

# In-depth introduction to Húsavík Energy

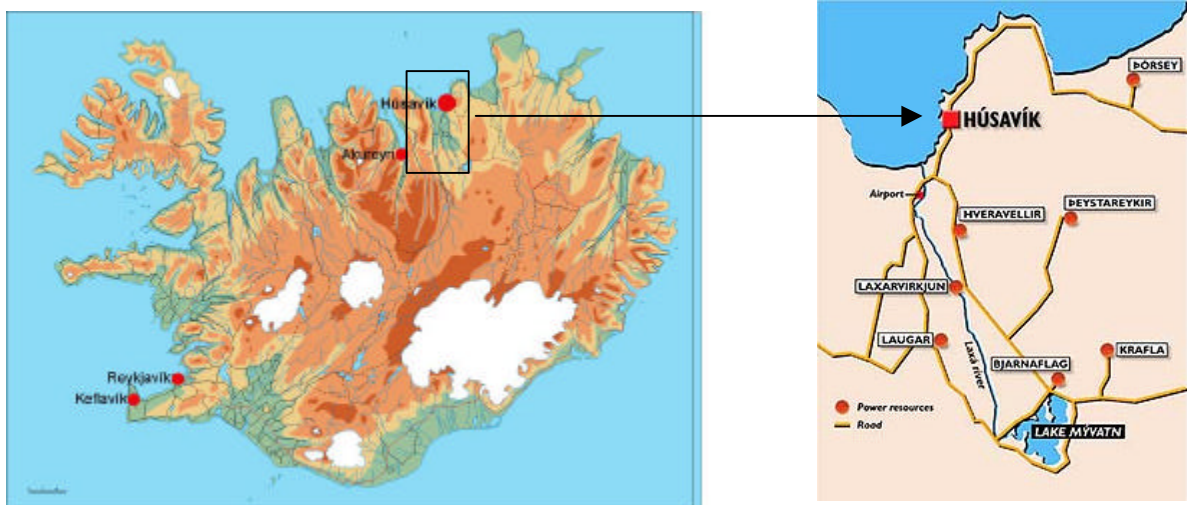
## Historical background

The Viking, Garðar Svavarsson, sailed northward from Sweden late in the 9th century to find and settle new territory. The Sagas report that he took land at Eystrahorn on the East Coast and sailed with his merry men around the island ending up on Tjörnes. There he built houses on Borgarhóll close to Húsavík and stayed the following winter. Hence the town's name, which loosely translated means "The inlet where the houses stood". Garðar is then reputed to have returned to Norway boasting the island's beauty and natural wealth. The country was then named "The Isle of Garðar" but the name did not take, as is well known. One of Garðar's merry crew, a man called Náttfari, absconded with a male slave and young slave girl when Garðar left. He settled with the girl in Iceland where they lived for the remainder of their lives. Náttfari and his people are therefore Iceland's first settlers.

During the period 1100 – 1260 a quarter of all foreign ships landing in Iceland took harbour in Húsavík. During the whole of the 16th century large quantities of sulphur were exported from Húsavík to continental Europe where wars raged. Rich sulphur mines were to be found in the geothermal areas around Lake Mývatn and Þeistareykir.

Húsavík with its approx. 2.500 inhabitants has long been the centre of trade, legal and religious administration for the farming areas in Þingeyjarsýslur. The very beautiful Húsavík Church is a living magnum opus of this period.

The town's location on the coast of Skjálfandaflói is very picturesque and much frequented by visitors from far and wide. It has many tourist attractions to offer, boat trips to Lundey, trips to Grímsey, whale watching, fossil finds, salmon fishing in Iceland's most beautiful and famous salmon river Laxá in Þingeyjarsýsla, to name but a few.



Picture 1 Iceland - Húsavík

## **Geothermal area**

Located some 20 km south of Húsavík is the Hveravellir geothermal area. Geothermal fluid from the three boreholes that were drilled there in 1974 – 1998, ranges in temperature from 120° to 130°C. Close by are several natural hot springs and pools that discharge about 100°C hot water. The production wells range between 400 – 1.000 in depth. Two of the wells are considered amongst the greatest hot water producers of all low temperature wells in Iceland.

The geothermal area has been extensively explored and studied over a period of decades and is thus well understood. The reservoir's capacity potential has been assessed applying up-to-date reservoir modelling techniques and the results show that it can sustain a 75-100 MW artesian flow development.

## **Geothermal utilisation**

Húsavík started utilising the geothermal hot water from Hveravellir as early as 1970. The Hveravellir fluid was flashed to 100°C on site and the hot water fed under gravity to the town through a 20 km long buried asbestos pipeline. In Húsavík it was used for space heating, drying and also to heat greenhouses and farmhouses in the district. Some 15°C were lost en route to the town and significant thermal energy was lost in the flashing process. The geothermal fluid contained within the Hveravellir reservoir is of a quality suited for direct use.

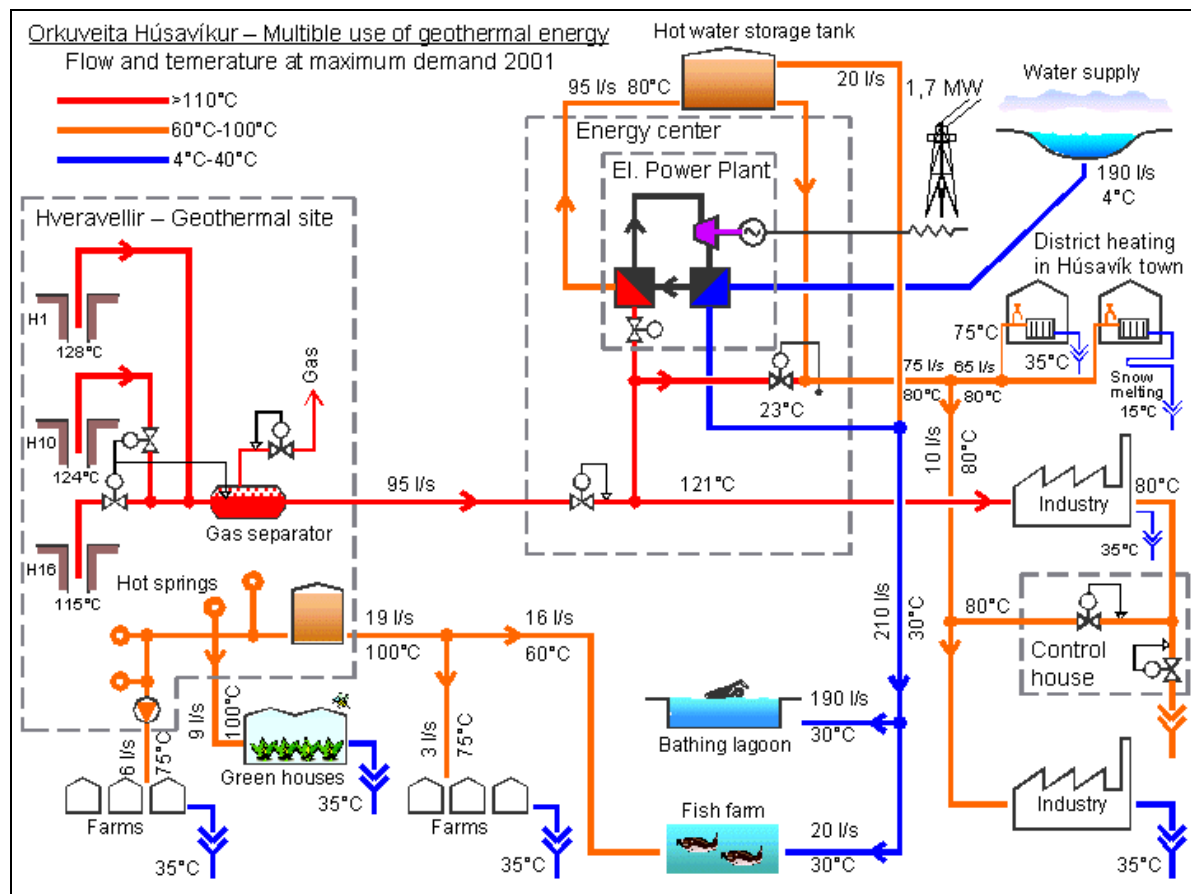
In recent years it became clear that the old pipeline needed a thorough overhaul. In Húsavík new markets were opening up for 80°C to 120°C hot water both for heating and industrial use. This prompted the idea of expanding the foreseen refurbishment of the existing system to include diverse cascaded use. The current highly innovative multi-utilisation development plan for the Hveravellir geothermal resource was primarily conceived to increase its value and reap added environmental benefits. This is achieved by combining in a single system the production of electricity and the provision of suitably hot water for industrial, fish farming, greenhouse, health centre and heating applications. Such an integrated system effects vastly improved efficiency in the utilisation of the thermal energy. The provision of inexpensive thermal energy that is suitable for a multitude of applications close to the consumer location has a great potential to improve the overall economy and employment situation of the township of Húsavík and its surroundings.

The 124°C geothermal fluid from the production wells is transported under pressure to the Energy Centre located in the town. A new thermally insulated steel pipeline is buried along the old pipe for most of the way. The temperature loss en route is expected to be approx. 3°C.

The Energy Centre building houses the Kalina Binary Electric Power Plant. It also houses banks of heat exchangers and control equipment. The net output of the electrical plant is 1,6 MW, which suffices to meet about three-quarters of the town's current electricity demand. From the Energy Centre, water of up to 120°C in temperature and of the appropriate quantity, will be piped to the diverse industrial users in Húsavík and to the town's District Heating system.

A trout and salmon farm is located close to the town requiring hot water to adjust the rearing temperature that promotes optimal growth rate and health conditions for the fish. In addition to these there is a fish drying facility in Húsavík that uses geothermal water. A steady growth in the demand for 80°C hot water for space heating and health use in Húsavík added further urgency for considering a major renewal of the geothermal hot water supply.

Picture 2 depicts in a simplified diagram the new integrated geothermal energy supply system and the highly diversified utilisation planned.



**Picture 2** Húsavík Energy: Multiple-use of geothermal energy – Process diagram

## Project costs and financing

The total capital investment in the Húsavík Geothermal Development is 11 million Euros. The Húsavík Municipality finances about 92% thereof, other project partners 2% and the remainder comes from the European Union. The Fourth Thermie Framework Programme supports the project as an innovative demonstration project. The EU support amounts to 663 thousand Euros.

## Energy prices

Húsavík Energy sells hot and cold water and electricity for domestic and industrial use. The energy tariff currently takes into account the quantities purchased, time and

nature of use. The project implementation is not expected to affect the current tariff rates, which are in the case of electricity based on kWh consumption and for hot and cold water on m<sup>3</sup> consumption. How many kWh the user can extract from the hot water volume he purchases depends on the type of use applied. For instance if hot water is only used for house heating the user extracts the energy made available from the heat loss of 40°C, from 75°C to 35°C. If the same user utilizes the water further, for example for snowmelting, he will extract more energy since he is now lowering the temperature 60°C, i.e. from 75°C to 15°C. The cost of kWh to the user will in turn decrease since the hot water is tariffed by volume, not heat extracted.

Rates are depicted in the following table.

<b>Electricity</b>			
Domestic use	0,09	Euro/kWh	Depends on quantity and type of use
Industrial use	0,05-0,1	"	
<b>Hot water</b>			
Heating	0,01-0,15	"	Depends on type if use and quantity.
Industrial use	0,032	"	
<b>Cold water</b>			
Industrial use	0,35-1,3	Euro/m <sup>3</sup>	Depending on nature of use.