Energy Generation and Business Opportunities

Global business demands brought energy intensive industry to Iceland and powerful international corporations have built up their operations here, providing Landsvirkjun with a solid revenue base. The rapidly changing environment of the energy market has created new opportunities for Icelandic energy. Competitive, long-term, reliable contracts give Landsvirkjun a competitive edge in this changing environment and new business opportunities enable the Company to further diversify its customer base for the purpose of minimising risk factors for Landsvirkjun in the future.

Competing at the international level

Landsvirkjun's main message to its current and prospective clients has been the availability of energy contracts, under market conditions, with an emphasis on the following factors:

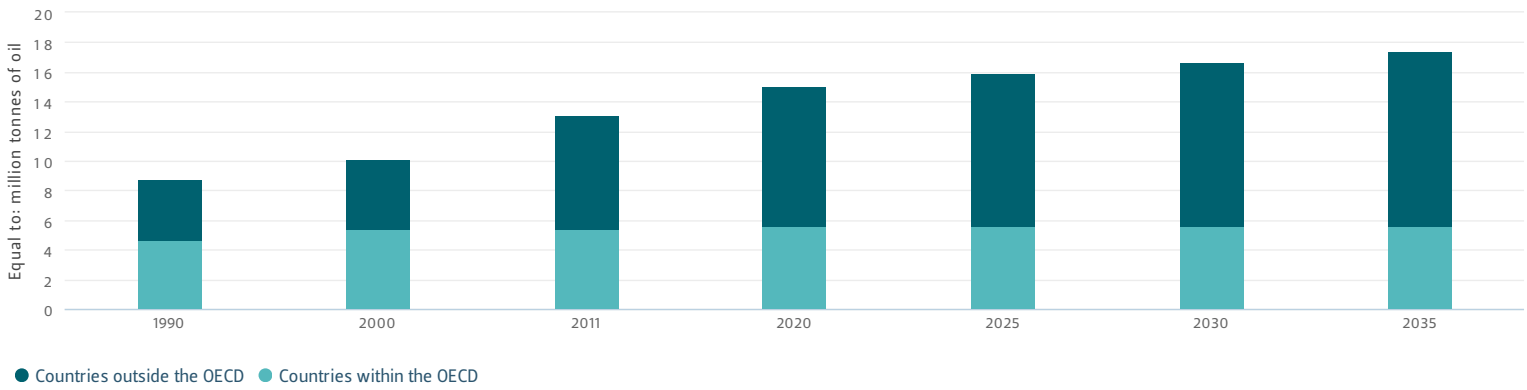
- The most competitive prices in Europe
- 100% renewable energy
- Reliable long-term contracts

Today Landsvirkjun offers 12 year, long-term energy contracts at $43/MWh. These terms are amongst the most competitive in the world. Landsvirkjun is active in dynamic marketing abroad. This year the Company took the initiative of inviting potential clients, from energy intensive industry, to assess the option of moving their operations to Iceland and using Landsvirkjun as their energy supplier. Data centers, metallurgical grade silicon metal production and carbon fiber industries were the focus of Landsvirkjun's marketing efforts.

Landsvirkjun offers the most competitive electricity prices in Europe with long-term contracts at $43MWh. In comparison, the average spot market rate for electricity in the period between 2010 and 2013 was $66/MWh in the Netherlands, $57/MWh in Scandinavia and $59/MWh in Germany.

Energy demands have increased rapidly in the last few years and energy prices have reached a historical high worldwide. There are indications that demand will increase worldwide and many European countries are already prepared to pay high energy prices in order to ensure the security of supply.

Worldwide demand for energy



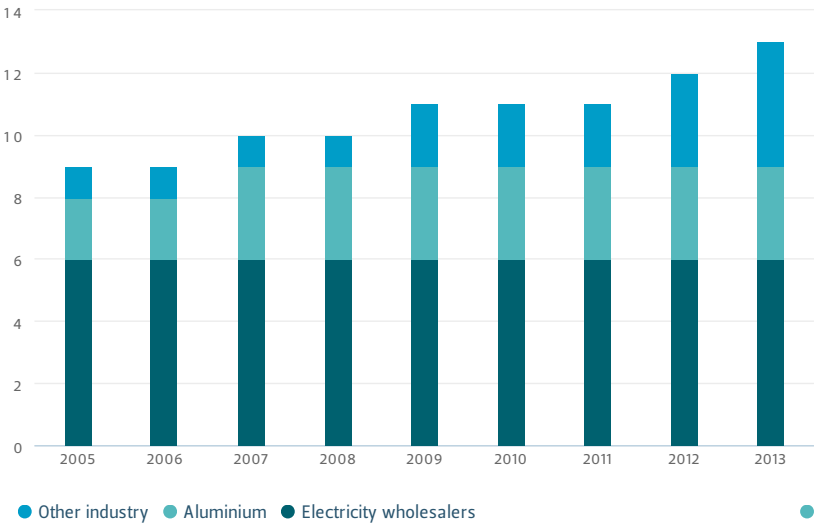
New customers

Landsvirkjun's customer base has expanded in the last few years. New industry fields have chosen Iceland as the location for their operations. This is because Iceland offers competitive, long-term energy contracts and the assurance of security of supply.

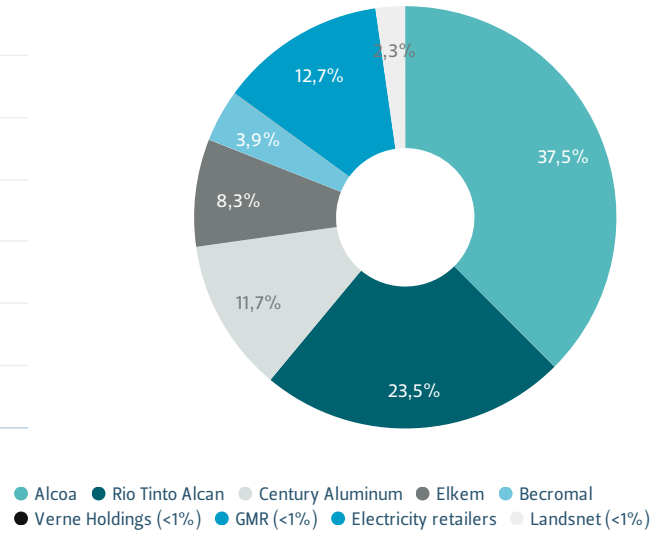
A new long-term agreement on energy supply was entered into with GMR Recycling ehf and took effect this year. GMR Recycling uses electricity to recycle waste from aluminium plants and other sources. Landsvirkjun will also sell its energy to the German company PCC who intend to construct a metallurgical grade silicon metal production plant at Bakki near Húsavík. Landsvirkjun signed Letters of Intent with regard to the main components of energy contracts with several other companies in 2013.

In 2013, Landsvirkjun sold 13.186 GWh of energy: the highest energy sales in Landsvirkjun's history.

Number of customers



Division of electricity sales 2013 (MWh)



Energy generation 2013

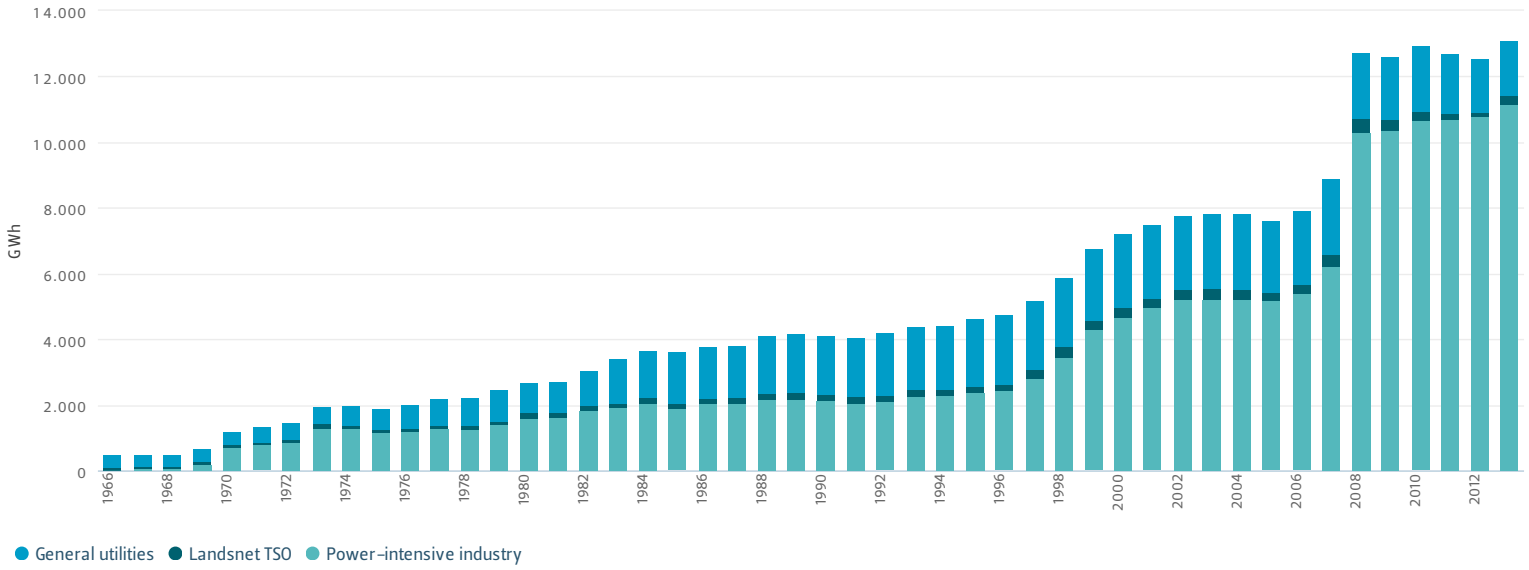
Landsvirkjun operates 13 hydropower stations, 2 geothermal stations and two wind turbines, in five areas of operation, all over Iceland. We believe in an integrated approach where prudence, reliability and the harmony of operations with the environment and society, are fundamental to our operations.

Landsvirkjun's total energy generation for 2013 was 12.843 GWh. Over 85% of the energy is utilised by energy intensive industry and nearly 15% is utilised by smaller companies and for domestic use. Landsvirkjun generated 12.712 GWh of electrical energy for the Landsnet transmission grid in 2013. Hydropower generates 96% of the energy and 4% of the energy is generated using geothermal energy.

TOTAL GENERATION 2013 12.843 GWh

Hydropower: 12.337 GWh, Geothermal: 500.5 GWh, Wind power:5.5 GWh

Landsvirkjun‘s Electricity Sales 1966–2013



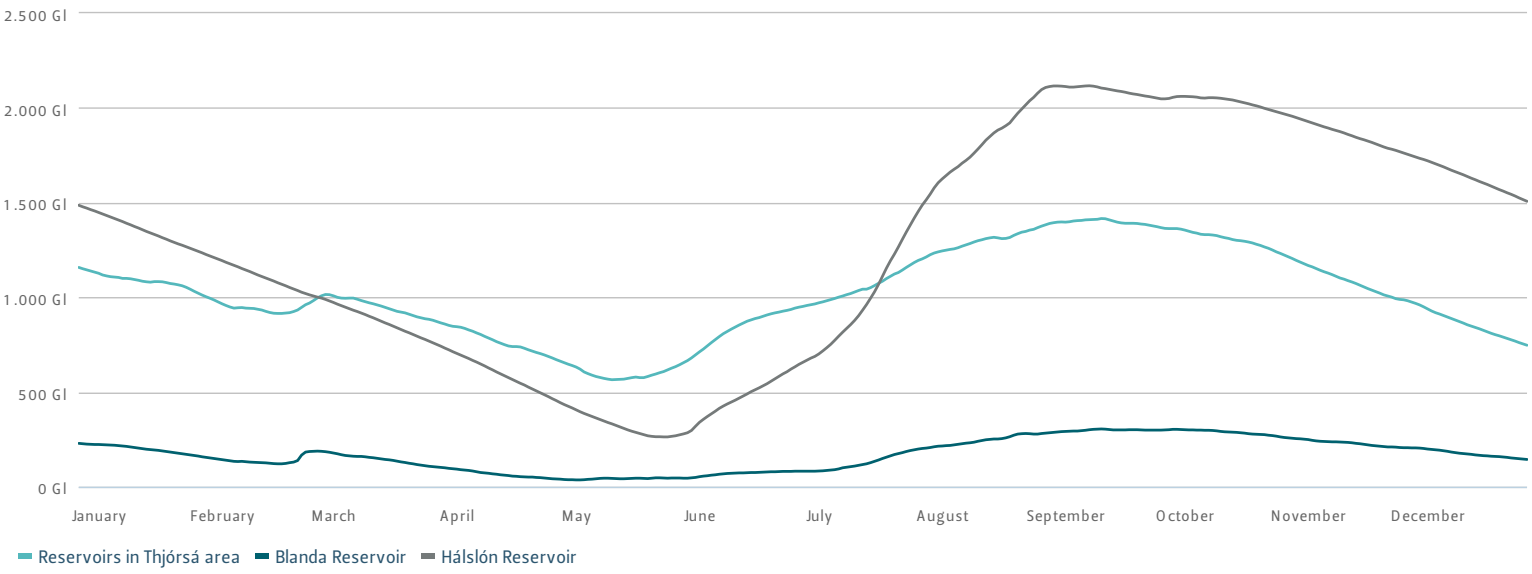
How much water do we have?

Landsvirkjun generates electricity from renewable energy sources such as hydropower, geothermal energy and wind power. The natural cycle of water is utilised to produce electricity and is therefore dependent on the weather. The hydropower system utilises this natural cycle by collecting the glacial melt in its storage reservoirs to utilise over the winter period. Weather conditions in Iceland are unpredictable but energy consumption is similar between years. This means that much of the water can end up in the spillover of the stations during an average year.

The water inflow to Landsvirkjun’s reservoirs in 2013 was unlike that of previous years. The summer was cold and dry and glacial melt was under average.Reservoirs did not fill in the Þjórsá, Tungnaá and Blanda water catchment areas. The Hálslón Storage Reservoir filled up towards the end of August and remained full for three weeks.

Reservoirs are an effective storage unit for electricity. Landsvirkjun has a storage capacity of 5150 GWh.The highest level reached was 4500 GWh, in 2013.

Water reservoir status by area: 2013

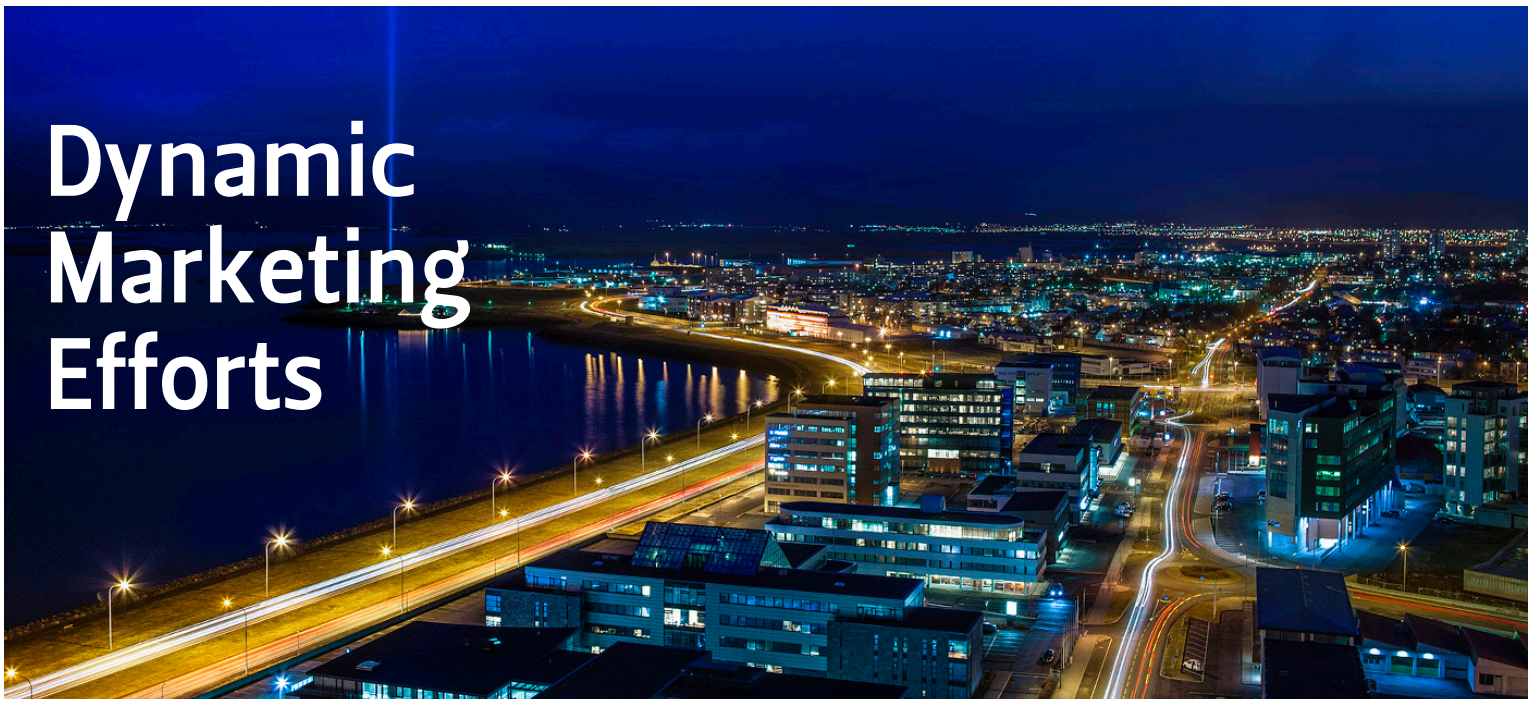


Proven best practice

In 2013, an assessment of the Blanda Hydropower Station was conducted in accordance with theHydropower Sustainability Assessment Protocol (HSAP).

The results of the assessment show that Blanda meets Proven Best Practice on 14 out of 17 topics assessed using the Protocol. The protocol assessed 17 differing topics, pertaining to the operation of Blanda, in order to assess the sustainability of the hydropower project when compared with international standards.Landsvirkjun will use the experience of the assessment to do even better in other areas of operations and to support the sustainable use of natural resources.

Dynamic Marketing Efforts



The rapidly changing international energy market has created a number of opportunities for Landsvirkjun. The demand for energy from international businesses is diverse and growing rapidly. Landsvirkjun has responded to this demand by offering competitive energy contracts. The Marketing and Business Development Division purposefully seeks new opportunities in power intensive industries with the aim of maximising long-term value creation. New business opportunities enable the Company to further diversify its customer base for the purpose of minimising risk factors for Landsvirkjun in the future.

A clear message in international marketing

Landsvirkjun strives to offer its current and prospective customers the most competitive terms in Europe and long-term energy contracts. Renewable energy sources in Iceland allow the Company to offer its customers a clear advantage over its competitors who are more reliant on volatile fuel markets. Long-term energy contracts enable businesses to minimise risk factors and electricity generated from 100% renewable resources is rapidly becoming an important component in international business.

Landsvirkjun's main message to its current and prospective clients has been the availability of energy contracts, under market conditions, with an emphasis on the following factors:

- The most competitive prices in Europe
- 100% renewable energy
- Reliable long-term contracts

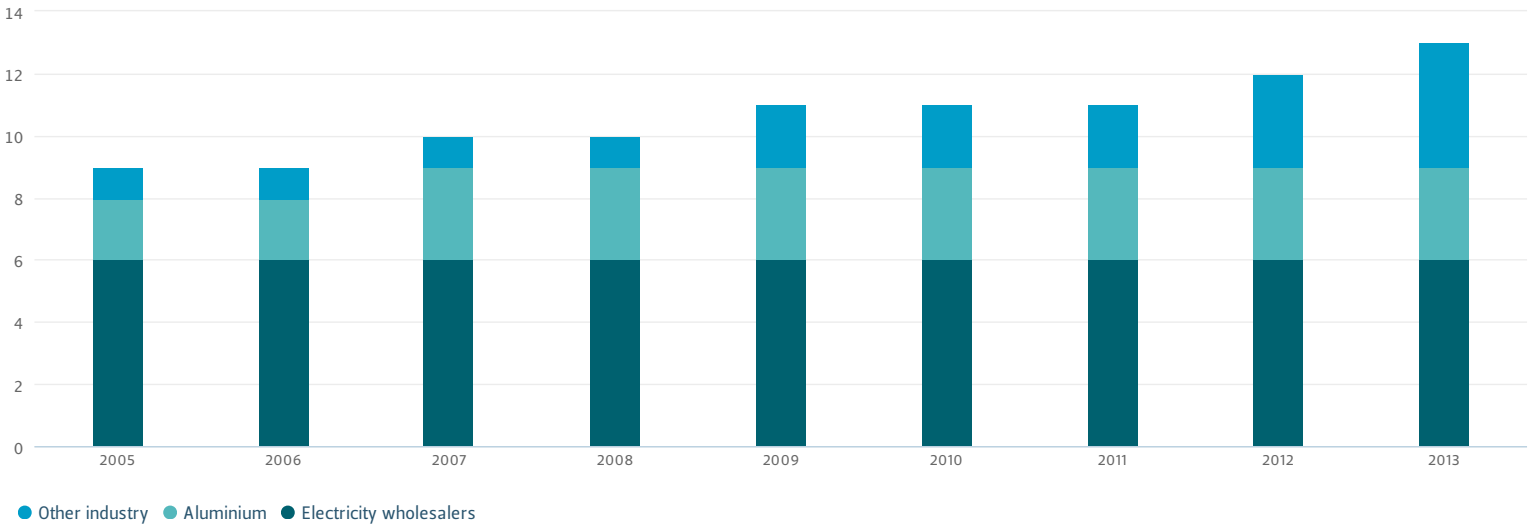
New customers

A new long-term agreement on energy supply was entered into with GMR Recycling ehf and took effect this year. GMR Recycling uses electricity to recycle waste from aluminium plants and other sources and is presently using 8MW of power during weekdays. The objective is to reach 10MW within three years. The energy contract was signed in June, 2012.

The German company PCC intends to construct a metallurgical grade silicon metal production plant at Bakki near Húsavík, capable of producing 32,000 tonnes per year. The facility will need 58MW and over 400 GWhr of electricity, annually. Landsvirkjun will provide the electricity for the project and has worked closely with PCC in the last few years. A power contract was signed in the first quarter of 2014, subject to conditions precedent. The construction of the silicon metal plant is scheduled to begin in 2014 and the facility will begin operations in 2017.

United Silicon hf. also intends to construct a metallurgical grade silicon metal production plant in Helguvik, capable of producing 21,000 tonnes per year. The facility will need 35MW and over 300 GWh of electricity, annually. Landsvirkjun signed a term sheet with United Silicon hf. in 2013 and a power contract subject to conditions precedent was signed in the first quarter of 2014. Construction of the plant is scheduled to begin in the summer of 2014 and operations in 2016.

Number of customers



Landsvirkjun signed Letters of Intent with regard to the main components of energy contracts with several other companies in 2013. Landsvirkjun is currently involved in serious discussions with a number of other companies.

The uncertain global economic environment has delayed the decision making process in businesses worldwide and has slowed down the development of numerous projects. However, many businesses are preparing to proceed with projects once the economic environment improves. The outlook for 2014 is unclear but Landsvirkjun is confident that the demand for energy will exceed supply, once the international economy recovers.

This year, work continued on marketing Iceland as an advantageous location for diverse power intensive industries. Landsvirkjun's customer base has increased in the last few years and new customers within new industries have chosen to begin operations in Iceland, as a result of long-term energy contracts and the security of supply.

The World Economic Forum has assessed the security of supply in Iceland as one of the most reliable in the world. Of the 148 countries assessed, Iceland achieved the 3rd– 9th position.

Source: The Global Competitiveness Report 2013-2014.

The marketing drive this year included advertising via the web and printed materials, participation in various conferences, meetings, a new website and more. Marketing measures also included the production and distribution of promotional videos, shown at various locations worldwide.

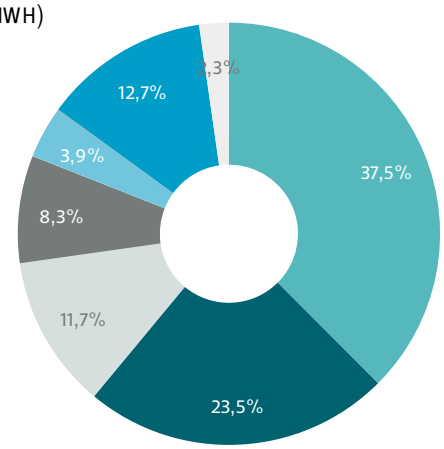
International data centers are a prime example of a new industry in Iceland and Landsvirkjun believes that Iceland is a particularly suitable location for this type of business. Competitive energy contracts, a continuously cold climate, a strategic location between Europe and the USA are just some of the advantages offered by Iceland. Two international data centers are already in operation in Iceland and Landsvirkjun's marketing efforts focused on expanding the customer base in this sector.

Services to current clients

Energy contracts with current customers ensure a solid revenue base for Landsvirkjun. Landsvirkjun's largest customers are three aluminium companies that purchase approx. 75% of the Company's production.

This year, new conditions were outlined for wholesale electricity dealers. Landsvirkjun hopes to implement new conditions within the next three years. New contracts were signed with wholesale customers at the end of 2013.

DIVISION OF ELECTRICITY SALES 2013 (MWH)

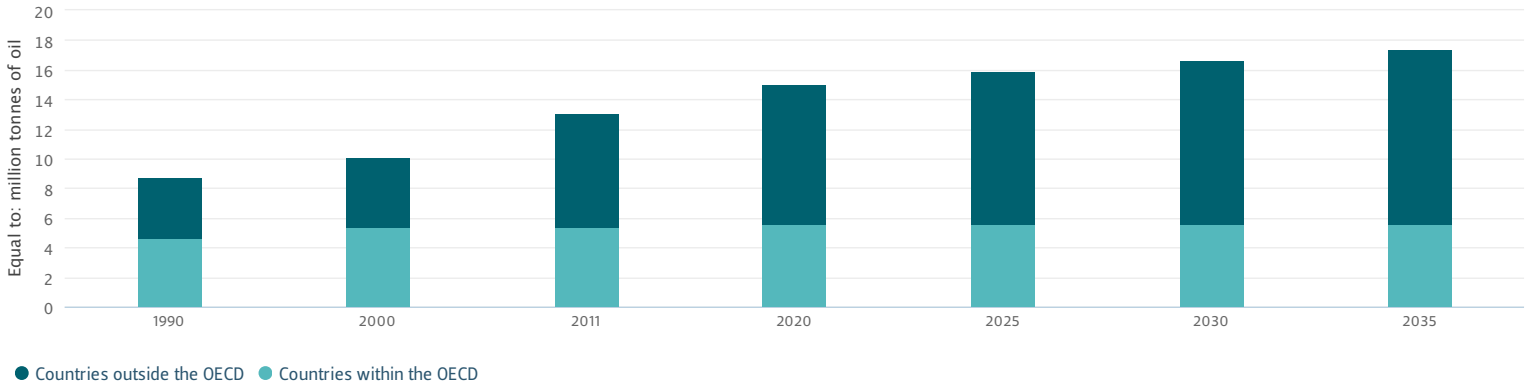


Rio Tinto Alcan in Iceland informed Landsvirkjun of a change to the scope of its upgrade project for the company's aluminium plant in Straumsvik, Iceland. The initial plan anticipated that the annual production capacity of the aluminium plant would increase to 230 thousand tonnes. However, an increase to 205 thousand tonnes is now anticipated. In light of this, it is likely that the power needs of the aluminium plant will be less than originally expected. Contract amendment discussions could take place with Rio TintoAlcan in the near future.

New opportunities for Landsvirkjun

The changing landscape of energy markets has created new opportunities for Landsvirkjun. The demand for energy has increased rapidly in the last few years alongside historically high energy prices worldwide. The next few decades will see ongoing, increased demand especially in developing countries, seeking out a better quality of life.

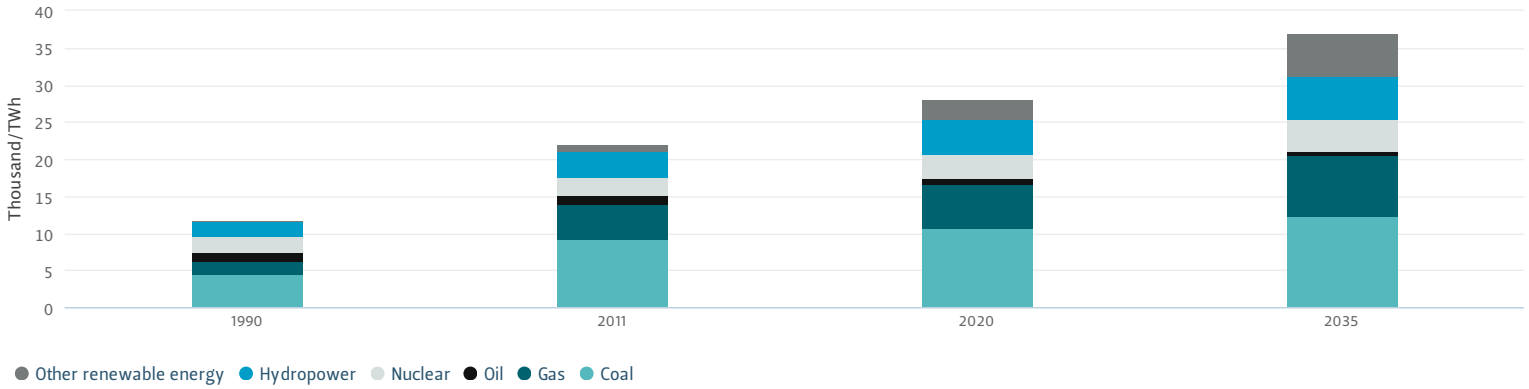
Worldwide demand for energy



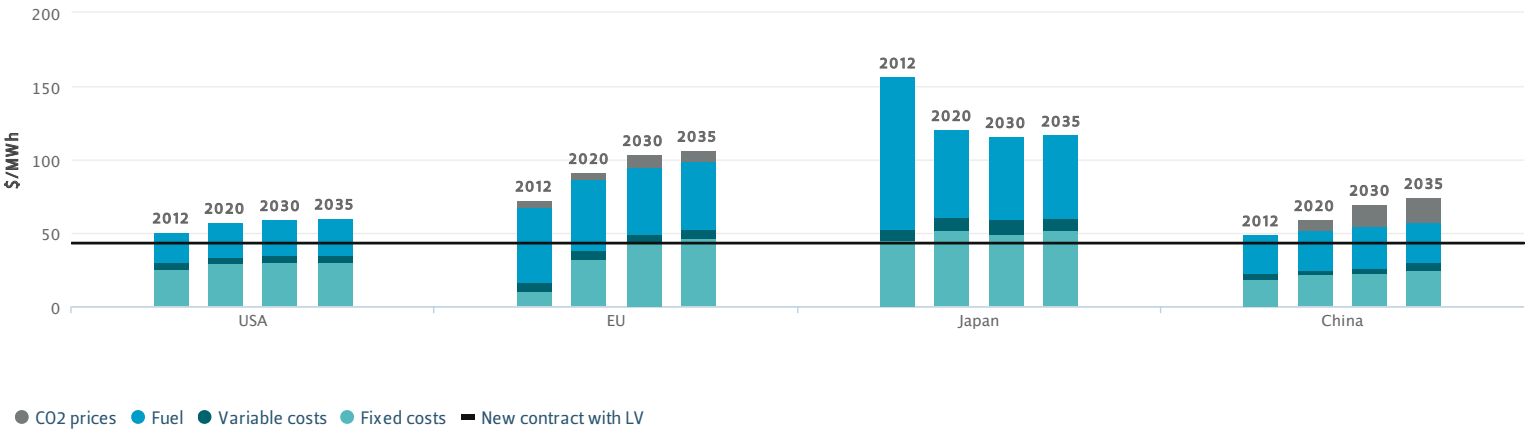
Over half of the electricity produced worldwide comes from burning coal and gas and the percentage is expected to remain high in the coming years. Coal and gas prices generally set prices within the electricity market. Increased demand will likely push the price of gas and coal upwards and subsequently increase electricity prices worldwide. More stringent measures on greenhouse gas emissions will also result in higher electricity prices.

The price of coal and gas is not uniform worldwide and this is evident in the competitive market for electricity. The relatively new technological advancement in American shale gas production is a prime example of this as gas prices have reached a historical low, resulting in lower electricity prices. However, the International Energy Agency believes that the technological advancements in the USA will not significantly affect markets elsewhere and the USA will be at a distinct advantage, with regard to cheaper gas and electricity, in the near future.

Energy sources worldwide



Average wholesale prices of energy



Rising electricity prices worldwide and persistent energy-price disparities between markets increase the demand for electricity in Iceland. Landsvirkjun generates all its electricity from renewable resources. The production costs for renewable energy are predictable and are generally independent of the price fluctuations associated with coal and gas. The Company's renewable energy production is also protected from the potential rise in costs related to greenhouse gas emissions. These factors enable Landsvirkjun to offer 12 year energy contracts at $43/MWh (indexed) with the option of a reduced rate for new, long-term investments. These terms are amongst the most competitive in the world.

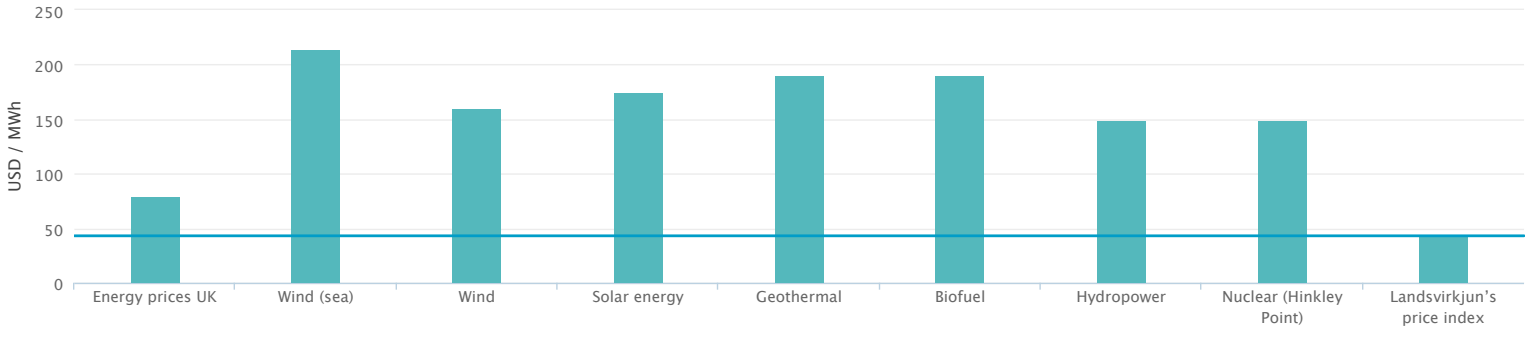
Landsvirkjun offers the most competitive electricity prices in Europe with long-term contracts at $43MWh. In comparison, the average spot market rate for electricity in the period between 2010 and 2013 was $66/MWh in the Netherlands, $57/MWh in Scandinavia and $59/MWh in Germany.

Source: www.montel.no →

A part of the European electricity market

Analyses suggest that all-in electricity prices in the UK and mainland Europe will further increase in the next few years. Many countries within Europe are concerned with energy security and are willing to enter into long-term agreements to ensure their future electricity supply. Even now, the British government is open to negotiate fair prices for renewable and nuclear electricity generation for 15 to 35 years.

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



Electricity prices Landsvirkjun's price index

Source Department of Energy & Climate Change, November 2013

Landsvirkjun has been involved in the process of assessing the feasibility of a sub-sea cable connection with the European electricity grid for some time. Recent research indicates that a sub-sea connection with Europe would in fact be both technically possible and financially feasible. Energy sales via a sub-sea cable could become an interesting addition to Landsvirkjun's business and could be complementary to increased energy sales and business development locally. This year was spent systematically increasing Landsvirkjun's understanding of the significance of the project for the Company and for Icelandic energy generation and society in general, should access to foreign markets be provided. Further and various investigations will continue in the near future. A detailed description of the sub-sea cable project can be found in the chapter on developing projects: þróunarverkefni Landsvirkjunar→

Guarantees of origin and green certificates

Ensuring access to markets for Icelandic guarantees of origin remained a key focus in 2013. Trading began with the Netherlands this year and Germany approved Icelandic guarantees of origin in the autumn. Work continued on building Landsvirkjun's contact network in the sector. Subsequently a Company representative was accepted both into RECS International and the World Resource Institute, a non-profit and leading organisation in the field of worldwide renewable energy. The market prices for guarantees of origin have fallen consistently throughout the year despite increased demand, in part, because supply has increased due to an increasing number of companies offering guarantees within the market. The Marketing and Business Development Division will concentrate its efforts in the near future on strengthening Landsvirkjun's position within the international guarantees of origin market. The green certificate market is relatively new and limited to Europe. The market is still developing but preliminary assessments imply that the sale of green certificates could increase Landsvirkjun's profits considerably in the coming years.

Operations and maintenance

Iceland generates 99% of its electrical energy from renewable hydroelectric and geothermal sources. Landsvirkjun generates over two thirds of this energy from hydroelectric, geothermal and wind power sources.

Landsvirkjun operates 13 hydropower stations, 2 geothermal stations and two wind turbines, in five areas of operation, all over Iceland. We believe in an integrated approach where prudence, reliability and the harmony of operations with the environment and society, are fundamental to our operations.

Hydropower: 12.337 GWh

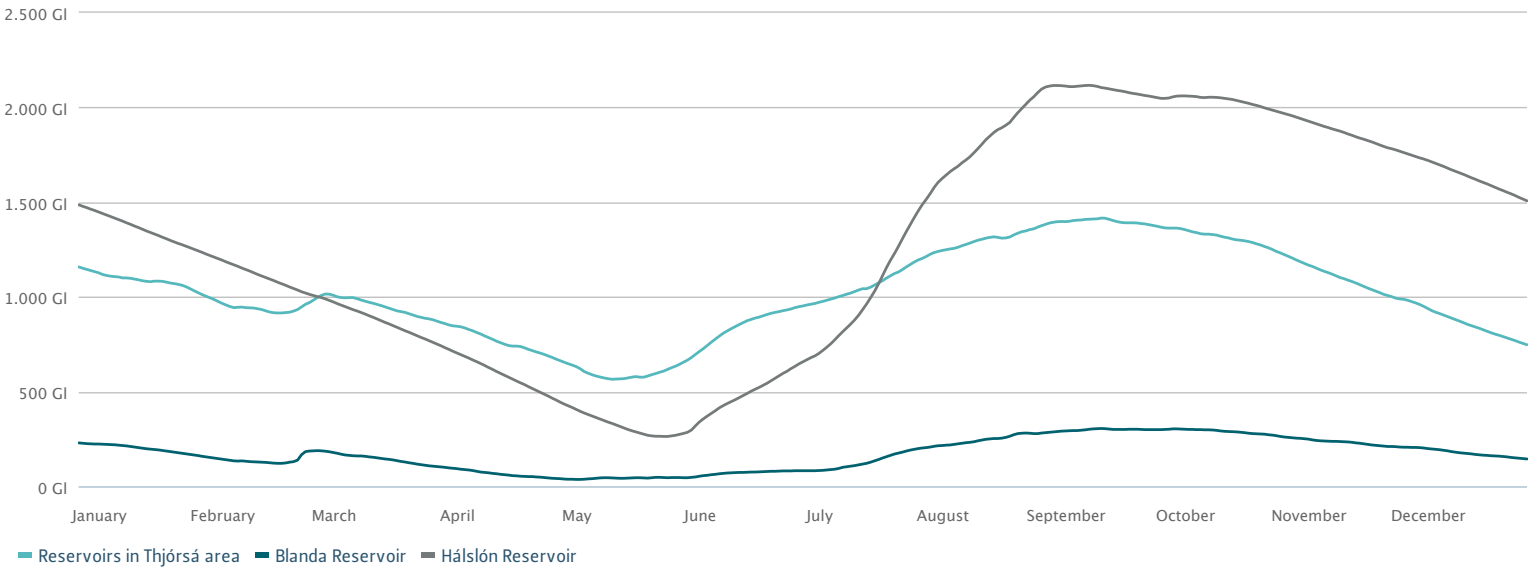
Landsvirkjun's water resources were poor this year. Water reservoir levels were low by the end of winter and spring and summer saw low temperatures and a dry climate. Approximately 600 Gl were needed in the reservoirs at the beginning of the winter period. The weather for the remainder of the year was unfavourable. Landsvirkjun's water reserves were low at the end of the year, or approx. 2,500Gl.

ENERGY GENERATION 2013 12.843 GWh

Water reservoir status by area: 2013

The water inflow to Landsvirkjun's reservoirs in 2013 was unlike that of previous years. There was high 'snow melt' in the water catchment areas in Þjórsá, Tungnaá and Blanda in February, most of the snow in the area thawed and the inflow rate was tenfold. Precipitation levels were low for the rest of the winter and there was no snow accumulation within the area. The spring floods were minimal as a result of these weather conditions and the 'snow melt' from the Langjökul, Hofsjökul and Vatnajökul Glaciers was below average. Reservoirs did not fill in the Þjórsá, Tungnaá and Blanda water catchment areas. Snow accumulation was high in eastern parts of the country and temperatures in the spring were initially low. The lowest water level on record was recorded on the 28th of May at Hálslón; 570 m.a.s.l (55 metres below the highest operating water level). Temperatures rose at the beginning of June and the water flow increased in rivers and lakes in the eastern part of the country. The Hálslón Reservoir filled up towards the end of August and remained full for three weeks.

Water reservoir status by area: 2013



Geothermal energy: 500.5 GWh

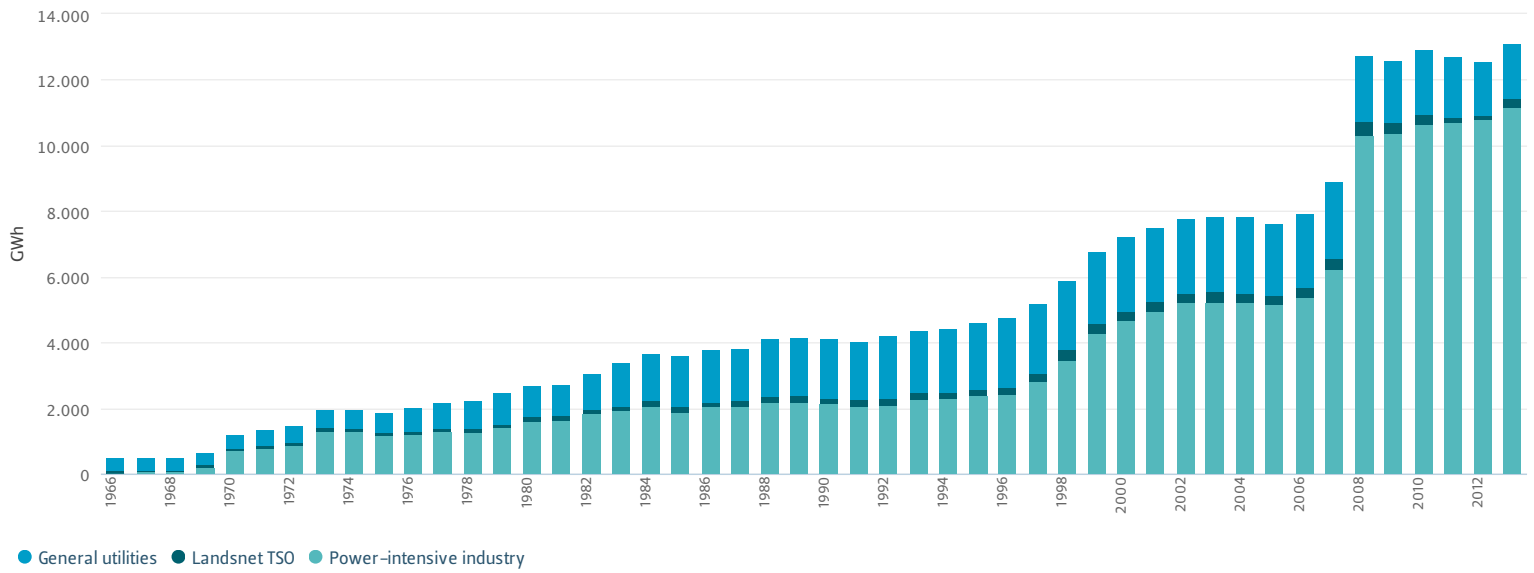
In 2013, energy generation at Landsvirkjun's geothermal stations at Krafla and Bjarnarflag was approx. 500.5GWh. Landsvirkjun is committed to utilising geothermal energy in a sustainable and responsible manner. An integral part of this approach is ensuring that a balance is maintained between the utilisation and the natural renewal of the geothermal reservoir.

Separated water not utilised directly for electricity production is injected back down into the geothermal reservoir. Since 2012, re-injection levels have been increased, gradually, from 80kg/s up to 140kg/s. Currently, only 32kg/s is not re-injected into the system but all separated water will be re-injected into the geothermal reservoir at Krafla.

Wind power: 5.5 GWh

Landsvirkjun's first wind turbines became operational this year. The two wind turbines each have an installed capacity of 0.9 MW and operations have been successful this year, with minimum disruption. Safety issues pertaining to the maintenance of the wind turbines are a priority and specialist training is required for those employees involved, as a result of the height employees work at. Training has mostly been executed in Iceland where a special practice area was set up for training and drill purposes.

Landsvirkjun's Electricity Sales 1966-2013



Operation of power stations

The operations of Landsvirkjun's power stations were successful throughout the year. There was one serious incident when a cable terminator failure occurred at the Búrfell Hydropower Station. There were 76 unforeseen interruptions at Landsvirkjun's power stations during 2013, compared with 77 in 2012.

Landsvirkjun's goal is to ensure that generating units in the power stations are available 99% of the year; not accounting for routine maintenance periods. The goal was achieved this year as units were available 99.7% of the time, compared with 99.9% in 2012. The monitoring, maintenance and operation of power stations was routinely carried out throughout the year. Landsvirkjun operates in accordance with an integrated, certified, Quality Management and Environmental Safety Management System, based on ISO 9001, ISO 14001, OHSAS 18001 and the Internal Electrical Safety Operation System (RÖSK), which fulfils the criteria set out by the Iceland Construction Authority, on electrical safety issues. Landsvirkjun has been certified as a producer of green electricity by the German company TÜV SÜD, who specialise in certification, testing and inspection. In addition, the Company's IT Division's safety management system is certified in accordance with ISO 27001.

Investments in operational power stations

There were 79 maintenance and refurbishment projects carried out at Landsvirkjun's power stations in 2013. A contract was completed on the purchase of a new step-up transformer for the Búrfell Hydropower Station which is due to arrive in the country in the middle of 2014. An excitation system was upgraded at unit 3 at the Írafoss Hydropower Station and a 23 year station control system was upgraded at the Blanda Hydropower Station. The new station control system should be operational by the middle of 2014. The penstock at the oldest and smallest Landsvirkjun power station, Laxá 1, was removed and the power station was taken out of operation. Refurbishment work was executed on one of the cooling towers at the Krafla Geothermal Station, alongside preparation work for the repair of the spare turbine rotor. The wicket gates were replaced in one of the machine sets at the Fljótsdalur Hydropower Station.

Asset management of power stations

Long- term plans are essential where the renewal and refurbishment of equipment is concerned. Projects must be prioritised in accordance with the overall interests of the Company. The implementation of new procedures for asset management, in line with the Asset Management Standard ISO 55001, continued this year and a special software system for asset management was taken into use. The objective of asset management is to optimise the management of assets, to ensure that they fulfil their designated role and requirements. Effective maintenance cannot prevent the need for the renewal and refurbishment of power stations, within the estimated lifetime, if the equipment ceases to fulfil its designated role or if it poses a danger.

Long term investment needs are identified on the basis of age and condition. Short-term investment need proposals are collected in a comprehensive database and are then prioritised according to a specialised evaluation, based upon risk assessment and the objectives of the Company at any given time.

The software used considers three key factors in asset management:

Asset projections/plan

Assessment of investment needs: 15–20 years

Investment plan

Implementation plan: 1–3 years

Management systems

Supervision of the management of investment projects

The software significantly simplifies the process of analysing how the different contributions to investments in operations will affect future risk factors for the Company and effectively keeps track of asset management.

International assessment of the operation of Blanda Hydropower Station: HSAP

The results of the Hydropower Sustainability Assessment Protocol (HSAP) assessment of the Blanda Hydropower Station have been released. The assessment was based on the new international protocol on the sustainability of hydropower stations and is governed by a multi-stakeholder body with representatives from social and environmental NGOs, governments, commercial and development banks and the hydropower sector. A Protocol Governance Council been established to ensure multi-stakeholder input and confidence in the Protocol content and application. The International Hydropower Association (IHA) is responsible for day to day running of the protocol assessments.

An international protocol for the sustainable use of hydropower

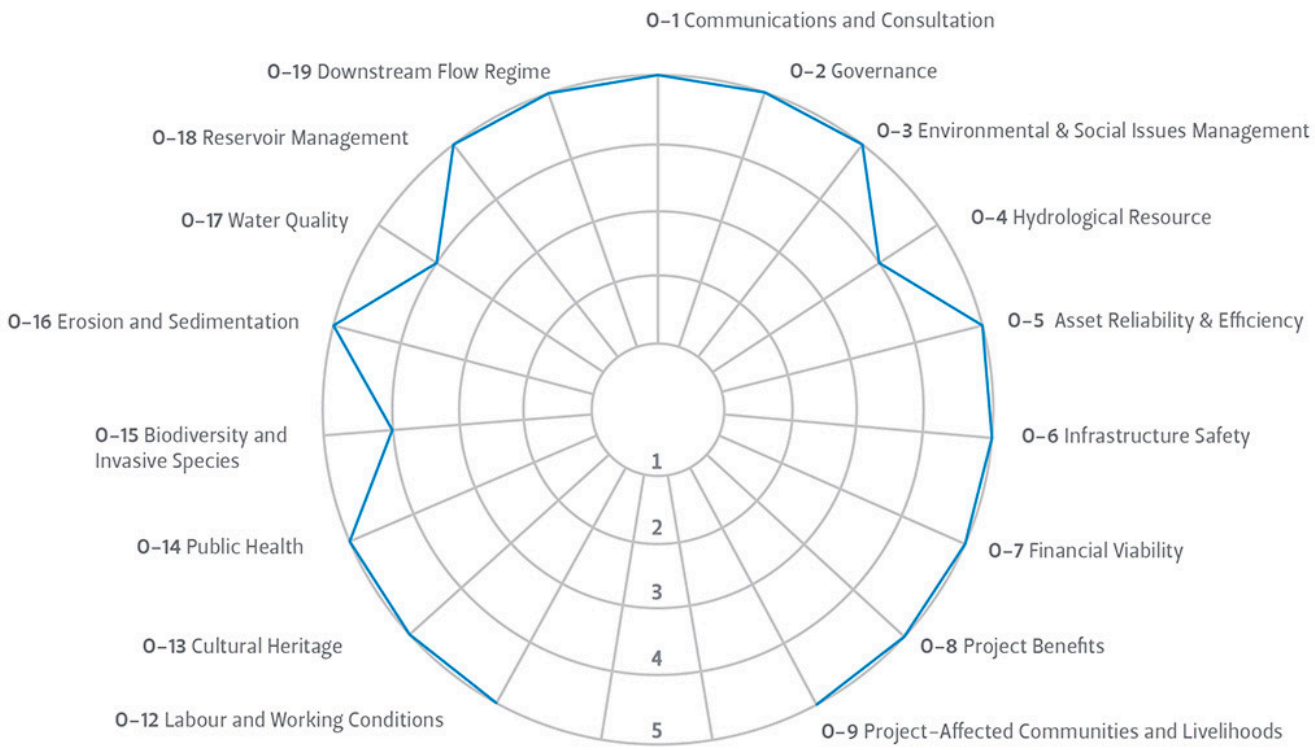
PERCENTAGE OF TOTAL ENERGY GENERATION 7%

Blanda Hydropower Station is responsible for approx. 7% ofLandsvirkjun's energy generation.

The Protocol was first launched in 2011. The Protocol was developed between 2008–2010 by the Hydropower Sustainability Forum, comprised of "representatives of developed and developing country governments, the hydropower sector, social and environmental NGOs, and commercial and development banks" (http://www.hydrosustainability.org) alongside the IHA who initiated the project. Landsvirkjun has given the project its full attention, via its membership, and has actively supported the development of the protocol. The Director General for The Icelandic National Energy Authority represented the Icelandic government throughout the project.

The Protocol assesses the sustainability of hydropower projects and is built on 20 clearly defined topics. The Protocol can be used for four main stages of hydropower development: Early Stage, Preparation, Implementation and Operation. The audit is executed by an accredited assessor who carries out an evidence-based objective assessment. Documents pertaining to the operation of a hydropower station are utilised for the assessment, the validity of which is confirmed via a number of interviews with a diverse range of stakeholders and input from other parties.

Results of the assessment



1. More than one significant gap against basic good practice 2. One significant gap against basic good practice 3. Meets basic good practice with more than one significant gap against proven best practice 4. Meets basic good practice with one significant gap against proven best practice 5. Meets basic good practice and proven best practice

The results of the Blanda assessment

The Blanda assessment took place at the Blanda Hydropower Station and at Landsvirkjun's headquarters in Reykjavík in September, 2013. The assessment was carried out by three international experts. The assessment was comprehensive, including interviews with Landsvirkjun employees and over 30 individual representatives from the various stakeholder groups: agencies, municipalities, companies and organizations. The protocol assessed 17 differing topics, pertaining to the operation of Blanda, in order to assess the sustainability of the hydropower project Communications and Consultation; Environmental and Social Issues Management; Hydrological resource; Labour and Working Conditions; Biodiversity and invasive species. The results of the assessment show that Blanda meets Proven Best Practice on 14 out of 17 topics assessed using the Protocol. Blanda exceeds Basic Good Practice on all 3 remaining topics, each of these with only one significant gap against proven best practice.

Documents

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

HSAP – Blanda Power Station
8.25 MB PDF FILE

Iceland's newest hydropower station

The Búðarháls Hydropower Station is located within the Þjórsá– and Tungnaá River water catchment area. The Station utilises the 40 metre head in the Tungnaá River from the tailwater of the Hrauneyjafoss Power Station to the Sultartangi Reservoir. The installed capacity of the Station is 95 MW and the generation capacity is estimated at 585 GWh/yr. The Station became fully operational in February 2014.

Continual improvement

Two earthfill dams were constructed at the Búðarháls Hydroelectric Power Station, to the east of the Búðarháls ridge and a short distance upstream of the junction of the Tungnaá River and the Kaldakvísl River. One of the dams was built across the Kaldakvísl River and the other across the tailwater from the Hrauneyjafoss Power Station. The dams are both approximately 25 metres

at their highest point and have a combined total length of 1400 metres. The two dams form the intake reservoir for the Búðarháls Hydropower Station, given the name Sporðaldalón (the Sporðalda Reservoir). The reservoir's total surface area is approx. 7km2.

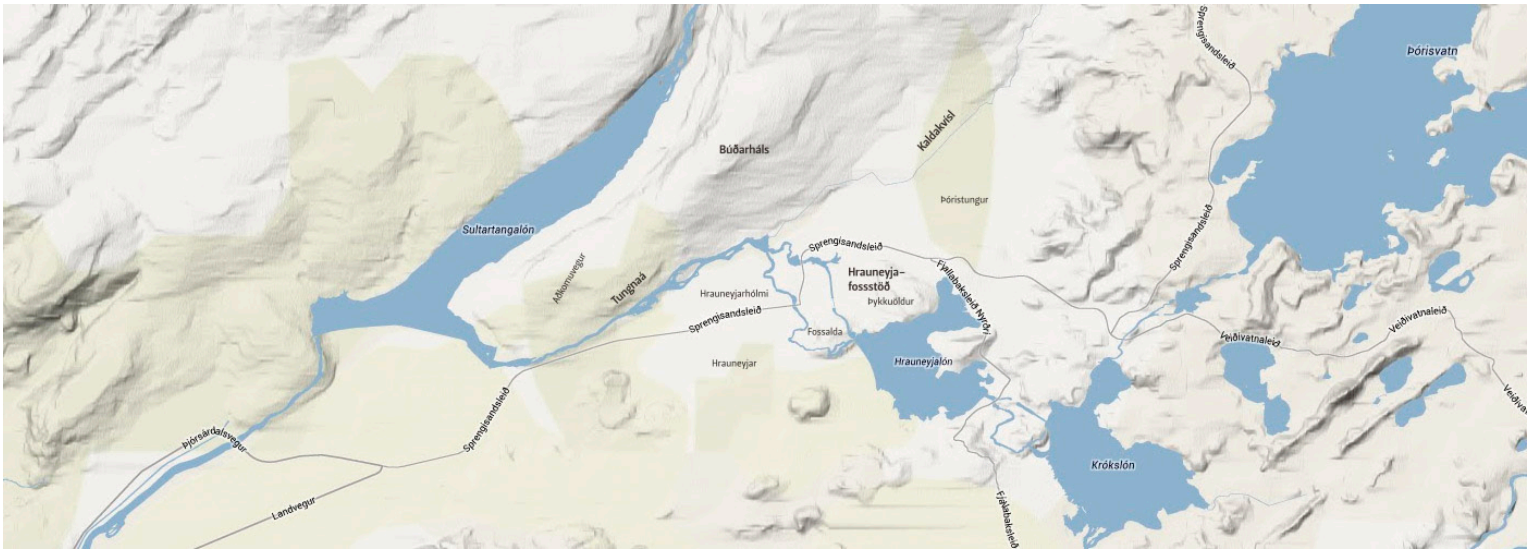
TOTAL INSTALLED CAPACITY

95 MW

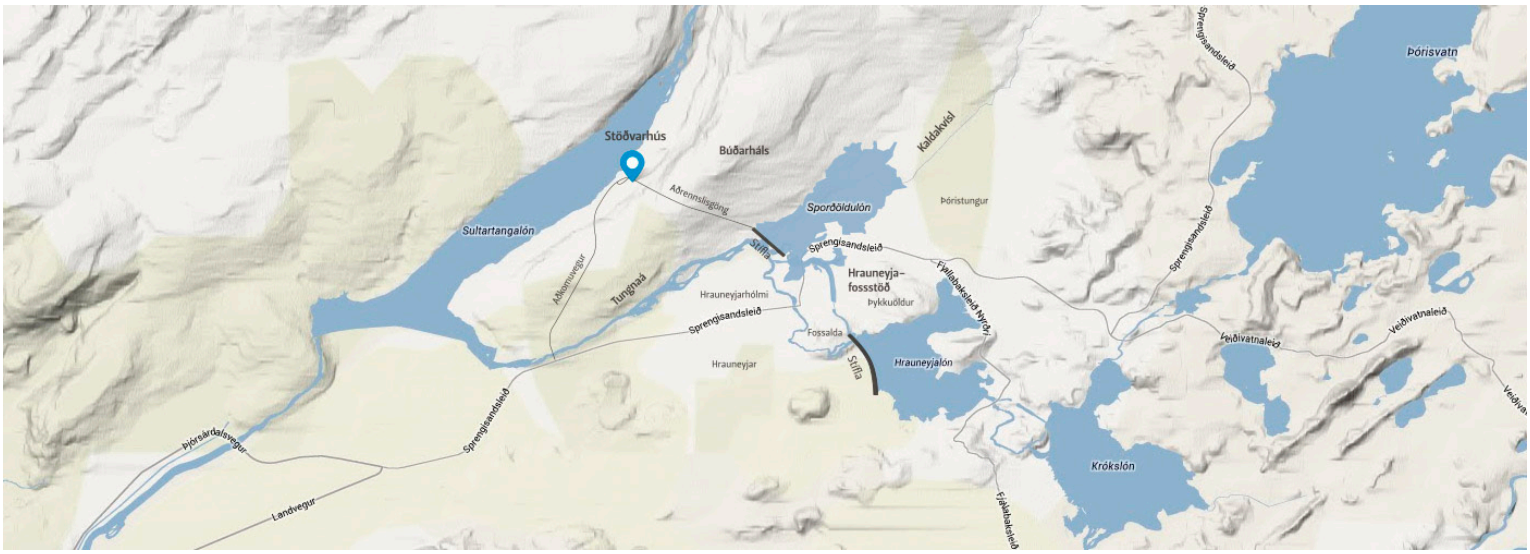
The total installed capacity of the Búðarháls Hydropower Stationis 95MW and the generation capacity is estimated at585GWh/yr.

A headrace tunnel, approximately 4 km in length, conveys the water from the intake structure at the Sporðalda Reservoir, westward through the Búðarháls ridge, to a surge basin on the west side of Búðarháls ridge. Two steel penstocks convey the water from the intake to the Station's turbines. The powerhouse is mostly above ground, built into the western slope of the Búðarháls ridge. There are two generating units, each with an installed capacity of approx. 48MW.

Before



After



Overview of the development

Construction work for the Búðarháls Hydropower Station began at the end of 2001. The initial development of the area included the construction of a bridge across the Tungnaá River and an access road, across Búðarháls ridge, up to the construction site for the powerhouse and the Sporðalda Dam. In the summer of 2008 and 2009 more preparatory work was carried out, including the laying of a power cable from the Hrauneyjafoss Power Station to the proposed construction site. Work camps were also erected.

The first tenders were advertised in June, 2010. An agreement was reached with the construction company Ístak with regard to the construction of the tunnels, dams, powerhouse and other structures in connection with the development. In December, 2010, an agreement was reached with the German company Voith–Hydro for the supply of all mechanical equipment and electrical equipment for the power station. Tenders for other parts of the project were completed by 2012. A contract was signed with IAV Construction, with regard to the construction and installation of penstocks in 2011. A contract was signed with the French company Alstrom Hydro, with regard to the construction and installation of gate equipment in January, 2012. A contract was also signed with the Portuguese company Efacec with regard to the production of generator step up transformers in April 2012. All tenders were advertised in the European Economic Area.

CUBIC METRES OF CONCRETE **65.000**

65,000 cubic metres of concrete and 4,500 tonnes of steelwere used in the construction of Búðarháls.

The single largest project phase undertaken in the development of the Búðarháls Hydropower Station was the construction of the headrace tunnel through the Búðarháls ridge. The underground headrace tunnel is approx. 4 km in length and the total cross section area is 140 m2. The tunnel was excavated from both ends and in two phases, as a result of its height. Excavation work was completed in September of this year and water was released into the tunnel in November. The geological conditions were more challenging than originally anticipated and consequently the completion of tunnelling work was 60 days behind schedule. Work on the powerhouse and intake structure was fully completed by the end of 2013.

The filling of the Sporðalda Dam began in the summer of 2012 and was completed by late autumn, 2013. The filling of the Sporðalda Reservoir began in November 2013 and was completed within three weeks.

All the mechanical equipment and electrical equipment for the power station was supplied by the German company Voith-Hydro. The equipment was mainly manufactured in Heidenheim, Germany but also worldwide in Sweden, Brazil, China, Croatia, Italy and Spain.

The installation of equipment was successful and reached completion by the beginning of October, when the testing period began. Turbine 1 generated electricity for the transmission grid, for the first time, on the 16th of December, 2013. It officially came online on the 11th of January, once testing had been completed. Turbine 2 began generation, once testing had been completed, on the 8th of February, 2014.

Nearly all of Landsvirkjun's hydropower stations use Francis turbines. However, the Búðarháls and Steingrímstöð Stations use Kaplan turbines. Kaplan turbines are suitable for low head, high flow areas. The Kaplan turbine is similar to a ship propeller; the rotor blade pitch is adjustable in order to steer the power and efficiency of the turbine.

Francis Turbine
Suitable for high head >50-600 M

Kaplan Turbine
Suitable for low head <50 M

The gate equipment was provided by the French company Alstrom Hydro but the manufacture of the equipment was mostly completed by Pemel, their Portuguese sub-contractor. The manufacture of the gates began in the middle of 2012 and work on the erection of gate frames and gate track equipment was completed alongside other construction work. The draft tube gates became operational in August of 2013 when water was channelled into the Station from the Sultartángi Reservoir. The erection of gates and gate equipment and finally the wheel gates for the intake structure was completed in November, 2013.

The penstocks for Búðarháls were designed and manufactured by an Icelandic company. Landsvirkjun has previously purchased penstocks for its stations from manufacturers abroad. The manufacture of the penstock parts began in the beginning of 2012 in the town of Garðabær at Teknís, a subcontractor for ÍAV. The first units were transported to the site in May of that same year. The erection of the penstocks was successful and was completed by the beginning of 2013 with the exception of sandblasting and paintwork which was completed in July.

On average, three hundred on-site workers were involved in the construction of the Búðarháls Hydropower Station. The measured labour force for the Búðarháls project by the end of the year, was approx. 900 man-years, not including those employees who worked on the manufacture of mechanical equipment and electrical equipment all over the world.

The penstocks at the Station are manufactured and designed in Iceland.

Safety issues were at the forefront of construction work carried out for Búðarháls and all necessary measures were taken to prevent accidents. The success rate was high and all employees were encouraged to remain 'safety aware' throughout the project.

The Búðarháls Hydropower Station project reached completion by the end of 2013, with the exception of finishing work and mechanical equipment testing. The Station began operations in February, 2014. Work camps and contractor's equipment will be removed from the area in the near future. The summer will be spent completing work on the clean-up and landscaping of the areas around the station's structures.

Design and supervision

The design of the Búðarháls Hydroelectric Power Station was completed in cooperation with a number of Icelandic engineering consultants. Efla hf provided the civil and structural design for all components and was responsible for the project management of other design work. Mannvit hf predesigned the penstocks and gates and Verkís hf predesigned the mechanical equipment and electrical equipment. The architectural design of Búðarháls was undertaken by the firm OG Architects.

The supervision of the site was the responsibility of staff provided by Landsvirkjun, in cooperation with staff supplied by the engineering consultancy firm Hnit hf.

Power Stations

Landsvirkjun operates thirteen hydropower stations, two geothermal stations and two wind turbines, in five areas of operation, all over Iceland. The Búðarháls Hydropower Station is the sixteenth station to come online and began full operations in March, 2014. Landsvirkjun believes in an integrated approach, when it comes to the operation of its power stations, where prudence and reliability are held as core values alongside a commitment to growth, in harmony with the environment and in consensus with society.

Icelanders produce 99% of their electricity via renewable energy resources and Landsvirkjun generates 75% of this energy. The largest resource for this energy is hydropower but geothermal energy and wind energy are also utilised. Landsvirkjun generated 12.843 GWh of energy in 2013.

Bjarnarflag Power Station

1969 / Geothermal

CAPACITY	GENERATED
3 MW	18 GWh/year

Blanda Power Station

1991 / Hydropower

CAPACITY	GENERATED
150 MW	990 GWh/year

Búrfell Power Station

1972 / Hydropower

CAPACITY	GENERATED
270 MW	2.300 GWh/year

Fljótsdalur Power Station

2007 / Hydropower

CAPACITY	GENERATED
690 MW	5.000 GWh/year

Hrauneyjafoss Power Station

1981 / Hydropower

CAPACITY	GENERATED
210 MW	1.300 GWh/year

Írafoss Power Station

1953 / Hydropower

CAPACITY	GENERATED
48 MW	236 GWh/year

Krafla Power Station

1977 / Geothermal

CAPACITY	GENERATED
60 MW	500 GWh/year

Laxá Power Station I

1939 / Hydropower

CAPACITY	GENERATED
5 MW	3 GWh/year

Laxá Power Station II

1953 / Hydropower

CAPACITY	GENERATED
9 MW	78 GWh/year

Laxá Power Station III

1973 / Hydropower

CAPACITY	GENERATED
13,5 MW	92 GWh/year

Ljósafoss Power Station

1937 / Hydropower

CAPACITY	GENERATED
16 MW	105 GWh/year

Sigalda Power Station

1978 / Hydropower

CAPACITY	GENERATED
150 MW	920 GWh/year

Steingrímsstöð Power Station

1959 / Hydropower

CAPACITY	GENERATED
27 MW	122 GWh/year

Sultartangi Power Station

1999 / Hydropower

CAPACITY	GENERATED
120 MW	1.020 GWh/year

Vatnsfell Power Station

2001 / Hydropower

CAPACITY	GENERATED
90 MW	490 GWh/year