

The Geothermal Installations at Svartsengi and Reykjanes Centre for Research and Development, Training and Educating Tourism

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ABSTRACT

An important integral part of the geothermal power plants of HS Orka hf are two exhibitions for educating students and visitors about geothermal energy and energy related issues. Every year thousands of visitors and students visit the power plants. The operation of the power plants has led to the development of special equipments and special working procedures. Parallel to the operation comprehensive research and development of construction materials and working procedures has been carried out. The geothermal installations are looked at as a research and development platform for the company as well as its components suppliers, research institutions and schools. The paper describes the educative exhibitions and how they support the Blue Lagoon and the tourist industry in Iceland. The research and development activity is outlined and the most important tools and working procedures developed are counted for.

1. INTRODUCTION

Whereas HS Orka hf has developed the Svartsengi and Reykjanes field from the very beginning, whereas the power plant complex in Svartsengi is the first geothermal CHP (Combined Heat and Power) plant in the world and whereas the reservoirs at Svartsengi and at Reykjanes are today the most difficult ones in Iceland to harness due to high mineral content and high salinity the company has from the very beginning put great emphasis on research and development. The research and development undertaken are also to support the downstream businesses like the Blue Lagoon. By comprehensive research and development, HS Orka hf has been able to increase total energy efficiency of the power plants, increase the availability of the plants, lower operation cost of the plants, to broaden the income base and to bring in downstream companies. From the very beginning the power plants have welcomed visitors in order to educate them about the geo resources Iceland is blessed with. As the number of visitors increased and awareness of sustainability evolved the company decided to establish special conference and education centre. Icelandic students as well as students from abroad have in the overhaul period got summer jobs in the power plants. The power plant complexes are ideal and important interdisciplinary training platforms, a resource which has not been fully harnessed yet.

2. ELDBORG, CONFERENCE, VISITOR CENTRE

Eldborg, the conference and visitor centre at Svartsengi, inaugurated in 1998 replaced a visitor hall in the control and maintenance shop building, the second building of the power plant complex in Svartsengi to be erected. HS Orka hf owns and maintain the facility and the Blue Lagoon hf operates it. The facility has four main functions: exhibition; a man maid rift under the building, housing an exhibition

on geology and geophysics of the area as well as geothermal technology. The basaltic rock walls of the rift exposing natural crevices, cracks and pores are an excellent show case of the rock structure of the reservoir and lights up the mechanism of fluid percolation and heat exchange, conference halls; there are three well equipped conference rooms frequently used for education, kitchen and a canteen; serving meals for employees of the power plant and some of the employees of the Blue Lagoon company as well as serving the conference halls, lounge and dormitory; the dormitory comprises four well equipped single bed bedrooms intended for scientists, experts from abroad and trainees. Main learning: whereas there are 15.000 to 20.000 people per year visiting Eldborg and the power plant complex, sovereigns and parliamentarians are frequent visitors, university students from abroad are frequent visitors, Icelandic students regular visitors and environmentally concerned people frequent visitors it is clear that Eldborg with the adjacent power plants are fulfilling underlying needs. The exhibition, the education given and the happy marriage of the Blue Lagoon activity and the power plant have in a positive and creative way influenced in recent years the environmental debate in Iceland. Based on a lesson learned, Eldborg is one of HS Orka's major tools to convey the message, that one should holistically and carefully investigate possibilities of integral usage of all available objective and subjective resources instead of harnessing the geothermal reservoir for sole power generation. Holistic approach leads to minimum waste of the valuable/limited natural resources and supports more effectively sustainable development of the society. The power plant complex and the visitor centre have turned out to be an important stop in scheduled tours of the tourist agencies.

3. POWER PLANT EARTH

Power Plant Earth, a unique exhibition on energy and a tourist centre is an integral part of the power plant building at Reykjanes. The exhibition deals with the universe from the Big Bang until today, informs about our solar system, endeavor to explain that energy can't be produced only transformed from one form to another, the role of energy in our everyday life, geothermal resources, harnessing geothermal resources, our carbon foot print and much more. Today the exhibition being in operation for one year has attracted thousands of visitors and has been frequently visited by planned tour groups of tourist agencies. This further proofs how interesting the geothermal operations are and how important it is to educate people about renewable energy resources, environmental issues and the climate change we are facing and what real solutions there are to solve the imminent energy problems.

4. RESEARCHES, DEVELOPMENT, TRAINING

From the very beginning diversified R&D has characterized the geothermal operation of HS Orka hf. The R&D work,

not only build up experience and know how in the company it also encourage innovative and entrepreneurial thinking and enriches the company culture. Building a standalone 2X50 MW power plant and 6 integrated power plants (2MW/6MW/8.4MW-ORC/30MW/30MW) all with different type of units, operating and maintaining the plants solely by HS Orka's employees and adapting the units to evolving geothermal reservoirs (steam cap developing) has been very instructive for the employees of HS Orka hf, the engineering consultants and the contractors. Therefore in many aspects the power plants have been and still are an important training base for highly skilled geothermal technicians. Just to give insight into the outcome of some of the R&D work, few of the specialized equipments developed are listed:

- Work over equipment on flowing wells under pressure.
- Inflatable packer for inspecting and maintaining the well head on a bleeding well.
- Easy maintained two phase flow control valve for well heads.
- Mobile separator/silencer for work over and flow testing of high temperature wells.
- An efficient low maintenance separator/direct contact heat exchanger /de-aerator unit integrated in one 11 m high column.
- Plug decomposer for two phase flow collecting pipes.
- Silica (SiO₂) precipitator easy to operate and maintain.
- Silencers/flashers easy to maintain. Today the 6th generation in operation and further developments ahead.
- Maintenance software designed for geothermal operation.
- Weather proof insulation system.

DISCUSSIONS

There are only two renewable energy resources available, the sun and the heat of the earth. For the last two decades or so one has increasingly focused on the sun. Solar farms, windmills and wave and current plants have been developed and erected. Of some reason which is difficult to understand, geothermal energy resources have not for a decade or two been exploited to a desirable degree. It is often argued that geothermal resources are not reliable, do not last for long, too expensive to exploit, they are mainly located in remote areas and they are not renewable. The Icelandic experience reveals that this is not true. One of the reasons why people around the world are skeptical about the relevance of geothermal energy is that they know very little about the nature of the resource, how it can be harnessed and where it is to be found. People very often relate geothermal energy to earthquakes and volcanism which pictures the resource as a vulnerable one. Unfortunately it can be reasoned that the school system has failed even in many of the so called geothermal countries. This is what we have learned from the tens of thousands of visitors HS Orka hf has received. Therefore it is vital to educate people about geothermal energy, its nature, how environmental friendly it is, how it can be utilized and what role it can play in the 21st century. Opening the power plants for visitors and keeping educative exhibitions is HS Orka's way to educate people ignorant about geothermal energy.

CONCLUSIONS

More than three decades long operation of geothermal facilities with integrated exhibitions and visitor centre has without doubt revealed that in order to get people worldwide to look at geothermal energy as a reliable and environmental friendly source of energy one has to put great effort in geothermal education. Today it is obvious that lack of well trained and skilled geothermal people, scientists, technicians, operators, maintenance people etc. is one of the main hurdles for fast and secure development of the geothermal industry. Therefore it is questioned whether a number of selected geothermal installations worldwide could not in an organized way be used as training and educating platform under the auspice of some international geothermal association or the UNU-GTP (United Nations University Geothermal Training Program).