

Svartsengi Resource Park

Réykjanes Peninsula



Introduction

HS Orka owns and runs the geothermal power plants at Reykjanes and Svartsengi. The heat and electricity from the power plants is used both for the district heating system and to distil water from subterranean steam.

Since the establishment of the power plant in 1976, the company has focused on “reading” nature and incorporating sustainability principles in its operations. The first IS activities, now well-known and established, emerged unintentionally.

In 1976, as a result of water outlet from the power plant, the infamous blue lagoon was formed. A few years later, the brine’s healing properties for skin diseases were discovered, which led to further scientific studies on its healing powers and the establishment of the Blue Lagoon spa facilities.

Further development of IS activities could be described as a “snowball effect”. The derivatives of the “snowball effect” led to the development of the Resource Park, which was defined and instituted in 1988–1989.



Case Study Approach

The data on the market access of renewable energy technologies were collected both from the case studies in different renewable energy technology projects and from the secondary sources. To collect specific project data, a template was established with following subsections:

- **Technology description and a project summary**
 - Innovative characteristics
 - Technology readiness level
 - Available product / service supports from the manufacturer
 - Any standard procedures / requirements for integrating the technology into existing electricity networks, buildings and/or mainstream energy appliances / systems
- **Commercialisation of the technology**
 - Is the technology already a commercial solution?
 - Are there re-sellers of the technology, or is the technology available only from the manufacturer?
 - Identified main market area
- **Cooperation partners and networks**
 - Description of the roles of the co-operation partners and networks in the RE technology project.
 - How have they supported the market access of the technology?
- **Assessment of the technical and economic risks**
 - What kind of procedures have been made for assessing the technical and economic risks of the project
 - Who is bearing the risk of the investment (manufacturer, client, shared between them)?
 - Is the public sector involved in risk sharing? (e.g. co-financing, or platform for technology demonstration)
- **Drivers and barriers in the RE technology project**
 - Main drivers in carrying out the RE technology project
 - Barriers, and how they have been overcome (such as price of energy, availability of resource, specific expertise, policy enabling the technology)
- **Funding and support mechanisms**
 - The financial support received by the project: amount/support rate, type and purpose of the support, agency providing the support, significance of the support for the project
 - Types of soft support/advisories received during the project: the use of soft supports (advisory, training, mentoring etc.) during the technology development or implementation, and how successful these have been
- **Monitoring the performance**
 - How are the technical/non-technical aspects of the RE technology case monitored?
 - Information on the design, installation requirements and procedures, operational performance, and costs/financial arrangements
- **Conditions for the technology transfer & adaptation in different partner regions**
 - What are the main requirements/preconditions for transferring the technology and applying it in other partner regions?
 - Description of the main drivers and barriers for the technology transfer (such as. Energy price, resource needs, certain support etc.)
- **Project results**
 - Benefits & lessons learnt
 - Post- project benefits

Technology Description

The companies within the Resource Park use the green electricity and side streams from the Svartsengi power plant (geothermal steam, geothermal brine, geothermal condensate and geothermal CO₂ as resources) in their operations. Spill water waste from one company could be used as input for another. The Resource Park model shows that geothermal fluid has more uses than simply as a source of energy.

The Resource Park companies utilize geothermal resources for a methanol production plant, a molecular farming facility, a geothermal spa and clinic, an algae farm and more. The geothermal resources are used for fish farming, at fish drying facilities and for the production of protein, enzymes, cod liver oil, sea vegetation and algae. Thus, in contrast to a conventional power plant that only earns revenue from the sale of electricity, the Resource Park has multiple revenue streams.



Figure 1. At Svartsengi Geothermal Power Plant.¹

TRL and Technology Scale

The technologies are at a commercial level; thus they are TRL 9.

¹ Western Development Commission 2016.

Cooperation partners and networks

There is a robust network of different actors involved in development of the Svartsengi Resource Park, including:

- *HS Orka and HS Veitur* – Those two energy companies formed the lifeline of the Resource Park. They have been the key actors in the development of the official Resource Park, sharing of knowledge, experience and expertise, and offering vocational training about geothermal heat processing.
- *The Blue Lagoon* has actively participated in the development of the Resource Park. It is an example of a company that operates by the ideology of the Resource Park and has been remarkably successful. They also share their experience in embedding the Resource Park's ideology.
- *ORF Genetics and CRI* have recently started their operation at Svartsengi and participated in the development of the Resource Park through their own operation. They are examples of companies that have decided to start their business in the Resource Park's region.
- *Kalka* is the Garbage Disposal Centre of the Sudurnes area and is owned by the five municipalities. It services the recycling and garbage disposal needs of the companies in the Resource Park, in the spirit of the rooted environmental ideology of the Resource Park. Kalka also operates an incineration plant in Helguvik and produces energy from waste.
- *Keilir* in collaboration with the companies based in the park, provides educational support for the staff. It also offers access to techniques and technology for research. *Keilir* Conducts the research, especially in connection to the adaptation of the technology already in place but improves and modifies it.



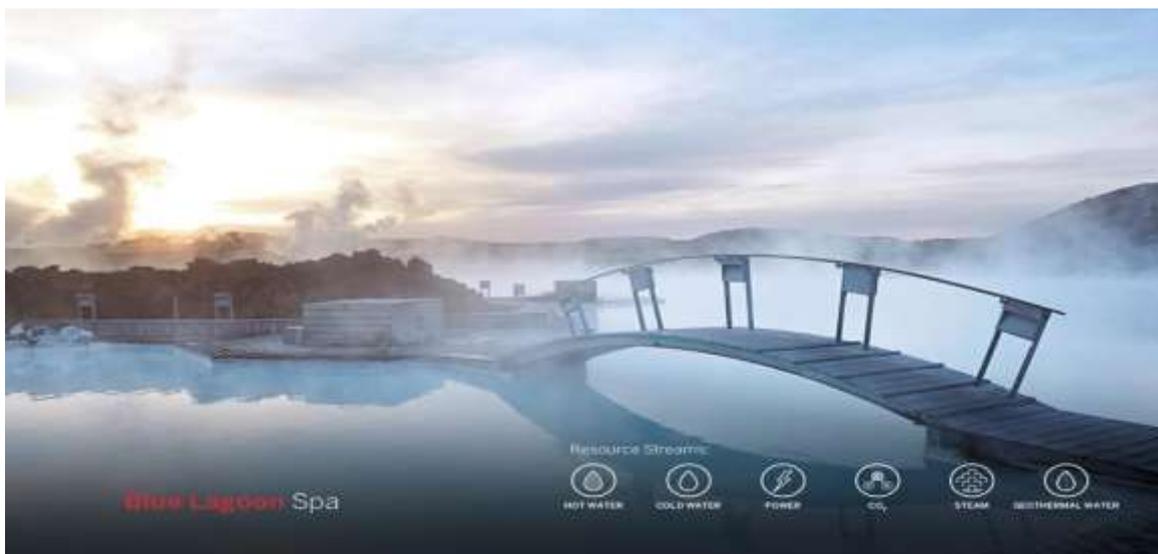
Haustak hf specialices in drying fish Innovation Center Icelnd 2016. products for the Nigerian market²

The public sector has also played essential role in the development of the Resource Park. There has been active participation and collaboration between the five municipalities in the Sudurnes area, including joint industrial zone planning, marketing activities and liaison between public institutions in Iceland. In addition, various other institutions have played essential roles in the Resource Park development:

² Innovation Center Icelnd 2016.

- *Innovation Center Iceland* is a founding partner at the Svartsengi Resource Park. ICI provides support services for research and development projects.
- *SSS* is an association of the municipalities in the Sudurnes area. It provides communications support, discovers new actors in the area, participates in feasibility studies, develops investment packages and supports innovation projects and growth companies.
- *Kadeco* is an impartial development actor established by the Icelandic government in October 2006. Kadeco has created a framework to develop Ásbrú, the former U.S. Army compound at Keflavik International Airport. Kadeco is potential development project partner and has capacity to find and analyse development opportunities and attract new investors in the region.
- *Visit Reykjanes*, established in 2009, promotes the Resource Park.
- *Promote Iceland* provides support services in targeting foreign markets and attainment of foreign investments.

Svartsengi Resource Park is an example of an industrial ecosystem with diversity of actors and efficient use of material and energy flows, in close cooperation. There are *actors*, which can be considered as anchor tenants, (i.e. organisations that coordinate /govern, assist others, collect information, motivate) and there are key actors in terms of material and energy flows.



Blue Lagoon ³

Risk assessments and supports received

Technical risks within the Resource Park require continuous research and development.

Economical risks are of a minor consideration and are divided and shared between different companies. For example - HS Orka has been the lead investor in the Blue Lagoon since the company's foundation in 1992. While, CRI and ORF Genetics obtained their own financing but received some financial support from HS Orka during the initial phase of development.

³ Innovation Center Iceland 2016.

The Resource Park has multiple revenue streams, resulting in diversified financial risk. Furthermore, each company bears their own risk of investment in their private business development. The companies at the Resource Park are dependent on the resources provided by the power plant, which makes the symbiotic relationship unique and strong. Some institutions in close cooperation also share the risk of technology demonstration. The project has received support through the vast network of actors, as described above.

Drivers and barriers

An essential driver for the Svartsengi Resource Park has been the ability to utilise natural assets while incorporating sustainability principles in all its operations. At the core of this philosophy is a holistic approach where there are multiple uses of the available resources of different natures with the goal of - creating a society without waste. The key principles behind the philosophy are to maximize the utilization of every resource and waste is reduced to a minimum. The main aims of the Resource Park are to “equally” pursue ecological balance, economic prosperity and social progress. Bridging different social and technical cultures and interconnecting various disciplines have been central elements in the Resource Park approach.

The barriers during the system development have been minor, mostly related to the variation of interest and lack of commitment of some actors for sharing the information and resources.

Other barriers identified are - the missing formal co-operation venue, and risks related to political decisions and permission.

Conditions for the technology transfer, adaptation and new market deployment

The source of the energy is situated on the Reykjanes Peninsula, and technologies are not directly transferable to different regions; thus they may require adaptation. Technology transfers would require support systems both in technical and economic terms. Geothermal technology (drilling, conversion) is already transferred in other areas with geothermal resources. Low energy prices may be a barrier for developing the cost efficiency of the energy systems.

Project Results

Benefits

Svartsengi's success is an important for creating further symbioses. At the same time, it is important that the parties trust each in order to be able to work as one unit. These factors align with earlier studies on the confidence and trust in industrial symbioses, where regional scale was considered optimal, as there is both trust among closely located actors, as well as needed diversity of resources available. At the resource park, co-location and mutual trust both favour the system development.

Benefits of Svartengi Resource Park have been profound. In 2016 the total number of employees at the Resource Park was over 900 and another 600 in derivate jobs. This is a tremendous achievement when considered the fact that HS Orka only has 60 employees.

Since 2006, the Southern Peninsula has experienced two severe downturns with direct economic consequences and with rate of unemployment around the highest levels since the end of WW2. However, a turnaround seems to be taking place with the emergence of new industries, most of which are directly or indirectly linked to geothermal activity. The Resource Park is a good example of this development. The Park contains a cluster of companies basing their operations on the collective use of geothermal energy from HS Orka.

The cluster forms an economic unit which is stronger, more efficient and more flexible than the simple sum of the relevant companies. The efficiency is reflected in collective experience and knowledge in the field of harnessing geothermal energy, for the benefit of all of the companies. The growth of the companies within the Park has played a leading role in the resurrection of employment on the Southern Peninsula of Iceland and the economic turnaround that is currently taking place there. It is estimated that one out of every four new jobs created on the Southern Peninsula stems from the Resource Park.

Total revenues in Resource park in 2016 was 180.505.415 euros and has been growing. It is no coincidence that the growth period within the Resource Park has gone hand in hand with the economic crisis in 2008 and the economic recovery that followed it. A decrease in the real exchange rate and positive conditions for export businesses have contributed to the rapid growth of many companies within the Resource Park. In 2013 the combined income of all nine companies was ISK 20.5 billion, which amounted to 1% of Icelandic GDP in the same year.

From 2008-2013, the added value of all nine companies within the Park increased by more than 21% in real terms. During the same period the added value of the Icelandic economy as a whole decreased by 1.7% in real terms implying considerable value creation in the Resource Park while the economy was contracting. The volume of growth within the Resource Park is also reflected in the fact that wages paid by the companies in the Park are approximately 30% higher than average wages in Iceland.

Lessons Learnt

In order to inspire the companies' toward further developing of the Resource Park there is a prerequisite to make them enthusiastic about implementing the concept. The persuasion follows from demonstrating the benefits of the collaboration within the Resource Park to the company itself.

The cooperation between the companies within the resource park has created a lot of opportunities and spin offs for the Southern Peninsula. There are many indication that the operations of the Resource Park are changing in nature. The emphasis on research and development is increasing and tourism related services are also growing.

Post Project Benefits

Further development of the Resource Park is underway including the construction of a new fish farm near Svartsengi, plans for a station to transform excess carbon dioxide (“CO2”) from the plant into a commercial product (removing hydrogen sulphur from CO2) and preparation measures to clean and produce silica. Codland also has plans to build a factory in Reykjanes where collagen will be extracted from fish skin.

Contact Information

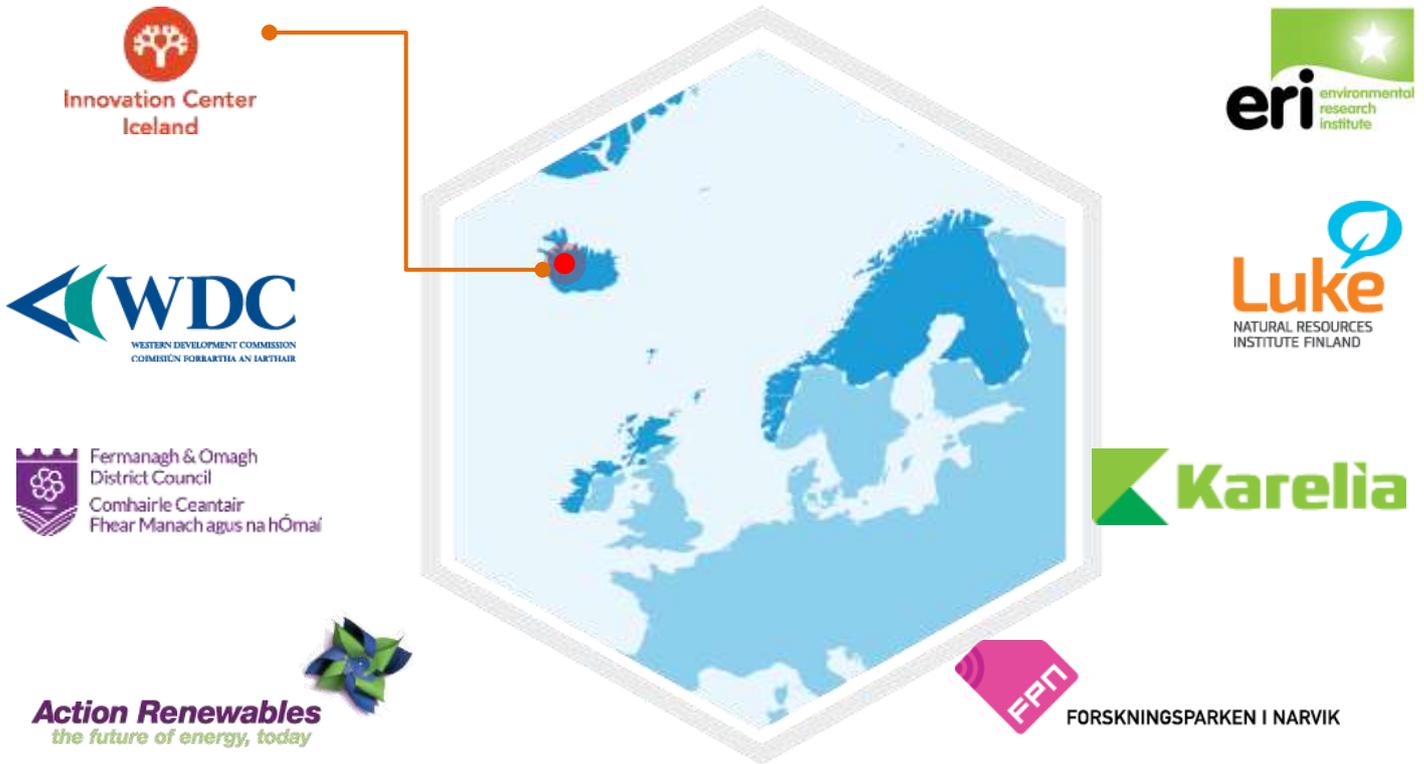
Website: www.resourcepark.is

Companies: www.resourcepark.is/companies/

PARTNERS

GREBE will be operated by eight partner organisations across six regions:

Innovation Center Iceland



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