District heating for holiday homes

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Abstract

Reykjavík Energy is constantly pursuing new market opportunities for energy products. One recent project was the development of a district heating service in an area mainly consisting of holiday homes in Grímsnes, 60 km east of Reykjavík. District heating systems for holiday homes change dramatically the utilisation period, enabling the owners to use it all year round despite of the harsh Icelandic climate. Tackling this project required different approach than in densely populated areas, both technically and from a marketing perspective. The following article will describe the concepts of heating holiday homes using district heating, challenges that were met on the way, solutions to problems and a summary of the project.

Keywords: *district heating, holiday homes, new products, sparsely populated areas.*

1 New markets for district heating

In Iceland most of the traditional market for district heating services has been covered. Most of the city's, towns and villages that are close to geothermal energy utilise it for space heating. Reykjavík Energy however has taken the initiative and began looking at different market areas for district heating, namely holiday homes, normally located in the countryside. The demand for district heating in holiday home areas has caught us at Reykjavik Energy by a surprise. District heating is a commodity celebrated by many holiday homeowners.

The purpose of this paper is to describe projects in this market area hoping it may challenge others to start looking for new ways to utilise geothermal energy and work towards increasing the utilisation of geothermal energy in the energy markets.

2 The concept of holiday homes

It is becoming more and more popular in Iceland to have access to holiday homes, either by owning or renting short term. There is a strong desire for many urban residents to retrieve from the rat race into the tranquillity of the countryside to relax and find comfort at a unique location chosen or developed by you. Those who can, spend a lot of their time and effort in their holiday homes, building, maintaining, gardening and/or relaxing.

Holiday home areas are usually built on small section 5 to 10 thousand square meters, normally built in clusters where services such as roading, waterworks and electricity are accessible.

The holiday home gives shelter from the harsh and rather unpredictable Icelandic climate. Typically the main occupancy is during the summer time. But summer time in Iceland is quite different from the typical European summer climate, all sorts of weather can be expected.

As can be seen from the weather data shown in Figure 1 the heating season lasts the whole year for holiday homes, or at least during its occupancy.

2.1 Holiday homes

Holiday homes can be categorised into two basis categories, privately owned and public usage (in some cases limited e.g. to union members).

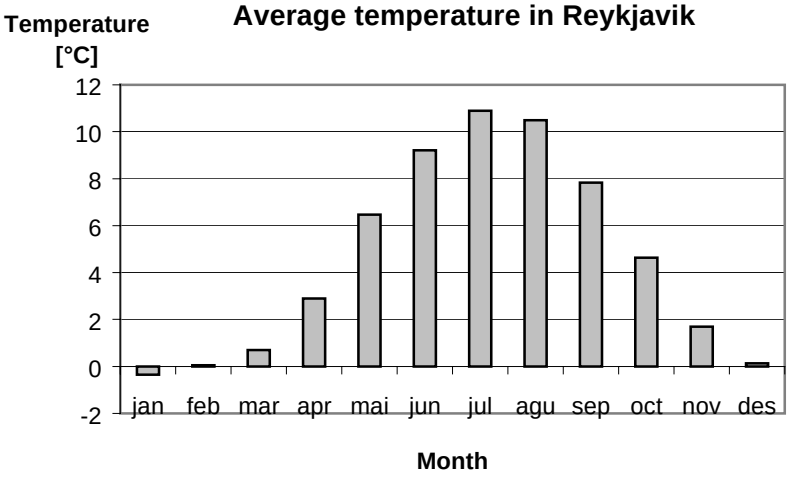

Figure 1: Monthly avarage tempertures in Reykjavík, Iceland.

2.1.1 Public holiday homes

The demand for public holiday homes is normally huge during the summer season. Every week is booked months in advance. For several reasons this time of peak demand is getting shorter, e.g. shorter school holidays and more concentrated vacation periods. Outside the peak periods most of the houses are vacant. This has put some strain on the owners; increased utilisation of the homes is essential for the financial well being.

2.1.2 Private holiday homes

The ownes and the closest family and friends generally use private holiday house. The occupancy is normally more distributed and less frequent than for public holiday homes. Still the demand for comfort is increasing; attraction is needed for the children and grandchildren to come for a visit.

2.1.3 Increased utilisation

Holiday houses are normally far from being some kind of bungalows, the investment is considerable and normally the holiday homes are quality houses. And the comfort shouldn't be less than at home e.g. demand for similar appliances as at home. Most holiday homes have some space heating appliances, electricity, gas or district heating which is getting more and more common.

Considering the investment people and organisations have made in their holiday homes it does not come as a surprise that the majority of the owners wants to increase the utilisation period of the houses. The houses must be inhabitable despite the climate and fully equipped with all modern appliances to provide the comfort and leisure.

The best way to increase the utilisation is to plug the holiday homes into a district heating system. Heat the houses all year round and the possibility to install a spa (Icelandic: "heitur pottur"), which has a huge attraction for all generations. Holiday homes with access to district heating service and equipped with a spa pools

have higher utilisation than those without. Owners of public holiday homes are experiencing a boycott of those homes without spa pools. Similar applies to new holiday home areas, those with access to district heating service are much more popular.

3 Feasibility

The market for district heating in holiday home areas is definitely there. But there are of course few conditions that have to be met before the district heating service can be built. Necessary prerequisites are:

1. Geothermal energy
2. Market
3. Feasibility

3.1 Geothermal energy

Geothermal resources can be found in quite a few places in Iceland. Most of the geothermal energy located close to traditional market e.g. towns and villages have already been harnessed for district heating. Many holiday home areas are located in the vicinity of geothermal resources that can easily be harnessed. Other energy sources for the district heating such as electricity and oil are too expensive.

3.2 Market

Holiday home areas that are potential for district heating project have to be densely populated. The number of holiday homes must also be considerable. Those parameters are however case sensitive, based on the investment in each project.

3.3 Feasibility

Project must be planned ahead and its profitability must be determined. Availability of the geothermal energy, harnessing costs, transportation and distribution must be planned and estimated. The income will then determine the feasibility with acceptable rate of return for the investment. Reykjavík Energy uses methods of cash flow analysis to determine wether projects are feasible or not.

4 Grímsnes district heating service

The first project on district heating for holiday homes, Reykjavík Energy initiated was in Grímsnes. Grímsnes is located 60 km east of Reykjavík and is located between the rivers Sogið and Hvítá.

4.1 Grímsnes holiday home area

Over 1500 holiday homes have been built in Grímsnes. It was estimated feasible to build a district heating in a part of the area, which covers approximately 750 holiday homes. This area is the most populated and concentrated making it the most feasible. It is not fully built yet; the estimated number of sections is well over 1000. Our expectations are that most of the un-built sections will be occupied within ten years.

The number of holiday homes in the neighbourhood is constantly growing. The demand for sections is huge in this area. This gives us good hope for the future, extending the district heating in Grímsnes even further now that we have the basic structure ready.

4.2 The district heating service

The district heating service in Grimsnes was commissioned in December 2002, after approximately one year of construction and additional year for planning and design.

4.2.1 The geothermal resource

The geothermal field is located very close to the market. Three production boreholes have been drilled and the capacity of the most successful bore is 60-70 litres per second of 84°C water. The chemistry of the water allows it to be distributed directly to our consumers and it can be used for washing and bathing.

The full capacity of the field is unknown but the above-mentioned boreholes can supply a total of 1200 holiday homes with sufficient hot water.

4.2.2 The distribution system

The main supply pipe running through the area is of pre-insulated (Poly-Urethane) steel, dimensions DN 200, 150 and 100. For all dimension below DN 100 and throughout distribution network we used pre-insulated PEX (poly-ethylen-crossbound). The distribution network is of course a one-pipe system no return pipes being necessary. The return water is discharged into the lava. The flexibility of the PEX pipes has an advantage over the rigid steel pipes. This has been especially helpful when tracing paths, bypassing trees or other structures inside the sections.

The supply temperature measured at the holiday homes ranges from 55° to 80°C, depending on the distrance from the geothermal field and the number of connected holiday homes in the vicinity. The supply pressure varies from 2 to 6 bar.

4.2.3 The delivery and sales

Reykjavík Energy connects the supply pipe to each customer in a cabinet normally located on the exterior of the holiday home. The customer connects his heating systems into the cabinet as well. By using the cabinet as a connection point Reykjavík Energy can have access to the connection at all times, doesn't matter whether the holiday home is occupied or not. Reykjavík Energy supplies bypass valve, filter and flow restriction into each of the cabinets. The customer supplies all other equipment necessary.

The energy tariffs are simple, the customer subscribes to a certain flow and the flow determines his annual tariff. The flow restriction in the cabinet is adjusted to the subscribed flow.

Minimum subscribed flow is 3 litres per minute, which is in most cases sufficient for heating a normally sized holiday home. The customers can add to the minimum flow according to their needs. Many customers with spa pools have subscribed to additional one or two litres per minute.

Table 1: District heating tariffs in Grímsnes.

Item	Cost [kr]	Cost [$]	Cost [€]
Annual fee:			
-Min. flow 3 litres per minute	47,364	592	526
-Additional 1 litres per minute	9,848	123	109
Connection fees	104,415	1,305	1,160

Selling energy by restricting the flow does seem awkward at first, especially when energy savings are considered. The sale does not encourage the customer to

save energy, but it encourages the utilisation of the peak flow to its fullest. Critics have claimed it would have been better to install meters at each holiday home and sell the energy by cubic meters.

The tariff structure was determined bearing two things in mind:

- The structure may not encourage customers to turn down the heating of the holiday homes during periods of non-occupancy, which normally are during winter periods. This would affect the neighbouring customers, decreasing the flow in the distribution system and increase the risk of frost damages in the system.
- With flow restriction at each holiday home it is easier to determine the simultaneous flow and therewith dimensions of the distribution network. In fact this means smaller diameters and less investment in the system as a whole.

4.2.4 Marketing

The most challenging task in this project is marketing part. It was impossible to predict the participation of holiday homeowners and their rate of connection to the district heating. In towns were district heating had been built most of the potential customers hooked up within a year from its commissioning. It was, in most cases, far cheaper to use geothermal district heating service than electricity or oil. The encouragement to connect holiday homes to district heating is not only about money; it is about increasing the comfort levels and it enables extended utilisation of the holiday homes all year round.

The risks of the projects in regards to the marketing were identified and challenged by a team at Reykjavík Energy. Most of the foreseeable problems were solved before the construction began:

- Press releases, direct mail and meeting with the association of holiday homeowner in the areas were used to inform people about the plan to build a district heating service, get responces and discussion on the project.
- Reykjavík Energy prepared guidelines on how to connect to the district heating system and recommendations on how holiday homeowners should plan their heating systems. Simple things such for instance having a closed circuit heating system through a heat exchanger with anti-frost fluid circuling in the house, minimizing the risk of leaks in case of frost damages.
- Rule number one during construction, never go into a section without consulting the owner on where and how to lay the supply pipe. By doing it this way the damage was minimised to the vegetation and structures. By consolidating the owner he was partly responsible. Before the project started we expected to get a lot of claims regarding this issue, but until today there has been relatively few.
- Tariffs are kept at a minimum to get as much participation as possible. Tariffs are very low when compared to similar district heating services. This required a cost focused project, where each part was tendered out to contractors, to keep the cost at a minimum.
- Extended services were offered to those interested. Reykjavík Energy offered to design and build the heating system for the holiday home owners. The interest caught us by surprise, almost 10% of applicants have used this service.

4.2.5 Achievements

The participation in Grímsnes district heating has been very good, beyond our original estimates. Of 750 holiday homes, 500 have applied for connection to the district heating and 350 have already been connected to the district heating service. This achievement is considerable taking into account the fact the district heating was commissioned in December 2002.

The priority over the next two years will be to increase the number of participants, getting to those 250 holiday homes that have not participated and keeping a close eye on the neigbouring holiday home areas with possible extention of the district heating in mind.

5 Other projects based on the Grimsnes model

5.1 Munaðarnes

Next year Reykjavík Energy will begin construction on a new DH service in a holiday home area approximately 100 km north of Reykjavík. 160 holiday homes are in the area, about 90 of them are publicly owned that is owned by a union. The number of holiday homes is much smaller there than in Grímsnes, the tarfiffs will be somewhat higher as the investment will be distributed onto fewer customers.

5.2 Hlíðaveita

Tthe district heating service Hlíðaveita, which has been in operation since 1980's, was recently aquired by Reykjavik Energy. Hlíðaveita was originally built to service approximately 15 farms located in the vicinity of the geothermal field that is utilised. With increased contruction of holiday homes in the area that have been hooked onto the DH system and the fact that the district heating service was primarily designed to service farms, it does not come as a surprise that the service is in need of restructuring. Reykjavík Energy sees the potential in the area as a holiday home area servicing more than 500 homes within few years. The DH service will be restructered and build according to the model used in Grímsnes.

6 Summary

Based on the experience from Grímsnes, we are convinced there is a future for district heating services in holiday home areas and other sparsely populated areas. We have considerable knowledge about the market and learned much, which will come in handy in future projects of similar kind during the construction phase.