Búrfell

hydropower station

Landsvirkjun

National Power

Búrfell station

The river Thjórsá is harnessed at Búrfell by a dam on the river which previously flowed south above Mt. Búrfell, diverting it northwards through the Sámsstadamúli mountain ridge and down into the Thjórsárdalur valley. A tunnel has been blasted for this purpose through Sámsstadamúli, which runs north from Búrfell and south from Mt. Skeljafell, and the powerhouse stands at its foot in Thjórsárdalur.

A dam 4 km above the station diverts the River Thjórsá to the west through a special ice-barrier running at right angles from the north of the dam to the west bank of the river. A surface waterway containing a sluice runs to the west and into a cirque between the mountains Búrfell, Skeljafell and Sámsstadamúli, where the water collects in a 1 km^2 reservoir, Bjarnarlón, which is used to meet fluctuations in demand during the course of the day. Water is channelled from the western edge of the reservoir to a headrace tunnel which has been blasted through the basalt strata of Sámsstadamúli. The headrace tunnel divides into two concrete-clad pressure shafts which utilize a head of 100 m, then convey the water 200 m horizontally to the powerhouse. Steel cladding is used in the final 100 m and the shafts branch out to feed the six turbines. After driving the turbines in the powerhouse, the water exits via surge basins into a short channel before entering the River Fossá in Thjórsárdalur, which joins the River Thjórsá 2 km downstream.

The front wall of the powerhouse is decorated with a mural by Sigurjón Ólafsson, who also made the sculpture “The Noise Troll” standing in front of it. Three 220 kV transmission lines lead to Reykjavík two to the Sultartangi Station.

Water wheels for all six turbines at Búrfell Station were upgraded in 1997-98, boosting its installed capacity from 210 to 270 MW.

Hydro Development on the River Thjórsá

Ideas for harnessing Thjórsá at Mt. Búrfell were originally proposed some fifty years before the project was launched. From 1915-1917, Norwegian engineer Gotfred Sætersmoen made studies of the Thjórsá area on behalf of Titan, a private company founded with the aim of developing hydropower in Iceland. In his report, Sætersmoen suggested harnessing Thjórsá at Mt. Búrfell

to produce electricity which would mainly be utilized for fertilizer production. He envisaged five stations on Thjórsá from the Urridafoss falls and upriver beyond Búrfell, as well as a station at Hrauneyjafoss on the River Tungnaá. Búrfell would have been by far the largest station. The plan was to dam Thjórsá at Klofaey and divert the water through an open channel into Bjarnarlón and to an intake dam at Sámsstadaklif.

Around 1960, the Thjórsá development was first given serious consideration. Such a large project offered very economical electricity production if high utilization could be achieved from start-up, but consumption in Iceland then was not growing fast enough

to make the Búrfell station viable. Attention soon began to focus on the possibility of setting up power-intensive manufacturing industries which could utilize a substantial part of the production from the start. Feeling that it lacked the resources to undertake such ventures itself, Iceland set up a committee for power-intensive industry in 1961 to explore the possibility of negotiating with parties from other countries to own and operate industrial plants. At the same time, an intensive programme of preparatory research for the Búrfell hydro project was launched. Eventually, in 1966, these two programmes converged with the signature of a contract with Swiss Aluminium Ltd. for the construction of an aluminium smelter in Straumsvík, and the go-ahead for the Búrfell project, both of them

scheduled to enter operation over the period 1969-1972. This arrangement thereby also secured economical electricity production for the general market.

The community and tourism

Búrfell Station is located towards the head of Thjórsárdalur valley in south Iceland. A hamlet has developed around the site, and the station and its employees form an important part of the rural community. An average of 35 employees work at Búrfell Station, half of them local people. Others have homes elsewhere but spend a large part of the year in Thjórsárdalur.

In the vicinity of the station are renowned historical sites such as *Stöng*, a farmhouse swamped by an eruption in Mt. Hekla in 1104. A replica *Saga Age farm* has been built nearby, along with a replica of the medieval church which originally stood there. The Saga Age farm is open daily from June 1 to September 8, from 10:00-12:00 and 13:00-18:00.

Thjórsárdalur is also renowned for its natural wonders which include the waterfalls *Hjálparfoss* and *Háifoss* and the chasm known as *Gjáin*. A wide range of travel and tourist services are also on offer in the vicinity of Búrfell.

Thjórsárdalslaug swimming pool is open daily in summer (except Mondays and Tuesdays) from 10:00-21:00.

In collaboration with local people, Landsvirkjun is working on enhancing the valley environment and making it as attractive as possible for travellers. And the outcome has been that in recent years Thjórsárdalur has become one of the most popular places among travellers through south Iceland.

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 ower 1900 MW with the new Kárahnjúkar 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's ranks among the best in the world.

Production and demand of electricity

From the time the company 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 heavy industry. Landsvirkjun negotiated contracts for increased energy purchases by the Straumsvík aluminium plant, Icelandic Alloys and a new aluminium plant, Norðurál. 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, initieally 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.

Búrfell and the establishment of Landsvirkjun

After Landsvirkjun was founded, construction began on the Búrfell Station, which has been Iceland's largest power plant until the new Kárahnjúkar plant came on line. Approximately one third of the investment capital was provided by the World Bank, so that it exercised considerable influence on the organisation of Landsvirkjun. One can say that the bank regarded its financing as a form of development aid for Iceland.

The World Bank stipulations shaped Landsvirkjun as a company, and many of those provisos have characterised company operations ever since. The bank emphasised that the company should be independent and free from government interference. With this condition in mind, the bank insisted that the government and Reykjavík municipality each own half of the company. The bank formulated Landsvirkjun's original depreciation rules, accounting practices and pricing policy to be in line with Western models. Furthermore, the bank emphasised that Landsvirkjun should be streamlined, putting all projects out to international tender and engaging outside engineering consultants for project management and for supervision of the subcontractors who constructed power plants. This has remained company policy, resulting in a current staff of only around 200, even though the company represents one of Iceland's most extensive operations.

Specifications:

Drainage area:	6,400 km^2
Average discharge:	340 m^3/s
Harnessed discharge:	260 m^3/s
Gross head:	115 m
Installed power capacity:	
6 (45 MW) Francis turbines	270 MW

Commissioned:	1969
Headrace tunnel:	length: 1,564 m
	diameter: 10 m
Pressure shaft:	diameter: 5.5–6.0 m
River Thjórsá dam:	370 m long
Design:	Harza Engineering Co Int., USA
Powerhouse:	Width: 19 m
	Length: 85 m
	Height: 31 m, of which 18 m underground and 13 m above ground
Powerhouse architects:	
	Gudmundur Kr. Kristinsson
	Gunnlaugur Halldórsson
Main contractor:	Fosskraft
Manufacturer of turbines and generators:	
	Thoshiba, Japan
	Sulzer, Germany

www.landsvirkjun.com

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