Research, the Environment and Society

Landsvirkjun is a leader in the sustainable use of renewable energy sources. We strive to seek out innovative and unconventional pathways in technological development, in cooperation with universities, research institutes and independent experts. Landsvirkjun is constantly looking to the future and exploring unique opportunities for ongoing success. A key factor in the Company's achievements is the dedicated team of employees who uphold prudence, progressiveness and reliability as core values in their work. Landsvirkjun has a clear policy on social responsibility and is committed to maximising the positive impact of business on society and the environment, and diminishing the negative.

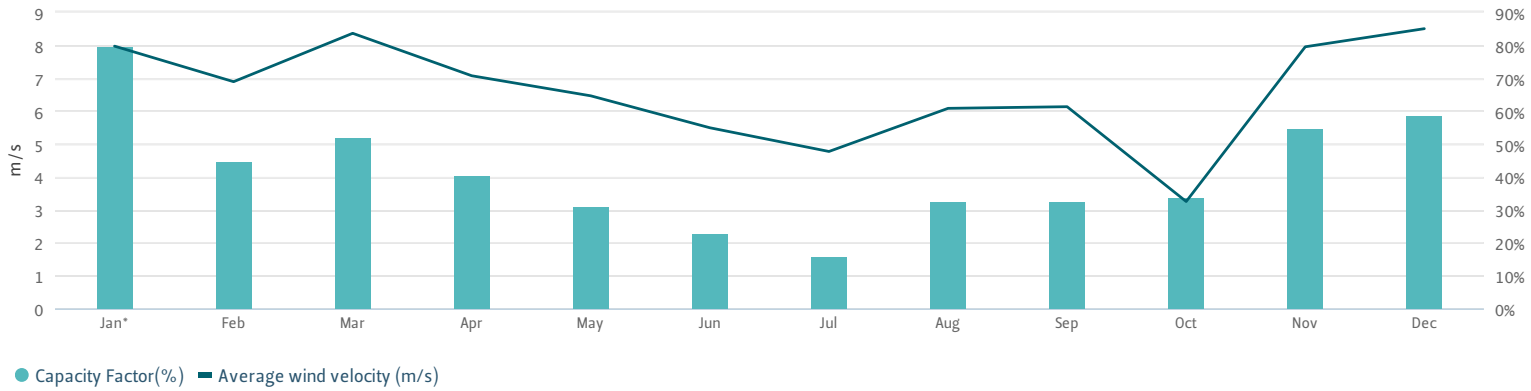
Wind energy becomes a valuable resource

To the north of Búrfell, approx. 70km from the coastline, is a lava field by the name of Hafið. Landsvirkjun has erected two 900 kW wind turbines in the area, for research purposes. The wind turbines have been successfully operated since the end of January, 2013 and are the largest of their kind in Iceland.

This is the first time that the feasibility of wind energy has been investigated and there are clear indications that Iceland is an advantageous location for electricity generation, utilising wind power.

Wind turbine capacity in 2013

After nearly one year of operation, the average capacity factor for the wind turbines is approx. 40%, which exceeds all expectations. In comparison, the average capacity factor worldwide is approx. 28%.



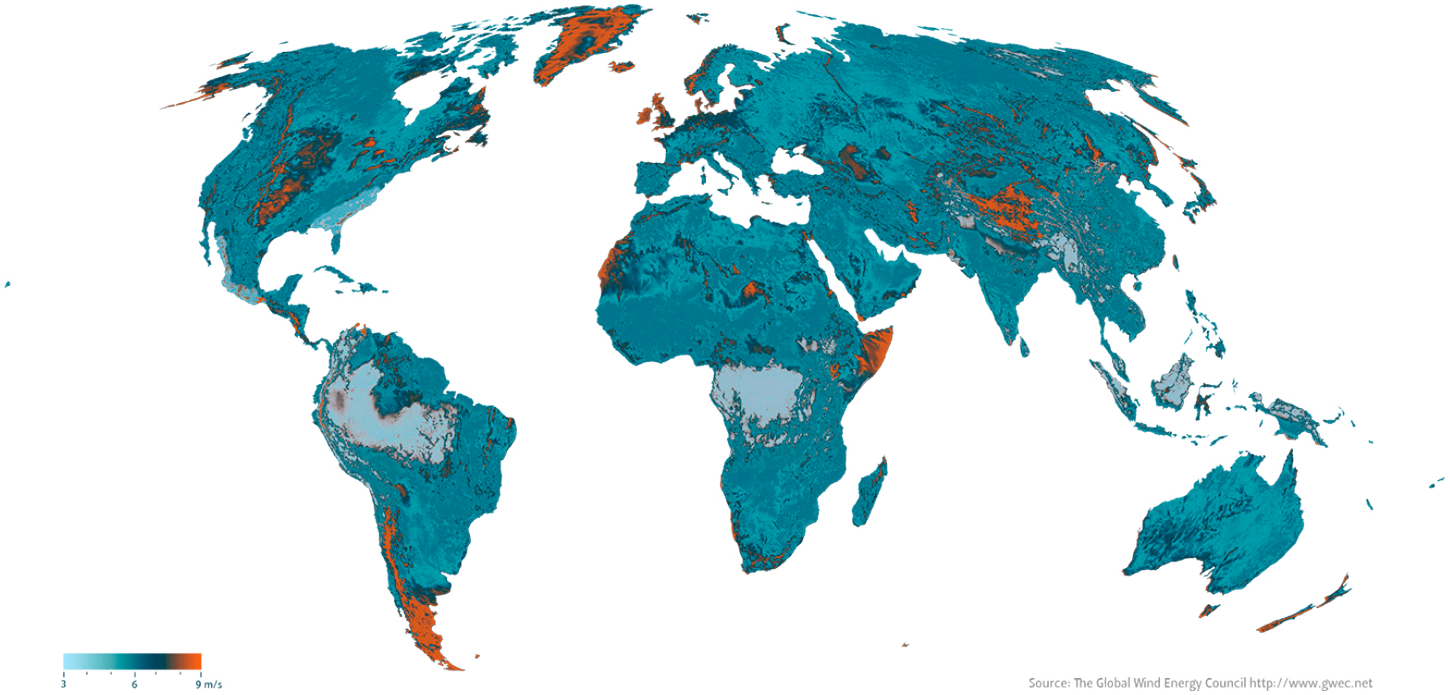
Wind velocity is relatively high, at a relatively low height in Iceland. This significantly reduces the cost of energy and operating costs as hub heights can be kept much lower than in other countries.

A natural wind tunnel forms in this area and wind speeds reach an average of 10–12 m/s, at a height of 55 metres. Elsewhere, wind turbines are usually raised by the sea or offshore where wind speeds are more consistent than in inland areas. The yearly average capacity factor for Hafið is approx. 40% which is unusually high. In comparison, the average capacity factor worldwide is approx. 28%.

The wind turbines

THE MAST HEIGHT 77 METRES	ENERGY GENERATION BEGINS 3 m/s	INSTALLED CAPACITY 1.800 KW
GENERATION CEASES 34 m/s	WIND VELOCITY AT PEAK EFFICIENCY 15–28 m/s	ANNUAL ENERGY GENERATION 6 GWh

Average wind speed at 80 meters



Iceland is the one hundredth country in the world to utilise wind energy for energy generation purposes. The opportunities are extensive and wind energy could potentially become the third pillar in Landsvirkjun's electrical system. The installed capacity of wind energy worldwide now represents over 3% of all energy consumption, or 318 GW. Rapid technical advances within the field are making wind energy an increasingly feasible option. The World Wind Energy Association expects the installed capacity of wind energy worldwide to double by the end of 2016; it could reach one million MWs.

The installed capacity of wind energy worldwide now represents over 3% of all energy consumption, or 318 GW. There are clear indications that Iceland is an advantageous location for electricity generation, utilising wind power.

How can we utilise the wind?

Wind energy and hydropower are generated using the same technology. A large magnetised rotor rotates within a copper wire covering, transforming kinetic energy into electrical energy. The turbine is located in the powerhouse behind the blades.

The wind turbines are manufactured by the German company Enercon and are gearless, direct drive mechanism wind turbines. The main advantages of this type of turbine include low maintenance costs, low energy losses, a longer life span and minimal noise emissions.

The wind turbines each have a 900 kW capacity and together their generating capacity could be up to 6 GWhrs per year. The energy generated would be enough to serve 1400 households.

Experience through operations

Research on the wind turbines at Hafið will provide valuable information on the unique operational environment in Iceland, focusing on the effect of icing, snow drift, ash, sand drift and noise, as well as the impact upon wildlife and the Icelandic community. The Hafið area is particularly suitable for the project as it is not in close proximity to residential areas but close to the necessary infrastructure; lines and roads. Other wind turbines could be raised in the area if the project proves successful.

Wind energy is not reliable as this type of energy generation is reliant on the weather. Wind energy could work well in conjunction with hydropower; when the blades are at full capacity then water could be spared in the reservoirs and the reservoirs could be utilised when wind velocity is low. If the project proves to be a success then wind energy could become an important additional resource, alongside hydropower and geothermal power.

Energy generation in harmony with the environment and society

Corporate social responsibility (CSR) is about maximising the positive impact of business on society and the environment, and diminishing the negative. Landsvirkjun has established a clear strategy on social responsibility that mirrors this. The Policy was a key project in 2013 and dozens of employees have been involved in its development throughout the last few years.

60 million ISK allocated by the Energy Research Fund

The Energy Research Fund's goal is to strengthen research in the fields of environmental and energy affairs. Since its establishment, in 2008, the fund has awarded grants in the amount of approx. 319 million ISK. The fund has awarded 30 grants at the doctoral level, over 60 grants at the master's level and approx. 130 grants for other research projects. In 2013, Landsvirkjun awarded 60 million ISK to 32 projects.

One of the objectives of the fund is to make Landsvirkjun's monetary contributions to research more efficient and transparent, and to ensure that the studies supported by the fund comply with Landsvirkjun's environmental policies.

Landsvirkjun also supports the universities in Iceland. Recently, the Company signed an agreement with Reykjavík University and the University of Iceland to support and encourage the development of expertise within the field of renewable energy. The collaboration will support the development of increased expertise in the field of renewable energy sources and their utilisation.

Investing in innovation

Innovation driven projects in Iceland have resulted in the establishment of a number of start-up companies. The companies cover a wide range of fields and have thrived in the last few years. Iceland is rich with natural resources and there is tremendous potential to create value by supporting this type of innovation.

Startup Energy Reykjavík (SER) is a mentorship-driven investment programme for seed stage, energy related business ideas. The programme was established in 2013 and the founders of the program are Landsvirkjun, Arion Bank, GEORG and Innovation Centre Iceland. The program offers its participants the opportunity to be mentored by a group of 50 experts from the science and business world and the opportunity to present their ideas to potential investors. The goal of the programme is the creation of shared value for the energy industry and society.

Knowledge is the key to progress

Landsvirkjun is intent on becoming a leader in the sustainable use of renewable energy sources and resolute in pursuing and supporting innovation and technological development within the field. In order to achieve this, extensive research is conducted in a diverse variety of disciplines, including research on ecosystems, meteorology, hydrology, glaciers and geology, to name but a few. The impact of power projects on ecosystems, water systems and various other factors are monitored, as well as the effectiveness of mitigation measures. A number of different parties, universities, research institutes, companies, individuals and scientists, both national and international, conduct this research.

Connecting with Europe

Landsvirkjun has been involved in assessing the feasibility of a sub-sea cable connection with the European electricity grid for some time. Preliminary assessments, carried out up until the turn of the last century, suggested that a sub-sea cable was technically possible but not economically feasible. However, changing conditions in the European energy market indicate that a sub-sea connection with Europe could in fact prove to be a lucrative project.

Connecting the Icelandic electricity grid to the European grid would have a substantial effect on Icelandic society and the Icelandic economy. It would therefore be crucial to assess both the negative and positive impact of such a project before moving forward. The prerequisites for a project of this scale would be the achievement of a broad consensus within society and effective cooperation with stakeholders.

In light of this, the Icelandic Ministry of Industries and Innovation appointed a 15 member, cross- party committee to assess the macroeconomic and social implications of a sub-sea cable and they returned their verdict to the Minister in June, 2013. The report was put forward for debate within the Icelandic parliament and then referred to the Industrial Affairs Committee of the Icelandic parliament. The committee returned its findings in February, 2014, recommending the further development of the project. They also stated the importance of raising public awareness and a broad perspective on the potential impact of the project.

Competitiveness of the project

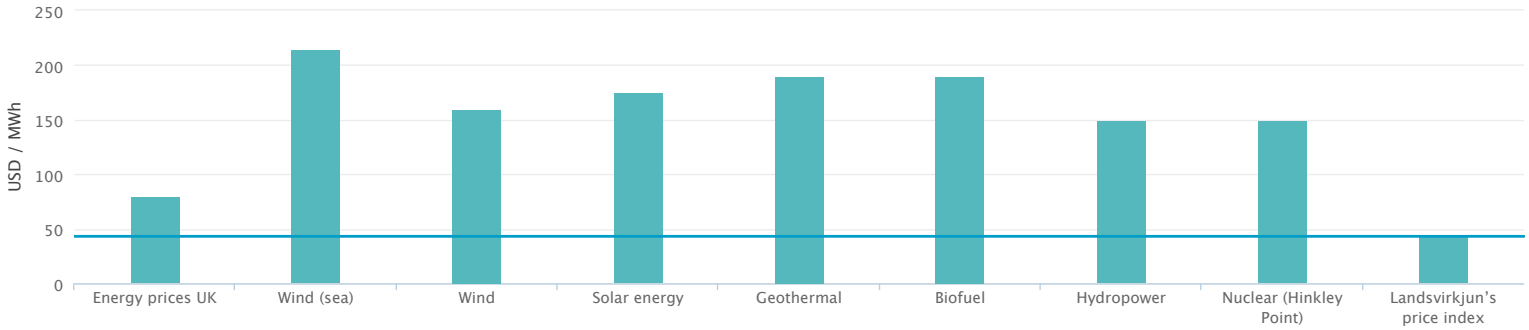
The changing landscape of the energy market and technological advancement are perhaps the strongest indicators that power exchange via a sub-sea cable could prove to be competitive within the international market. Sub-sea cable projects are becoming increasingly large-scale as new technology allows for longer and more powerful connectors, at greater depths, across difficult sea terrain.

The increasing demand for 'fossil fuel based energy' has resulted in historically high energy prices worldwide. Electricity prices are no exception as over half of the world's electricity is produced by utilising coal and natural gas. There is also increased awareness on the negative environmental impact of burning fossil fuels.

The International Energy Agency predicts that the demand for energy in 2035 will be 73% higher than what it was at the beginning of the century.

In light of this, Europe has developed a support mechanism to ensure the long-term profitability of renewable electricity generation and the reduction of GHG emissions. It is entirely possible that Icelandic electricity, generated via sub-sea cable, would be eligible for such support.

The Department of Energy & Climate Change in the UK guarantees electricity prices for 15-35 years to energy producers



Source Department of Energy & Climate Change, November 2013

Economic and societal effects

The latest assessments indicate that electricity sales via a sub-sea cable could prove to be profitable for Icelandic energy producers and competitive in price for electricity purchasers in the rest of Europe. However, the profitability of such a project would be dependent on bilateral agreements, addressing not only energy prices but the responsibility taken on by both parties with regard to the potential risk factors involved. Landsvirkjun has been purposefully involved in an informed discussion of the underlying risk factors involved, and this work will continue.

The large scale of the project would demand the broad consensus of Icelandic society for it to proceed. Further research would be required on the macroeconomic, societal and environmental impact of the project and an open and informed discussion, within Iceland, on the relevant factors would be necessary. Work has been ongoing on these issues, including the assessment carried out by the cross-party advisory committee appointed by the Icelandic Ministry of Industries and Innovation and an analysis conducted by Gamma (GAM Management) on the potential effects of the cable on Icelandic households.

Where would the energy come from?

A sub-sea cable supplied by hydropower in Iceland would offer the possibility of exporting and importing energy. Renewable energy within Europe is mostly reliant on intermittent energy sources such as wind and solar power. However, the demand for energy fluctuates on an hourly and seasonal basis and Europe needs to guarantee more reliable sources of electricity supply, in order to compensate for the unavoidable intermittency of solar and wind power.

A sub-sea cable would give Icelanders the opportunity to better utilise the country's energy resources and would increase the revenue created by these resources for the national economy.

The Icelandic grid can offer this reliability and a sub-sea cable would mean that Iceland could dispatch electricity, via the cable, according to need. The sub-sea cable would enable Iceland to better utilise the value of dispatchable, renewable energy.

The export of electricity would allow for the more efficient utilisation of resources in Iceland and generating more electricity, via currently operational hydropower stations. The inflow rate to the hydropower reservoirs in Iceland is variable between years but is, on average, higher than the amount required to fulfil current energy contracts. In isolated

electricity systems, excess water flows in spillways could be used, in part, if the system were connected with larger markets. Moreover, Icelandic consumers do not always fully utilise available energy resources and energy is therefore often wasted within the closed national grid. Connecting to a larger grid would mean more effective utilisation. In dry years or in the case of unforeseen circumstances, Iceland could reduce the energy export level and even import energy temporarily.

The exported electricity would be partly supplied by new power projects from already utilised areas and new areas. The prospect of new projects in hydropower, geothermal and wind energy would be reliant on the framework set out by the government on energy utilisation, including the Master Plan for Hydro and Geothermal Energy Resources in Iceland.

Preliminary assessments on investment costs and the length of the construction period show that the shortest distance possible would be the most economical option, under present conditions. The shortest distance for a sub-sea cable between Iceland and the UK would be approx. 1000km and appropriate locations at either end are presently being assessed, as well as different cable routes.

Potential connection areas in Iceland, for the sub-sea cable, are being considered as well as a number of other factors, including sea depth, sea terrain, wave height, fisheries and sailing routes. The project would also require necessary reinforcements of the electricity grid. The UK has focused on the issue of accessing the UK national grid. The next step involves further research on the feasibility of different landing locations, the impact on other industries such as fisheries and oil production, and of course the impact on the environment.

Statnett and National Grid, the owners and operators of the national grids in Norway and the UK, are developing a 1, 400 MW, 700 km sub-sea cable connecting the two countries.

Wind power in the future

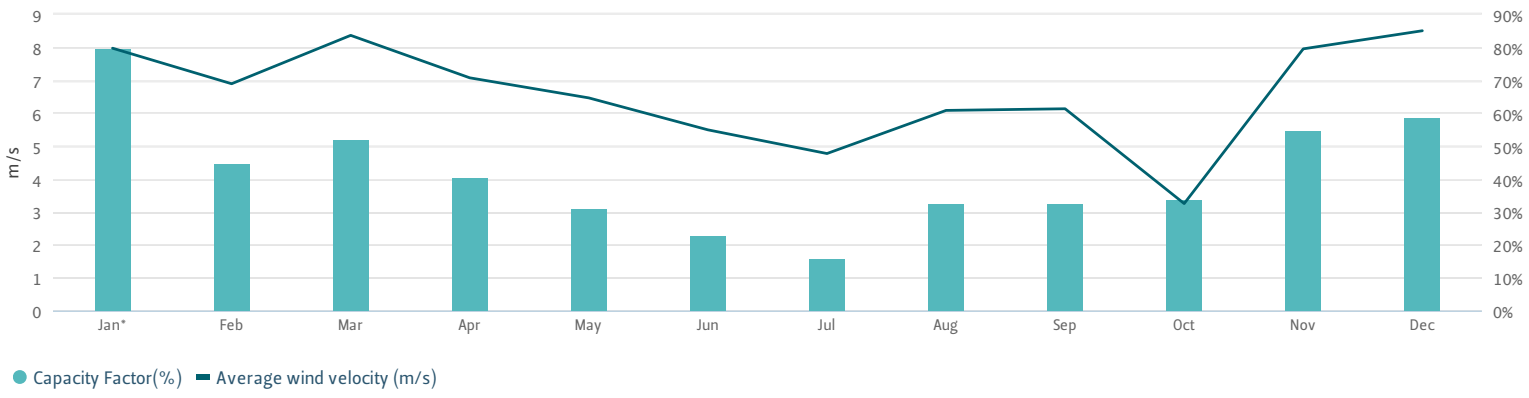
To the north of Búrfell, is a lava field by the name of Hafið. Landsvirkjun has erected two 900 kW wind turbines in the area, for research purposes. The wind turbines have been successfully operated since the end of January, 2013 and there are clear indications that Iceland is an advantageous location for electricity generation, utilising wind power.

The yearly average capacity factor for Hafið is approx. 40% which is unusually high. In comparison, the average capacity factor worldwide is approx. 28%. Landsvirkjun's wind turbines are relatively small (approx. 55 metres hub height), and this makes the high capacity factor even more remarkable. This is explained by the fact that wind velocity is relatively high, at a relatively low height in Iceland due to low surface roughness. This significantly reduces the cost of energy as hub heights can be kept quite low.

The wind turbines at Hafið have so far generated 5,900 MWh in the eleven months they have been in operation which is higher than the annual 5,400MWh initially predicted.

Wind turbine capacity in 2013

After nearly one year of operation, the average capacity factor for the wind turbines is approx. 40%, which exceeds all expectations. In comparison, the average capacity factor worldwide is approx. 28%.



The third pillar in the power system

Landsvirkjun has made the decision to conduct further research on the wind power capacity at Hafið, via extensive wind velocity and scenario studies. Proposals for the size and location of potential wind farm sites will also be analysed. The project is innovative as the potential of wind power has not been researched in Iceland before. Research areas will include the impact of the project on the environment, on society, the feasibility of development and operations and opportunities in utilising the interaction of wind power and hydropower. The legal framework and regulations will need to be reviewed as well as an analysis of the advantages of utilising wind farms for the electrical grid. An agreement has been reached with the engineering companies Efla and Mannvit who will provide consultation on the project. The project will be ongoing for the next two years.

The objective of the project is to ensure that Landsvirkjun has enough supportive evidence in the form of advanced analyses and data, to make an informed decision with regard to potential wind farms. Further research and preparation supports effective procedures in the development of wind power as the third pillar in the electrical system.

In Iceland, wind velocity is generally at its highest during the winter period when there is minimum water flow to Landsvirkjun's storage reservoirs. In addition, hydropower backed by storage is ideal for load balancing. Consequently, the possible synergy of wind- and hydropower electricity generation is high.

Environmental Research

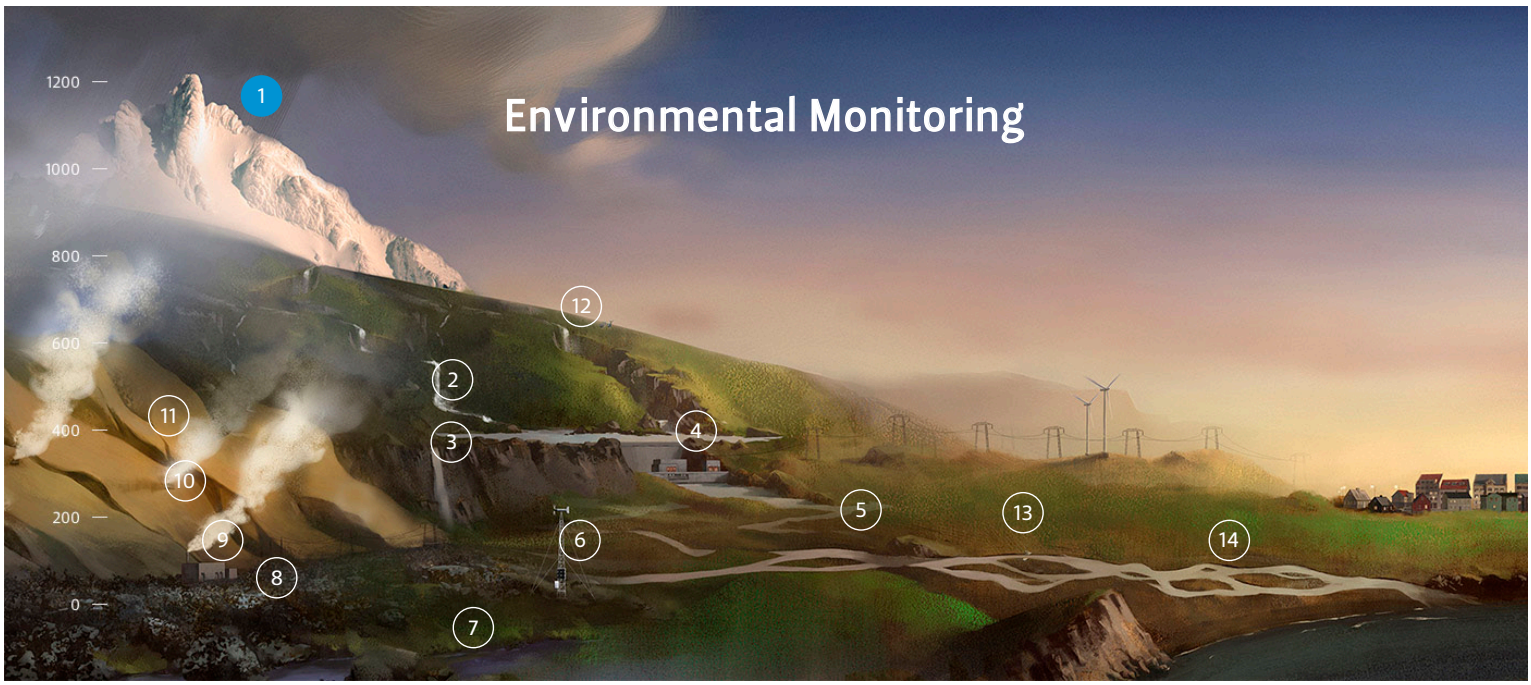
Environmental research is a crucial part of Landsvirkjun's operations. Research provides insight into the decades ahead and monitors a variety of environmental and societal factors affected by the Company's operations. Research provides baseline information as well as supplying crucial information on future scenarios which could prove important in the development and design of specific power projects.

Landsvirkjun works in accordance with a certified environmental management system. A detailed discussion of environmental monitoring and the Company Policy on environmental matters can be found in Landsvirkjun's Environmental Report.

Research, monitoring and mitigation measures

Extensive information on the natural environment and society are important in the development of potential power projects. Research is essential in acquiring new knowledge in the many areas possibly affected by the Company's operations. Research is conducted on ecosystems, geology, archaeology, geography, tourism and many other areas.

Once the decision has been made to utilise a resource, research monitoring begins. Initially the focus is on mitigation measures, executed for the purpose of minimising the environmental impact of development. Once the construction period reaches completion and operations begin, then research monitoring focuses on the impact of particular environmental aspects and the success rate of mitigation measures.



1 Glacier monitoring

Landsvirkjun operates an extensive research and monitoring program for glaciers which provide runoff to the Company's hydropower plants. The programme is run in cooperation with the Institute of Earth Sciences at the University of Iceland andthe Icelandic Meteorological Office. The mass balance of the glaciers is measured on an annual basis, in order to assess surface accumulation and surface ablation. The results show that the glaciers, providing the water resources for Landsvirkjun,have in fact diminished in the last two decades and this is believed to be a direct result of climate change. The increase in glacial melt results in increased runoff to hydro power stations and therefore creates opportunities for increased and improve–denergy generation. Landsvirkjun is already accounting for 'climate change impact' in the development and design of potential power projects.

2 Hydrology

Extensive knowledge on water flow characteristics is the key to better utilisation of the water resource. Landsvirkjun monitors all factors pertaining to the water cycle, from the moment a water drop hits the earth as precipitation, until it is returned to the sea to begin the cycle again. Analyses show the fluctua–tions in water flow and the factors influencing these changes. The water flow in rivers increases with high precipitation and long warm summers increase glacial melt.

3 Reservoir monitoring

Landsvirkjun's energy reserve is stored in the storage reservoirs of the Company and water surface levels are measured continually. The results are the basis for the management of the water resource and the storage reservoirs, the transfer of energy between different parts of the country and the implementation of contingency plans in the case of unusual water surface level changes. Other monitoring measures are commonplace in Landsvirkjun's reservoirs, including the erosion of reservoir banks and reservoir shoreline evolution. Bathymetric measurements are conducted in order to monitor the levels of sediment and glacial till deposited in the reservoirs by the glacial rivers and the corresponding changes in reservoir volumes.

4 SDam monitoring

All of Landsvirkjun's dams are closely monitored. The condition, movement and any leakage in the bedrock (in close proximity) is monitored. The ground water pressure in the actual dams, in the bedrock underneath them and the groundwater level in the proximity of the dams is monitored. These data are collected annually and the overall status of the dams is assessed. If results from the Sigalda Dam are assessed then it is clear that the leakage below the dam has decreased by 70% since operations began. This is due to extensive manmade sealing measures and natural sealing created by the sediment from the Tungnaá River.

5 Discharge

Extensive knowledge with regard to the discharge below the hydropower stations is essential as the discharge from the stations affects both humans and wildlife, in and around the rivers. Landsvirkjun has carried out thorough research on the discharge beneath Írafoss in the Sogið area in order to secure salmon migration in the river.

6 Meteorology

Meteorology has a significant impact on the water flow within the water resources utilised by Landsvirkjun, for energy generation. Landsvirkjun owns and operates numerous weather monitoring stations in the highland areas. They monitor air temperature, air pressure, wind speed, precipitation and sunlight. The results are submitted to the national meteorological database and to the Icelandic Meteorological Office, where they are further utilised for meteorological forecasts and as real time information on weather conditions. The results are therefore not only used by Landsvirkjun but also by the entire country.

7 Groundwater monitoring

Groundwater is closely monitored by Landsvirkjun at all of their power stations. The development of groundwater within geothermal areas is particularly significant and can indicate the need for mitigating action, in the case of utilisation affecting the groundwater. Results from the monitoring systems in the Mývatn area have so far shown that geothermal utilisation at Bjarnaflag has not affected the groundwater flow and water quality in Lake Mývatn.

8 Seismic Activity and land mass changes

Landsvirkjun monitors activity in geothermal areas by using a powerful network of seismic sensors and GPS monitoring systems. This enables the Company to recognise the layout of fractures in the subsurface, elevation changes, tectonic activity and volcanic activity. This information is also crucial in supporting successful borehole drilling in the area. The fact that subsidence in the Krafla area has been measured at 10cm, over the course of two decades, is a clear example of the value of such information.

9 Emissions

Emission records for the geothermal stations are kept and published in Landsvirkjun's Environmental Report. Landsvirkjun has also set up three hydrogen sulphide monitoring stations in Reykjahlíð, the results of which can be accessed in real time via the Landsvirkjun website.

10 Geothermal well monitoring

Geothermal wells are monitored regularly at Landsvirkjun's geothermal stations. Well temperature logs, pressure logs and the chemical composition of geothermal fluid are analysed as these provide information on the energy content and quality of the geothermal reservoir. Amongst other things, these observations have shown changes in the steam composition from the Krafla Geothermal Station, since the end of the Krafla Fires in 1984, where the level of carbon dioxide in the steam has decreased substantially.

11 Noise levels

The noise from geothermal areas can be decreased by using the correct type of mufflers for boreholes. Landsvirkjun closely monitors the noise levels, within the geothermal areas utilised by the Company in the northeast of Iceland, in order to assess the need for increased noise reduction measures and to monitor those already in place. Landsvirkjun is committed to keeping noise levels in areas close to popular tourist spots at the maximum noise level recommended for inhabited areas, that is 50db (A). The maximum noise level for energy production areas is 70dB (A).

12 Reindeer

The distribution and number of reindeer in the east of Iceland, in the Snæfellsöræfum wilderness, is monitored: in Brúaröræfi, Vesturöræfi, Fellum, in Múla and Hraun. Reindeer numbers are estimated via basic counting measures and aerial photographs of the area. The EIA conducted for the Kárahnjúkar Hydropower Station predicted changes to the distribution and number of animals. However, the affects were measurably less than initially predicted. Ongoing monitoring will show the long–term effects of the power project on the reindeer population.

13 Birdlife

Landsvirkjun's operations can have a diverse effect on birdlife. The construction of reservoirs and changes to the course of the river channel can affect their habitat. New roads, transmission lines, wind turbines and other manmade structures can also disturb the population. Research has shown, amongst other things, that the Hálslón Reservoir did not cause a decrease in the Pink– footed Goose population in the area, despite a reduction in grazing land. However, the decrease in the Long– tailed Duck could be attributed to increased turbidity in the river and water in the Hálslón Reservoir. Landsvirkjun is involved in monitoring birdlife in all current and new areas of operation, in order to better understand the effects on birdlife.

13 Freshwater ecology

Hydropower stations can have a significant impact on fish and other river biota. Landsvirkjun closely monitors river biota in all areas of operation in order to implement timely mitigation measures in the case of any measurable changes. Monitoring the fish population is mainly threefold: the analysis of fishing data to acquire information on changes to the fish stock, net fishing data to acquire information on the condition, diet, maturity and size distribution of fish and finally juvenile counts to acquire information on the density and recruitment of juveniles. Results in the Þjórsá area have shown that the construction of the power station and the resulting changes to water flow have improved conditions for the salmon population, thus supporting its growth.

Research and monitoring projects in 2013:

- A review of the vegetation map for the area affected by the Fljótsdalur Hydropower Station was completed. The vegetation map was utilised for various purposes, including research on reindeer routes, grazing and habitat within the area. The area originally covered by the vegetation map was extended and is now over three thousand kilometres in size. The project was completed in cooperation with the Icelandic Institute of Natural History. Other projects now underway in the area affected by the Fljótsdalur Hydropower Station include fish research in the water catchment area of Lagarfljót and Jökulsá in Dal.

- The warm groundwater stream at Mývatn was researched in connection with the impact of utilising the geothermal resources in the Bjarnarflag area. Air quality monitoring was increased in the Mývatn area and the results for three of the stations were published on the Landsvirkjun website. The EIA report on the Bjarnarflag Station, now ten years old, was reviewed in order to assess the need for a partial or total re-assessment of the report.
- Work was ongoing on projects pertaining to the visual impact of geothermal stations, including issues of design and landscape integration. The objective is to focus more on the surrounding landscape of sites in the structural design process and to seek out new landscaping measures, designed to minimise the negative impact of unavoidable disturbances to land, in the power project preparation process. This year, procedures and guidelines for landscaping measures and clean-up work at power project sites were developed. An audit was completed on the location for ground material disposal and clean-up work as a result of work completed on the Blanda waterway.

Greenhouse gas emissions and carbon sequestration

Landsvirkjun aims to be a carbon neutral company and works systematically to reduce carbon emissions and other greenhouse gas emissions in its operations.

Carbon dioxide emissions from geothermal boreholes in Krafla, Bjarnarflag and Þeistareykir have been monitored for years. However, information on the natural emissions from geothermal fields is limited and a decision was made this year to increase research and therefore knowledge in this area. Carbon levels in the soil and vegetation at the Búðarháls Hydropower Station were measured, as a direct result of an assessment on GHG emissions in the Sporðalda Reservoir site area. Efforts to neutralise carbon emissions included an agreement with the Iceland Forest Service and the Icelandic Soil Conservation Service on carbon capturing in two new areas. An agreement was also reached with Kolvið on the neutralisation of all carbon emissions as a result of Landsvirkjun's use of petroleum and diesel for transportation purposes, the air travel of employees, and the disposal of waste.

Information dissemination

Landsvirkjun is committed to successful cooperation with society by supporting transparent working methods and knowledge dissemination. Extensive information on environmental research can be found in Landsvirkjun's Environmental Report. Research reports can presently be accessed at Landsvirkjun's library but the objective is to make all these available via the web at Gegnir.is. The success of research carried out in the affected areas of the Fljótsdalur and Kárahnjúkar Stations can be accessed on the sustainability web run by Landsvirkjun and Alcoa www.sjalfbaerni.is→.

Summaries and real time information on the monitoring of various environmental aspects can be accessed annually at Landsvirkjun's website.

Download documents

Find and download enclosed documents at http://annualreport2013.landsvirkjun.com/

PDF HSAP – Blanda Power Station
8.25 MB PDF FILE

Potential Power Projects

In 2013, Landsvirkjun was in the process of assessing twenty potential power projects all over the country. The proposed parliamentary resolution on the Master Plan for Hydro and Geothermal Energy Resources in Iceland was approved in January, 2013. The Master Plan ranks energy projects and divides them into three main categories: 'appropriate for development', 'under consideration', and 'protected', in accordance with Act No 48/2011 on the Conservation and Energy Utilisation Plan. There are presently 67 projects under consideration; 16 of these have been placed in the appropriate for development category, 31 are under consideration and 20 are in the protected category. The parliamentary resolution is expected to be reviewed on a four year basis, or less.

Landsvirkjun is considering potential power projects in various locations around the country. Each one is at a different stage in the preparation and licensing process.

Second phase of the Master Plan

The parliamentary resolution on the Master Plan, proposed by the Minister for the Environment and the Minister for Industry and Commerce, was approved in January, 2013. Amendments were made to the initial ranking system, outlined in the original proposal for a parliamentary resolution. Five potential power projects were moved from the appropriate for development category to the under consideration category. These included three potential power stations in the lower region of the Þjórsá River and the Skrokkalda and Hágöngur power projects. Out of the several hydropower proposals put forward by Landsvirkjun only one potential power project, in the Blanda water catchment area, was considered appropriate for development. Potential power projects in the Jökulsá River in Skagafjörður, in Skjálfandafljót, in the lower regions of Þjórsá and in Skrokkalda (along the Kaldakvísl waterway between Hágöngulón and Kvíslaveita) were placed in the under consideration category. Two alternative proposals put forward by Landsvirkjun (in conjunction with Orkusalan) for the Hólmsá River were also placed in the under consideration category. The proposed power projects at Norðlingaalda, Tungnárlón and Bjallar were all placed in the protected category, despite the fact that these were three of the most feasible proposals put forward by Landsvirkjun.

Three of the geothermal projects proposed by Landsvirkjun; the Bjarnarflag, Krafla and Þeistareykir power projects were placed in the appropriate for development category. The Hágöngur and Fremrinámar projects were placed in the under consideration category and the Gjástykki project was placed in the protected category.

Review of potential power projects within the Master Plan

A new Steering Committee was given the priority task of completing the review of the five potential power projects whose status was changed by the Ministries and the Icelandic parliament and two other projects where the prior

committee had reached a conclusion without considering all the available documentation. The projects under review were the three potential power projects in the lower regions of the Þjórsá River (moved to the under consideration category due to uncertainty surrounding the impact on salmon), a hydropower project at Skrokkalda and a geothermal project at Hágöngur (as a result of concerns with regard to the buffer zone in the Vatnajökul National Park), the Hólmsá hydropower project and the Hagavatn hydropower project.

The Steering Committee came to the conclusion that only three power projects in the lower regions of the Þjórsá River could be reviewed without appointing new expert committees and this work could not be completed before the end of the year.

The Steering Committee put forward a proposal in December, recommending that the Hvammur project should be moved into the appropriate for development category and that the Holta and Urriðafoss projects would remain in the under consideration category. A resolution is expected from the Icelandic parliament this spring but there is some uncertainty as to how the review of the other power projects will be conducted.

Third phase of the Master Plan

In November, 2013 the National Energy Authority requested information on the proposed power projects put forward for consideration, for the third phase of the Master Plan. Landsvirkjun outlined its intention of putting forward documentation pertaining to 24 power projects for consideration. These include three new proposals: The harnessing of Stóra Laxá and two wind farms (one in Hafið, to the north of Búrfell and another within a new waterway at the Blanda Hydropower Station). Landsvirkjun has announced plans for a review of some of the proposed power projects placed in the protected category. The proposals for the Norðlingaalda diversion, Bjallar project, Tungnaá diversion and Gjástykki project will be reconsidered by Landsvirkjun with the aim of lessening the environmental impact.

Power Projects

Bjallavirkjun
Hydropower

CAPACITY	GENERATED
46 MW	340 GWst/year

Bjarnarflag
Geothermal

CAPACITY	GENERATED
45–90 MW	369–738 GWst/year

Blanda Area
Hydropower

CAPACITY	GENERATED
31 MW	194 GWst/year

Gjástykki
Geothermal

CAPACITY	GENERATED
135 MW	1.107 GWst/year

Hágöngur
Geothermal

CAPACITY	GENERATED
135 MW	1.107 GWst/year

Hólmsárvirkjun, Atley
Hydropower

CAPACITY	GENERATED
65 MW	480 GWst/year

Holtavirkjun
Hydropower

CAPACITY	GENERATED
53 MW	415 GWst/year

Hvammsvirkjun
Hydropower

CAPACITY	GENERATED
82 MW	665 GWst/year

Norðlingaölduveita
Hydropower

CAPACITY	GENERATED
– MW	605 GWst/year

Skatastaðavirkjun
Hydropower

CAPACITY	GENERATED
156 MW	1.090 GWst/year

Skrokkölduvirkjun
Hydropower

CAPACITY	GENERATED
45 MW	345 GWst/year

Hydropower

CAPACITY	GENERATED
– MW	208 GWst/year

Krafla
Geothermal

CAPACITY	GENERATED
35–45 MW	1.107 GWst/year

Hydropower

CAPACITY	GENERATED
30–35 MW	180 GWst/year

Þeistareykir
Geothermal

CAPACITY	GENERATED
90–180 MW	738–1.476 GWst/year

Tungnaárlón
Hydropower

CAPACITY	GENERATED
– MW	270 GWst/year

Urriðafossvirkjun
Hydropower

CAPACITY	GENERATED
130 MW	980 GWst/year

Working in harmony with society

Landsvirkjun has a clear policy on social responsibility and is committed to maximising the positive impact of business on society and the environment, and diminishing the negative.

Corporate social responsibility (CSR) is about maximising the positive impact of business on society and the environment, and diminishing the negative. It is about creating a business environment where transparency facilitates stakeholder engagement. Landsvirkjun has set clear objectives in fulfilling its CSR Policy. Landsvirkjun's policy on CSR was a key project in 2013. The Policy has been developed over a two year period with the involvement of dozens of employees. There was particular focus on specific measures and employee awareness with regard to social responsibility. The work completed in 2013 was successful with many significant milestones achieved.

The UN Global Compact

In December, 2013 Landsvirkjun signed the UN Global Compact on social responsibility and committed to implementing the ten principles outlined by the UN in the areas of human rights, labour, the environment and anti-corruption. Our hope is to gain valuable input from this partnership in order to make our CSR Policy more transparent and effective.

Our CSR Policy is to create value, take care when working withthe natural resources we have been entrusted with and to sharethe knowledge we acquire to contribute to a better society.

Investment in innovation

Startup Energy Reykjavík (SER) is a mentorship-driven investment program for seed stage, energy related business ideas. The program, which offers its participants the opportunity to be mentored by a group of 50 experts from the science and business world, was launched in March 2014 and was active for a 10 week period. The founders of the program are Landsvirkjun, Arion Bank, GEORG and Innovation Centre Iceland. An investor assembly was held on the last day to give participants the opportunity to present their ideas to potential investors. The goal of the program is the creation of shared value for the energy industry and society.

Knowledge Saves Lives

Landsvirkjun's employees have shown initiative in social responsibility matters by utilising their expertise for good causes. Oscar H. Valtýsson, Head of Telecommunications at Landsvirkjun, has designed and developed an airborne search and rescue system in cooperation with Landsvirkjun, the software company Rögg and the Icelandic Coast Guard.

The new device has been funded by a number of companies including Landsvirkjun and the insurance companies VÍS, TM and Vörður. The engineering firm Héðinn voluntarily designed and manufactured the host and antenna mount for the Icelandic Coast Guard's helicopter. Vodafone lent out frequencies and experts at the Icelandic Institute for Intelligent Machines developed the mathematical and modelling software utilised in the positioning and navigational part of the search system.

The system is able to locate cell phones with great precision and can serve as a crucial tool for rescue and search parties. The Icelandic Coast Guard successfully utilised the device in September, 2013 during a search for a lost tourist at the Skaftafell Glacier. The final product will be handed over to the Icelandic Coast Guard for future operation during search and rescue missions.

SATISFIED EMPLOYEES **91%**

According to a recent survey conducted at the Company, 91% ofLandsvirkjun's employees believe that a CSR Policy is animportant aspect of Landsvirkjun's operations.

Achievements 2013

Landsvirkjun's CSR Policy outlines six key areas. Every year, Landsvirkjun defines key objectives (within each area) to focus on. In 2013, eight objectives were set and the results of this work can be seen below:

◉ Indicates that the objective has been achieved ◒ Shows that we are progressing well ○ Shows that we are at an early-stage of meeting the objective

Corporate Governance

Objectives 2013

◉ Verification and implementation of a code of conduct for Landsvirkjun

Landsvirkjun's Code of Conduct was published and implemented in December, 2013. There are nine categories, including the health and safety of employees, the importance of integrity and respect in communication and the handling of confidential information and conflicts of interest. The first three months of 2014 will give employees the opportunity to provide feedback on our Code of Conduct which will then be made public.

Objectives 2014

Implementation of the UN Global Compact in Landsvirkjun's operations

Implementing an ownership policy in operations

Value Chain

Objectives 2013

Re-evaluating our policy on contractors and suppliers with a view to our new policy on corporate social responsibility

Landsvirkjun's value chain includes service providers, suppliers, consumers and other stakeholders. In 2013, we re-evaluated our value chain policy. The scope of the policy was discussed, as were the methods utilised by other companies in implementing such a policy, performance criteria and the relevant standards and guidelines. Work on the re-evaluation of the policy could not be fully completed this year and will therefore continue throughout 2014.

Objectives 2014

Developing and implementing a policy on ethical business practices

Implementing a code of conduct for suppliers and service providers

Environmental Issues

Objectives 2013

Improving communication and consultation at all stages of preparation, development and operations pertaining to the environment, ensuring that our practices meet the requirements of good practice, in accordance with the HSAP and the GRI

In 2013, the International Hydropower Association conducted an assessment of the Blanda Hydropower Station utilising the HSAP (Hydropower Sustainability Assessment Protocol). The Protocol places particular emphasis on environmental and social aspects. The report showed that Landsvirkjun fulfils the highest standards of practice in 14 of the 17 topics. Landsvirkjun was awarded the second highest rating for the three remaining topics. Topics evaluated during the assessment included responsible governance, environmental and social issues management, public safety and labour and working conditions. The report is available on Landsvirkjun's website.

In 2013, preliminary work began on connecting the key sustainability indicators outlined by the GRI (Global Reporting Initiative G4) to the environmental aspects outlined by Landsvirkjun. Work will continue throughout 2014.

Increasing expertise on the environmental impact of geothermal energy utilisation, to further decrease the effects of geothermal power stations on the environment

Monitoring and environmental surveillance was increased on hydrogen sulphide levels, the climate and on air quality. Measurements on the concentration of hydrogen sulphide in the air are now accessible in 'real time' on the Landsvirkjun website.

Last year, Landsvirkjun took part in a number of research projects in order to further their expertise on the environmental impact of geothermal utilisation. Amongst these projects were the following:

Cooperation with ÍSOR on a report on sustainable energy production at Bjarnaflag.
A research project at Krafla initiated to map the "arteries" of the geothermal system. The results could be utilised to improve the energy utilisation of the system.
Participation in a number of research projects in connection with the utilisation of geothermal energy including the Deep Roots of Geothermal Systems Project which focuses on increasing expertise on geothermal systems and IMAGE: Integrated Methods for Advanced Geothermal Exploration, a European project which aims to improve research methods used to map geothermal systems.
Research on the impact of geothermal utilisation on the warm groundwater streams flowing into Mývatn.
Monitoring the chemical composition of borehole fluid, gasses and steam from boreholes and the geothermal system.
Research on the effective utilisation of the energy stream of water, steam and gas for further energy production or other uses. There are indications that it would be possible to produce pure carbon dioxide from geothermal gasses to be used for industrial purposes; thus transforming pollutants into raw material.
Research into methods for lowering the concentration of hydrogen sulphide from geothermal power stations. Part of this drive is the collaboration with SulFix, a collaboration of Icelandic energy companies working together in order to better understand the implications of re-injecting hydrogen sulphide into the geothermal reservoir.

Reducing the release of greenhouse gasses (GHG) and carbon neutralisation via larger scale carbon capturing measures than those in current use

Important steps were taken to reduce or neutralise greenhouse gas (GHG) emissions, including soil conservation and reforestation. An agreement was reached with the Iceland Forest Service and Soil Conservation Agency on two new areas of carbon sequestration. It is estimated that carbon binding will reach 2.5 T carbon / ha per year, within a decade.

An agreement was reached with Kolvið on the neutralisation of all carbon emissions as a result of Landsvirkjun's use of petroleum and diesel for transportation purposes, the international and national air travel of employees and finally the disposal of approx. one thousand tonnes of waste.

Research has also been conducted on the extent of natural emissions from geothermal areas.

Objectives 2014

Better use of resources – analysis of the diverse nature and uses of geothermal energy and the increased utilisation of hydropower

Developing a comprehensive plan of action with regard to the binding and emission of GHG

Establishing a transport strategy and developing energy exchange measures in transportation

Society

Objectives 2013

Shaping communication strategies with stakeholders in the Northeast

One of the cornerstones of Landsvirkjun's Policy is building a strong collaborative alliance with society, with a view to their interests, ensuring that society and the environment enjoy benefits from our operations.

Early on in 2013, Landsvirkjun committed to developing a communication plan for stakeholders in the Northeast of Iceland. Communication strategies for the area include two proposed project sites: Bjarnarflag and Þeistareykir. The Communication Plan is a development project created to minimise uncertainty and to prevent any breakdown in communication between Landsvirkjun and its stakeholders.

Objectives 2014

At least five open meetings with stakeholders in 2014

Dividends paid to owners

Human Resources

Objectives 2013

Review of Human Resources Policy in view of the new role and values at Landsvirkjun

We set the objective of reviewing our staff policy with respect to the major changes made to the policy and role of Landsvirkjun. This goal has been partially achieved and a draft of the policy has been completed. The implementation of the policy will be finalised in early 2014.

Objectives 2014

Increasing the proportion of female managers

Accident free operations

Knowledge dissemination

Objectives 2013

Promoting cooperation with the university environment to support and encourage the development of expertise within the field of renewable energy

Landsvirkjun signed three cooperation agreements with various academic institutions with this objective in mind.

In July, 2013 Landsvirkjun joined forces with Reykjavik University and the University of Iceland to support and encourage the development of expertise within the field of renewable energy. Landsvirkjun has pledged 80 million to university education, over a five year period, to promote university education and research in geochemistry, electric power engineering and other academic disciplines within the universities.

In October, 2013 Landsvirkjun and the Institute of Economic Studies joined forces in an effort to support and encourage research within the field of business and economics pertaining to energy generation, subsequently increasing public knowledge and awareness on the significance of these factors with regard to the economy. Landsvirkjun will contribute an overall total of 24 million ISK to the Institute of Economic Studies over a three year period.

Extensive efforts were made to share audits and reports executed for and by the Company by connecting with the electronic search engine gegnir.is. In 2013, approx. 300 reports were made available via this source.

Objectives 2014

Promoting access to our research

Promoting innovation by supporting innovative ventures in energy-related industries

Promoting knowledge via the Energy Research Fund

A dynamic workforce

At Landsvirkjun, we strive to provide a progressive working environment in order to engage people who are the best in their field. The Company has a diverse and dynamic work force where differing cultures and ideas nurture innovation and creativity. The role of the Human Resources Division is to provide employees and management with the support they need and effective human resource management.

Continuous improvement

A number of productive improvements were made to Human Resources (HR) matters at Landsvirkjun in 2013. These included the development of HR procedures and improvements to management systems within the Company. Two discussion panels were held, where current orientation procedures for new employees and retirement procedures were reviewed by current employees. Work also began on developing employee interview procedures into performance interviews (appraisals). Approximately 100 employees participated in workshops and focus groups addressing these issues. Performance interviews (appraisals) will be implemented in the first quarter of 2014.

SATISFIED EMPLOYEES **91%**

According to a workplace survey, conducted in 2013, approx.91% of Landsvirkjun's employees say that they are satisfied orvery satisfied at work.

A number of changes were implemented with regard to the organisation of Landsvirkjun in the middle of last year. The HR Division was made responsible for the Services Division; previously the responsibility of the Finance Division. The operation of the reception area, canteen, travel booking services and headquarters building management are now under the supervision of the HR Division. Last but not least, the HR Division took responsibility for developing internal marketing at Landsvirkjun, with a particular focus on social media and alignment with strategic initiatives and projects.

Professional Development

One of Landsvirkjun's main objectives in human resources management is a commitment to the professional development of their employees. Each year, Landsvirkjun invests in a comprehensive range of professional educational and training avenues and in inspiring and reinforcing management in their leadership roles. At the beginning of last year, all management teams were offered extensive management training where the main focus was on 'change management'. All employees took part in a prevention workshop on bullying and communication in the workplace.

HOURS OF EDUCATION AND TRAINING **11.000**

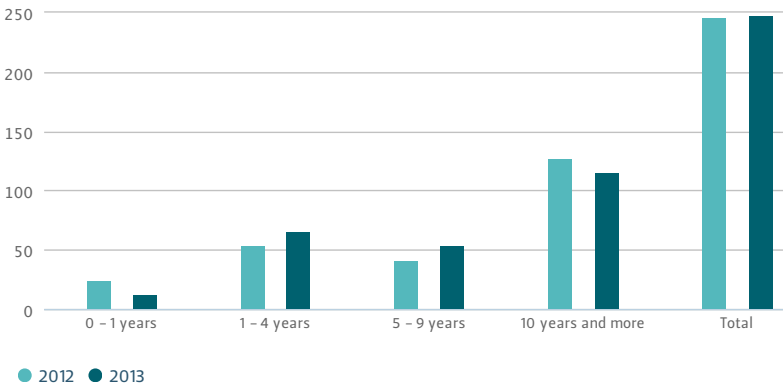
In 2013, Landsvirkjun invested approx. 11 thousand hours in theeducation and training of employees. This is equal to 275working weeks.

A dynamic workforce

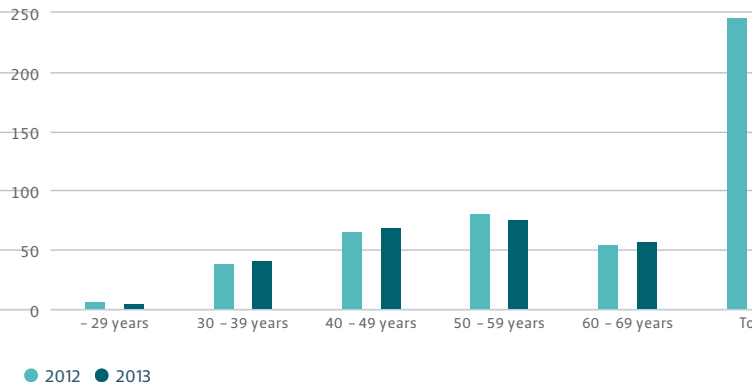
There were 247 full time employees at the beginning of the year with the exception of board members, students and other temporary employees. The average number of employees during the year was 298 but this total is heavily influenced by the temporary staff members employed for the summer duration. The total number of employees on the payroll at year end was 248, filling 242.25 full time positions. A total of 516 employees were paid salaries during the year, including summer staff and students.

Dedication and loyalty are the main characteristics of the Landsvirkjun work force. The average age of permanent employees at year-end was 50.4 years and the average length of service was 13.2 years. The turnover rate was 4% compared with 8.35% last year. Last year, 40 employees were recognised for length of service, the longest service period being 35 years.

Work experience



Age Distribution (in years)



Health and safety

The health and safety of employees is a key issue at Landsvirkjun and the occupational health and safety management system utilised by the Company is certified in accordance with OHSAS 18001. Working methods are specifically designed to prevent accidents and a so-called "zero accident policy" is adhered to. The Company does everything in its power to ensure no accident related absences. Unfortunately this goal was not met last year when two accidents occurred on site, leading to the absence of the employees involved. Safety issues remain a priority for Landsvirkjun and an accident-free operation is one of the main targets outlined by the Company.

Summer employment for young people

The number of employees at Landsvirkjun doubles during the summer period when approx. 230 young people and university students join our work force for summer employment. There were 780 applications last year and 154 young people between the ages of 16-20 were accepted; 82 young men and 72 young women. They attend to various maintenance and environmental projects for Landsvirkjun's sites, all over the country.

Out of the successful applicants, 70 were university students; 32 men and 38 women and they also attended to various projects at Landsvirkjun's sites all over the country. Landsvirkjun seeks to employ talented individuals with a view to the relevant education/experience and to ensure gender equality.

In recent years Landsvirkjun has run an enterprise that goes by the name of "many hands make light work" where they offer their partnership (and summer staff) to any local projects, promoting the development of tourism and environmental issues in the areas involved. There were 28 applications, from all over the country, from NGOs, individuals, sports clubs, government agencies, municipalities and national parks.