sustainable community until 2006 and it contained a vast number of issues, such as; sewage system, air quality and noise, waste, energy and natural resources, land use, nature conservation, transport, procurement, public participation, environmental education and life in the city in a new age. The number of projects was 92 and the implementation was fast and effective and over 80% of the projects were implemented in the planned time span. It was clear in 2005 that new LA21 was needed and the revision process started that year. It was also clear that new vision and new metrology was also needed. At the initial target setting phase of the LA21 revision, it was decided to ground it on rigorous public participation. Two groups were defined for the participation, first the Reykjavik citizens and second other stakeholders. Internet access in Iceland is one of the highest in the world so we decided to open an internet gate for the citizens, called Hallveigarbrunnur. Ideas and comments were also gathered via voice box and letters. We got 300 useful ideas in various fields to use in the LA21 revision. The project was nominated, along with Birmingham and Bristol, for the Eurocities award for participation (see

www.eurocities.org awards 2006). From the participation process, the second LA21, called Shaping Reykjavik, emerged. It was verified by the City council in 2006. At the same time, a special effort towards environmentally friendly travel options for the citizens was initiated. A transportation policy is also being implemented to reduce traffic in the Reykjavik area, aimed at saving money and reducing adverse environmental effects of transportation. The current LA21 consist of 9 environmental categories which each have objectives and projects.

Shaping Reykjavik comprises nine main themes:

- Transport
- Environment, public health and welfare
- Environmental quality
- Nature conservation and outdoor life
- Consumption and waste
- Land use and buildings of the future
- Green accounting and environmental management
- Democracy and public participation
- Environmental education

Appendix 2.

The Green Steps for Reykjavik

The City's policy is implemented through the environmental action plan, Green Steps for Reykjavik, which is based upon the current Local Agenda 21 and other related policies. It came into being in 2007 as a political manifesto of the present City Council. The Green steps contain several projects in ten fields or categories which are implemented from 2007 to date. The action plan is reviewed annually as part of the City's Work and Financial Plan, when funding is allocated to Green Steps projects. The review includes an evaluation of results and whether objectives have been achieved, and decisions on new projects to be undertaken. In order to evaluate the results of the City's environmental planning and action plan, the City administration carries out regular monitoring of specified Environmental Indicators, which are taken into consideration in reviewing the Green Steps, evaluating necessary measures, and prioritising projects. The indicators are accessible on the City's website (see <http://www.rvk.is/desktopdefault.aspx/tab-id-1004>). In addition to Local Agenda 21 and the Green Steps, the City has formulated a Climate and Air Quality Policy, a Transport Policy, a Cycling Plan and Waste Handling Plan, appointed a work group on the introduction of electric vehicles, etc. An estimated 1,4 million EUR will be allocated to structural projects relating to the Green Steps in 2010. Costs of changed services, publicity, education and other Green Steps tasks are not included in that sum.

The ten categories of Green Steps are:

- A Much Better Bus
- Green Vehicle Rewards
- Walking Green, Biking Green
- A Living City
- Better air quality for all
- Recycling for Everyone
- Green School and Pre-School
- Environmentally-friendly planning
- A Cleaner, Greener Reykjavík
- Leading by Example

Appendix 3.

Reykjavík City Environmental Indicators

Since 2002, Reykjavík City has developed a total of Environmental Indicators on various factors of the environment. The objective is to help the policymakers and politicians to better focus the decision-making process and to encourage knowledge-based decision making. The city took part in the Nordic Cities Environmental Indicators project which started in 2001, collecting 11 comparable and common data sets on the state of the environment. A report is given out regarding the environmental performance of the city each year. The indicators are now 15 in 6 various themes:

A. Impact of global warming:

Outflow of CO₂

B. Usage of resources:

Amount of waste
 Energy use
 Percentage of renewable energy

C. Water quality:

Water use
 Quality of drinking water
 Quality of coastal waters

D. Transportation:

Particle matter
 Number of days in which PM exceeds health limit values
 Noise from traffic
 Methods of travel

E. Biodiversity:

Salmon fishing and recovery of parr in the Elliða river
 The number of ducks at the Tjörn pond

F. Quality of outer environment:

Reservation areas
 Accessibility to outdoor areas

Appendix 4.

The Reykjavík Municipal Work School

Reykjavík operates the Reykjavík Municipal Work School (RMWS) (ice. Vinnuskóli Reykjavíkur). The RMWS is a unique feature amongst European cities. The school provides young people with work training and education in environmental matters. Over 70% of young people in Reykjavík aged 14-16 register with the RMWS for holiday jobs. The school also operates in winter for youth work alongside school attendance. The City takes account of their labour contribution in its planning. Under the supervision of instructors, young people work at cleaning and enhancing the appearance of the city, the urban area, the City periphery and senior citizens' gardens. RMWS is an Eco-school and has been awarded the Green Flag. Eco-Schools is a programme for environmental management and certification, designed to implement sustainable development education in schools by encouraging children and youngsters to take an active role in how their school can be run for the benefit of the environment. Adolescents and young people can thus play a direct role in keeping the city beautiful. The RMWS operates in collaboration with many other bodies working to develop the creative aspect of pupils' work and learning. The green priorities espoused by the RMWS stimulate the environmental awareness of young people who work at the school and unite them in implementing those priorities (more information on www.vinnuskoli.is).

Appendix 5.**The Reykjavik Nature School**

The City of Reykjavik operates the Reykjavik Nature School (íce. Náttúruskóli Reykjavíkur). Under Local Agenda 21 – Shaping Reykjavik, the City of Reykjavik aims to develop outdoor education in primary/lower-secondary schools and preschools and to create a platform for sound environmental work in schools. The Nature School has provided training for teachers in primary/lower-secondary schools and preschools in order to enhance their skills in outdoor and environmental education methods. The City has with the work of this school fostered outdoor tuition and nature studies in primary/lower-secondary schools and preschools in Reykjavik. Alongside this, over twenty schools in Reykjavik have been allocated adjacent areas to be utilised as outdoor classrooms to encourage knowledge and awareness of the nature value of the area. By working with the Reykjavik Nature School and the Reykjavik Municipal Work School children and young people receive focused and soundly based education about environmental concerns while at the same time learning to cultivate gardens in the urban area (more information on <http://www.natturuskoli.is/>).

Appendix 6.**1, 2 and Reykjavik - Collaboration with citizens**

The City of Reykjavik prioritises consultation and collaboration with its residents. In Local Agenda 21 – Shaping Reykjavik, the City places emphasis on promoting grassroots democracy and giving everyone an equal voice and equal rights in shaping their environment. As an example of a project to achieve this goal, extensive consultation took place under the banner „1, 2 og Reykjavik“ in 2008-2009. Its aim was to canvass opinion on maintenance works and smaller new projects carried out within the city environment. A comments website was set up where residents could submit suggestions and examples and track the status of their suggestions and those of other people. Residents were free to post comments about any district of the city. It was possible to attach comments to all district maps, browse an overview of comments and vote on other people's comments. A total of 2.517 comments were collected, all of them processed within the City's network, and 17.670 votes on the comments were counted. The City has also established a residents' consultation panel with a wide remit, and is developing ways to increase residents' involvement in decision-making on projects and on prioritisation in the City's budget.

Appendix 7.**The City of Reykjavik addresses the economic situation**

The City has reacted to the altered economic situation by agreeing on an action plan for the City of Reykjavik, whose strategic objectives are to affirm that the City will always be a leader in the promotion of its residents' quality of life, and that Reykjavik will be the first choice both for private citizens and businesses. Priorities in this process will be environmental concerns and increased collaboration with the national government on the most important issues for the city. Commissioned by the City Council, the Plan was produced by a team of around 200 people, with the objective of reducing the long-term negative impact of the economical difficulties that are now being confronted.

Appendix 8.

Environmental education in the City of Reykjavik

Project/Institution	Year	Aim	Methodology	Target groups	Scope	Website
Education department of the Reykjavik Zoo and Family Park	1990 (general education for the public and student groups) and 2004 (Aquarium)	To present Icelandic domestic animals, bring visitors closer to Icelandic agricultural practice and to strengthen the bond between people and animals. Show a few animal specimens of each species and highlight variation, colouring, both sexes and offspring. To be a role-model and offer refuge to wild animals under duress. Also present the wildlife of oceans and lakes, with special emphasis on the ocean around Iceland.	Organised animal education and work mornings for primary and secondary schools. Courses and "touch" teaching in the Aquarium for primary and secondary school groups. Information signs for the public and people offered to observe feeding times and to learn about animal behaviour.	Kindergarden, comprehensive school groups. Public.	5-6,000 school children per year. 186,000 members of the public.	www.mu.is
Eco Schools	2000 (in Iceland) International project	To increase environmental awareness, improve school environments, reduce waste and use of energy and water, give students the opportunity to tackle environmental issues.	Environmental recognition for schools.	Kindergarden, comprehensive schools and universities.	13 kindergardens, 15 comprehensive schools and two other schools (the Reykjavik Municipal Work School and the School of Nature) participate in the project.	http://landvernd.is/graenfaninn/
Neighbourwoods	2002	To increase knowledge and awareness of the value of forests for nature, people, culture and history, society and the country's economy.		Comprehensive schools.	19 contracts signed in December 2009	http://www.skoqur.is/utgafa-og-fraedsla/lesid-i-skoginn/
Education in the Reykjavik	2002 (education for the public) and 2006 (education for school groups)	To utilise the numerous plant collections in the garden to educate about the environment, gardening, botany, fauna, garden culture, garden products and to facilitate artistic creativity.	School groups and project work. Guides and information signs for the public.	Groups from all educational levels.	About 400 students in 2008. Statistics for general visitor numbers are not available.	www.grasagardur.is
The School of Nature	2005	To strengthen outdoor teaching in primary and secondary schools and to create a venue for comprehensive educational work within schools, in the spirit of the city's environmental policy.	Courses, induction, outdoor teaching, advice.	Teachers and students from kindergardens and comprehensive schools of Reykjavik.	Course participants: 686 teachers from 43 comprehensive schools and 37 kindergardens. The induction of outdoor teaching in 21 schools and kindergardens.	www.natturuskoli.is
Eco Champions	2007	To encourage people to work towards environmental protection, to raise awareness of how young people perceive environmental issues and to call for environmental leadership from the younger generation.	Yearly project competition. A venue for presenting model projects that relate to environmental education. In 2010, a special emphasis will be placed on projects that deal with biodiversity.	Students from years 5 to 10 (10-15 years old).	An awards ceremony takes place on the Day of the Environment, being the 25th of April every year. The Minister for the Environment delivers the awards.	http://www.umhverfisraduneyti.is/varldidar/
Environmental education at the Reykjavik Municipal Work School	2007	To shape environmental and development projects in collaboration with City institutions, with a view to improving the general City environment. To generate an understanding of environmental value and to promote the need for treating the environment with care, regardless of whom it has been entrusted to.	The Municipal Work School employees are responsible for environmental and nature education on-site during the working hours of students.	Uppermost level of comprehensive school.	Close to 4000 students yearly.	www.vinnuskoli.is