Laxá Power Stations

Landsvirkjun
National Power

Laxá Power Station

Laxá Hydro Stations

Three hydropower stations are located in the Laxá chasm, north Iceland: Laxá I, built in 1939, Laxá II from 1953 and Laxá III from 1973. Their combined rated capacity is 27.5 MW.

Originally, the River Laxá was harnessed on the initiative of the town of Akureyri to meet municipal electricity needs, and the Laxá Stations played a key role in the electrification of North Iceland. In 1950 the Icelandic State became a partner in the Laxá Stations and in 1983 they were merged into Landsvirkjun.

Landsvirkjun

The founding of Landsvirkjun in 1965 may be traced to the Icelandic government's interest in increasing the utilisation of energy resources by attracting foreign investors for power-intensive industry in Iceland. At this point, Landsvirkjun was established for the purpose of constructing and operating power plants which could both sell electricity to power-intensive industries and provide the general market with electricity at reasonable prices. Up to this time, the electrification of Iceland had been managed by government and municipalities around the country; however, these utilities were incapable of financing new energy projects.

Through its own means, Landsvirkjun has managed to develop its power system since 1965, with installed capacity expanding from about 90 MW to 1212 MW, rising to over 1900 MW with the new Kára-hnjúkar Hydro Station. At the same time, electricity prices on the general market have declined in real terms, while electricity sales in foreign currency to power-intensive industries have increased up to about 80% of the company's electricity production. Furthermore, the quality and security of supply from Landsvirkjun ranks among the best in the world.

Production and demand of electricity

From the time Landsvirkjun was first started until the end of the 1970s, the company built three power stations on the rivers Thjórsá and Tungnaá. During these early years, electricity sales were increasing to the Straumsvík aluminium plant, and sales were also negotiated with the company Icelandic Alloys at Grundartangi. Towards the end of the period, weather conditions and mushrooming demand resulted in a power shortage in Iceland, making construction of the Sigalda and Hrauneyjafoss plants in the late sventies a race against time. In 1983, Landsvirkjun became a national electricity company, whereas its operation up till then had been limited to the south and west of Iceland. The period of 1982 to 1996 was characterised by only a small increase in electricity demand and no success in attracting foreign investors to power-intensive industry projects in Iceland. It was in those years that Landsvirkjun built the Blanda Hydro Station, with many criticising the resulting surplus supply of electricity. In 1995-96, however, circumstances became favourable for attracting foreign investors in power-intensive industry. Landsvirkjun negotiated contracts for increased energy purchases by the Straumsvík aluminium plant, Icelandic Alloys and a new aluminium plant, Nordurál. All those contracts were completed in just under a year. This introduced a period of intense development at Landsvirkjun, which increased its production by about 60% in five years. The power plants at Blanda, Búrfell and the geothermal plant, Krafla, initially built by the Icelandic State, were enlarged, and new plants were constructed at Sultartangi and Vatnsfell in south Iceland. In 2002 negotiations were concluded for electricity sales to Alcoa Fjardaál at Reydarfjördur. Construction therefore began on Kárahnjúkar Power Plant at the beginning of 2003, which results in another 60% increase in Landsvirkjun's electricity production.

Powerful landscapes for hikers!

Many interesting routes for hikers and walkers can be found in the Laxá chasm area. Access to them is open to everyone, but hikers should show extreme caution, especially in the vicinity of the rivers and power station structures.

Scenic rout to the chasm edge

One short and very interesting trail for walkers and hikers leads up to the eastern rim of the Laxá chasm and along to the dam farthest upriver. The best place to start out is just downriver from the Laxá II dam. It is possible to walk up to the edge of the chasm from there, then follow the sheep tracks along the side. This route offers a marvellous panoramic view but caution must always be shown, since the rock can be loose in places.

Mt. Geitafellshnjúkur and Nykurtjörn

Mt. Geitafellshnjúkur is 430 m a.s.l. at its highest point. On its southeastern side is a natural basin in the land, walled by cliffs to the north. This is an ancient volcanic crater and the lake filling it is known as Nykurtjörn (the tarn of a "kelpie", a horse-like water spirit in folklore). There is a viewing dial on top of Geitafellshnjúkur, with a fine panoramic view. It is easy to walk up, starting from the southernmost set of power station workers houses and following the old track up to the ridge, and from there to the top. This walk takes 3-4 hours at a leisurely pace.

A walking tour of the Laxá Stations

The following 14 places or power station structures in the Laxá chasm are all clearly marked. With this brochure, a walk around them makes a pleasant and easy way to find out about their activities and functions while enjoying the magnificent scenery. An ideal place to start is at the Laxá III access tunnels, then follow the chasm upriver and back to the first building on the river.

No. 1 – Laxá III access tunnel

This excavated tunnel into the side of the cliffs leads to a vault housing the Laxá III turbine room. Originally the vault was designed for two turbines of 25 MW rated capacity each, and assumed that a 56 m high dam would be built upriver in the chasm to create a head of 83 m. These ideas sparked a major nationwide controversy in the early seventies which was resolved with proposals for the arrangement that can be seen today, whereby all plans for further dam construction were shelved and only one of the two turbines was installed.

No. 2 – High-voltage transformer

Electricity generated at the station is fed to a high-voltage transformer where the voltage is raised to 66 kV (66,000 volts) for transmission to users. A higher voltage is desirable to reduce power losses which occur during transmission as a result of the electrical resistance of the power lines. Before distribution to users, the voltage is reduced to 220 volt.

No. 3 – Salmon ladder

On the opposite side of the chasm is the highest part of the salmon ladder in Laxá. This impressive structure was part of the agreement resolving the Laxá power station controversy. Extending from the lowest point of the chasm, it measures 1,500 m long in all and ascends by almost 70 m. Part of it is a natural watercourse, while earth and concrete channels were created in places. The salmon ladder has never functioned properly, so that brown trout are still as ever before the only fish found in the upper reaches of Laxá.

No. 4 – Dams and the original Laxá I intake

The dam was built in 1939, to collect water for a wooden penstock leading down to Laxá I. With the construction of Laxá III, the upper part of the penstock was removed and the water diverted to Stations I and III via an intake tunnel in the eastern wall of the chasm.

No. 5 – Intake tunnel for Laxá III and Laxá I

Laxá I and III harness the natural flow of water by diverting it into a headrace tunnel to the generating equipment, although a small intake reservoir would be preferable. Reservoirs slow down the water current and the river's bedload is deposited as sediment, preventing sand and rock from damaging the turbines. Reservoirs also prevent disruptions caused by ice, since the water is taken from their bottom, not from the surface as is done here. Landsvirkjun has applied for permission to build a 10 m dam (by comparison, the mast supporting the lights is 12 m high) to prevent these problems. This would also reduce accumulation of sand downriver, which now poses a threat to the salmonís habitat

No. 6 – Laxá I and III intake access

Valves for regulating the water flow are fitted to the intake, and so are grids which are supposed to block rock and ice from reaching the Laxá III turbines. In winter, the temperature of the water as it flows to the grids is sometimes below 0°C, and on coming into contact with them it freezes and blocks them. To overcome this problem and ensure adequate flow, a section of the grids has to be removed, which in turn means that rock, sand and ice are much quicker to damage the machinery than would otherwise be the case.

No. 7 – Bypass tunnel access

The bypass tunnel contains pits which trap part of the sand sediment in the river and need to be emptied at intervals. One way that this is done is by releasing water through the tunnel at great force to sweep the sand away. Another method is to close the intake access and shovel the sand away with earth-moving equipment.

No. 8 – Penstock to Laxá I

A wooden penstock 2 m in diameter carries the water that drives Laxá I. After renovations in 1973 it can now carry 22 tons of water/sec. In winter, when the river level drops, the penstock is shut off and all the water is diverted to the Laxá III turbine.

No. 9 – Laxá I

The Laxá I powerhouse is the oldest building in the Laxá chasm, built in 1939. It houses two 5 MW turbines and the rated head from the intake is 39 m.

No. 10 – Laxá III tailrace

After driving the Laxá III turbines, water flows back into the river under the bridge. The tailrace tunnel from the powerhouse vault is 160 m long.

No. 11 – Laxá II dam

The dam was built in 1952 to create a reservoir for Laxá II and the rated head is 29 m. A gate structure is housed in one building and can be used for shutting off water to the station. The other building is constructed over a gate which can be used to empty the reservoir, for example during maintenance or sand clearance.

No. 12 – Penstock

A 378 m wooden penstock leads from the dam down to Laxá II. Measuring 4 m in diameter, it can carry 40 tons/sec. of water.

Nr. 13 – Surge basin

A surge basin is installed at Laxá II. The tremendous kinetic energy in the water flowing through the penstock means that if the Laxá II turbines have to be shut off suddenly, a water hammer would be created in it which could explode it. The surge basin prevents this happening by absorbing the blow of the water hammer, and also levels out fluctuations in flow through the penstock. A pipe leads from the bottom of the surge basin down to Laxá II.

Nr. 14 – Laxá II powerhouse

Built in 1950-1952, the powerhouse houses the 9 MW turbine for Laxá II. In 1997 a traditional rock wall was built beside the powerhouse, by a team led by local farmer Bergsteinn Gunnarsson. Behind it is an oil trap which in the event of an accident would prevent oil from leaking into Laxá and polluting one of Iceland's most renowned salmon rivers.

Specifications:

Drainage area:	1,550 km^2
Average discharge:	43 m^3/s
Rated head:	
Laxá I	39 m
Laxá I	29 m
Laxá III	39 m
Rated capacity:	
Laxá I	5 MW
Laxá I	9 MW
Laxá III	13.5 MW
Energy production:	180 GWh p.a
Tunnel length at Laxá III:	Headrace and tailrace 850 m Access tunnels 190 m
Design:	Árni Pálsson, engineer, Iceland (Laxá I) Verkfræðistofa Sigurdar Thoroddsen hf., Iceland (Laxá II and III)
Main contractors:	Højgaard & Schultz, Denmark (Laxá I) Stod hf, Iceland (Laxá II) Nordurverk hf, Iceland (Laxá III)

Manufacturer of turbines and generators:

Laxá I, unit 1:	
Turbines:	Kverner Brug, Norway
Generators:	A/S Titan, Denmark
Laxá I, unit 2 and Laxá II:	
Turbines:	James Leffel & Co, USA
Generators:	Westinghouse, USA
Laxá III:	
Turbines:	Esscher Wyss, Germany
Generators:	ASEA, Sweden

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