



Mapping the Icelandic Geothermal Energy Sector

A report on the sector and its marketing efforts

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Picture: Krafla Geothermal Power Plant of Landsvirkjun (ThinkGeoEnergy)

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Executive Summary

The worldwide energy sector is embarking on a period of change; the focus is on promoting a more sustainable and efficient energy sector where renewables play a centre role. This was evident at the COP21 Climate Conference in Paris and in recent policy developments in Europe. Geothermal energy will play an important role in this change, both when it comes to energy production and direct use for industry and district heating.

Opportunities in international markets offer unharnessed opportunities for growth for the Icelandic geothermal sector in developing geothermal technology and services that can be sold abroad. The Icelandic geothermal sector has worked on numerous projects internationally, these have however mostly been driven by individual companies and institutions. To ensure that the Icelandic geothermal sector can actively participate in the geothermal development taking place worldwide and to ensure continued and sustainable growth in international projects, cooperation within the industry, with Universities and government is important.

International branding exercise of Iceland's geothermal competence, as has been done by the New Zealand's geothermal sector should be considered. A concerted effort with a strategy and action plan on how and where to focus is advisable. A strategy should target both potential customers and agencies, organizations and financial institutions. Due to the nature of geothermal development and the importance of government funding and funding from international institutions, a close cooperation with the Icelandic governmental bodies is needed. A one-stop shop for international promotion of the sector would be recommended, for which Promote Iceland could play an important role.

For geothermal power development key markets for the near future are expected to be Southeast Asia (Indonesia and the Philippines), Eastern Africa (Kenya and Ethiopia), Latin America (Mexico and Central American countries), the Caribbean and Turkey. As for European markets district heating is considered as a key technology to decarbonise the heat sector and thus provides a fantastic opportunity for geothermal district heating.

Iceland is among the leading nations in the utilisation of geothermal energy, to maintain this lead and ensure its place in international markets; the sector needs to move fast.

The following is a summary of key survey responses and recommendations

- There is a need for a common strategy and action plan for the international promotion of the Icelandic geothermal sector.
- This should include all aspects of the sector from service, development and operation to education both for power production and direct use from heating and cooling to resource parks.
- Improving the cooperation between the relevant ministries and other government bodies in Iceland when it comes to international efforts in geothermal would greatly benefit the Icelandic Geothermal Industry. There needs to be a strong cooperation on government level and the creation of one-stop shop for international relations for the promotion of geothermal in general and the Icelandic sector's offerings in particular.
- The unique cascaded use of geothermal resources for power generation, heating and various other applications is seen as a role model internationally. Therefore the promotion of geothermal resource parks, similar to the one in Reykjanes, both within Iceland and Internationally, such as in Portugal, Turkey, and Africa could extend the business opportunities for the Icelandic geothermal sector.
- A toolbox for the promotion of the sector should be created with focus on international initiatives and policy development such as the Global Geothermal Alliance and the EU policy on Heating and Cooling.

- Funding needs to be made available for international promotion and business development.
- Participation in international research projects is very important, recent developments in participation are a positive step. Support should be provided to ensure Iceland's participation.
- Expand educational offers for e.g. continued education for UNU-GTP alumni with focus on research, but also direct involvement in projects in Iceland. Cooperation on educational efforts with a focus on how the universities and the UNU-GTP can complement each other is important. The alumni network of UNU-fellows should be seen as a business development tool for the Icelandic Geothermal Industry. This would require a stronger participation by the Icelandic geothermal companies, in the form of work placements, internships or similar.
- Increased cooperation on government level with the EU and its institutions, with focus on geothermal district heating and the EEA Financial Mechanism. Here Iceland could work with Europe on one of its biggest energy and climate challenge, by providing know-how, equipment, and funding to EU in developing geothermal district heating.
- After a successful Iceland-EU Roundtable on geothermal energy, this format should be continued and possibly held regularly, even annually. This and similar events could strengthen the visibility and perception for the Icelandic geothermal sector.

Introduction

There is tremendous potential for the utilisation of geothermal energy, both for power generation and direct use, heating purposes as well as for industry. As of today, the global installed power generation capacity is at around 13,300 MWe with an estimated 12,500 MWe in development across 82 countries¹. It is expected that installed power generation capacity will be reaching 21,443 MWe by 2020.² Current Direct use of geothermal energy for district heating, spa's, food production, and other industrial applications using heat is even greater and largely undeveloped.

According to the McKinsey report: Charting a growth path for Iceland, (2012). The international sector in Iceland offers unharnessed opportunities for growth. In the past Iceland has had limited dependence on exports of knowledge. The international sector is relatively small compared with other developed countries, employing close to 15 % of the workforce and contributing to 20 % of exports according to 2012 statistics. There is a high level of growth potential in the international sector by exporting knowledge, and this includes development of geothermal technology and services that can be sold abroad. This is also confirmed in the report; Mapping and Mobilisation of the Iceland Geothermal Cluster. The report recommended developing a strategy and an action plan to take advantage of the opportunities in the global geothermal sector. The strategy and action plan was never developed. Any attempts of the geothermal sector to take advantage of opportunities abroad have been uncoordinated and not very successful.

The Icelandic geothermal sector has seen some challenging times, due to the lack of development within the country and a certain lack in political support. Therefore, international projects have become increasingly important for the Icelandic geothermal sector to derive revenues and keep its activities in the sector alive. This has been done individually but also in few instances in tandem with other Icelandic players. However, there have been limited joint activities to promote the Icelandic geothermal sector as a whole outside of Iceland. A strategy is sought that will be of mutual benefit for both the geothermal sector as well as individual companies.

Internationally, geothermal development has gone through a difficult time. However, as was evident at the COP 21 Climate Conference in Paris and recent developments in Europe and worldwide geothermal is gaining momentum.³

Until now the focus in Europe has been on other renewable energy sources and conventional technologies, for geothermal the main focus has been on Enhanced Geothermal Systems (EGS). This has now changed with EU's strategy for Heating and Cooling, published in February 2016. District heating is considered as a key technology to decarbonise the heat sector and to reduce Europe's dependency on fossil fuels. The reason for this shift in policy is due to that the sector represents over 50% of the total energy use in the EU. Moreover, in 2020 one fifth of the energy consumed in the EU should come from renewable sources.

Within the EU, the potential of geothermal district heating is significant in the EU member states. According to the European Geothermal Energy Council at least 25% of the EU population lives in areas directly suitable for geothermal district heating⁴. There are around 10,000 district heating systems in Europe, representing about 15% of the European heat market⁵.

¹ Matek, B. "2016 Annual U.S. & Global Geothermal Power Production Report – March 2016" by the Geothermal Energy Association, at: <http://bit.ly/22wAvsM>, retrieved on March 21, 2016

² Geothermal Power Generation in the world 2010-2014 update report, Enel Green Power, A. Pisano. Proceedings World Geothermal Congress 2015. P. 1.

³ Launch of the Global Geothermal Alliance, the Climate Investment Fund dedication to geothermal and the launch of EU's Heating & Cooling strategy.

⁴ Developing Geothermal District Heating in Europe, p 6. Available at: http://geodh.eu/wp-content/uploads/2012/07/GeoDH-Report-2014_web.pdf

⁵ Commission Staff Working Document, Review of available information: COM(2016) 51 final, p. 87.

Opportunities within the heating and cooling sector are not limited to Europe, UNEP has recently launched a District Heating in Cities initiative, focusing on the benefits of district heating and cooling in cooperation with real projects in 45 cities.⁶

Outside of Europe there is considerable growth potential in Eastern Africa (the Rift Valley), Caribbean, the Philippines, the Asia-Pacific region and Latin America. At the same time, there is an increasing nationalized competition with U.S. players and players from New Zealand that bundle the forces of their national industries to look for projects outside of their home markets, this often paired with funding by their respective governments and/ or development banks. Despite its strong capabilities, the Icelandic geothermal sector now faces a much stronger competitive situation, making the origination of projects and revenues from geothermal projects more difficult.

In the past, Iceland was automatically connected with geothermal “know-how” and “expertise”. Increasingly other nations and industry groups position themselves with the same credentials often in tandem with their governments, through government-led business delegation trips to potential markets for their geothermal companies. They have founded groups that purely focus on international business development and coordinate their international marketing efforts, among others through representation at international trade fairs and conferences. These groups are working beside national industry associations and national cluster efforts but support each other when it comes to international markets. It is crucial for Icelandic stakeholders to strengthen cooperation efforts in marketing the Icelandic geothermal expertise internationally and to regain and maintain what is increasingly being taken over by other countries national initiatives.

1. Funding avenues

One of the largest challenges of the Icelandic export industry, including the export of geothermal know-how, is that there are no strong financial players that can accompany Icelandic companies and actually provide funding for projects of Icelandic companies internationally. This puts Icelandic players at a large disadvantage to U.S., Japanese, German and New Zealand players that can tap into funding through their national development banks or export funding tools to attract clients in potential markets for their products and services.

Icelandic companies therefore depend on tapping into funding available outside of the country, this can be funding from international development banks and in the European context from funding available through EU and EEA grants and programs. In order to utilize opportunities for funding in the European Union/ EEA and to utilise efforts by ICEIDA, the Nordic development bank, World Bank and Green Climate Fund, Icelandic actors need to move and need to create a concerted effort in marketing their capabilities vis-à-vis these institutions, national actors and developers.

2. Promotion

There have been joint promotional efforts by the Icelandic geothermal sector, often with a focus on individual countries or regions. In a more unified and targeted approach, the Icelandic Geothermal Sector could promote its experience and know-how as a whole, helping to sell the brand “Iceland Geothermal”, similar to efforts done by other nations. A strategy should be considered that targets not only potential customers, but also agencies, organizations and financial institutions. The latter could provide the funding for both individual projects and general work done by Icelandic companies on behalf of governments, regions and institutions.

⁶ UNEP District Energy in Cities Initiative, at: <http://www.districtenergyinitiative.org/the-initiative.html> retrieved March 22, 2016

The Global Geothermal Energy Market

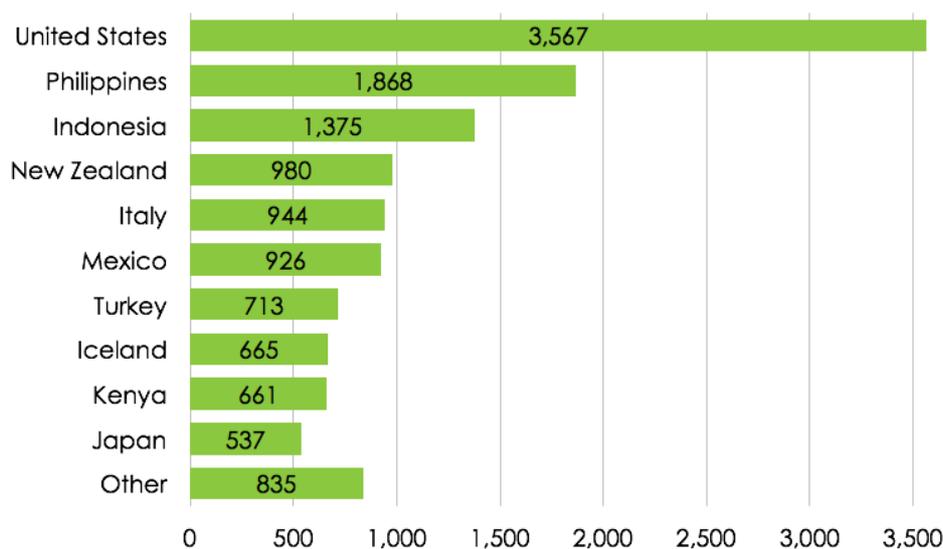
Geothermal energy is being utilised today for power generation, for heating and related purposes in so-called direct-use applications, and indirectly through geothermal heat-exchange systems (ground-source heat pumps).

While geothermal energy utilisation for power generation and direct-use heat applications derive their energy directly from a hot-water reservoirs, both natural and artificially created ones from deep geothermal resources and ground-source heat pumps utilise constant temperatures of the ground at shallow depths. For the purpose of this document, only the utilisation for power generation and direct-use applications will be considered, such as heat for district heating needs, and other industrial applications.

The overall worldwide prospects for geothermal energy utilization, be it for electricity generation or direct use, are excellent. While depending heavily on political and financial support, geothermal energy represents the only real base-load capacity alternative to fossil fuels, such as coal or oil. The largest potential in the short term are in the direct use of geothermal energy, particularly for heating and other applications that use heat directly. With technological developments, in binary systems and engineered geothermal systems, geothermal could be an elementary part of global power generation in the future.

In the global context, the United States has lead geothermal development for power generation and continues to be the country with the largest amount of geothermal power generation capacity. Other countries that have traditionally been “geothermal countries” include the Philippines, Indonesia, Mexico, New Zealand, Italy, Japan and Iceland.

TOP 10 GEOTHERMAL COUNTRIES INSTALLED CAPACITY (AUG 2016)

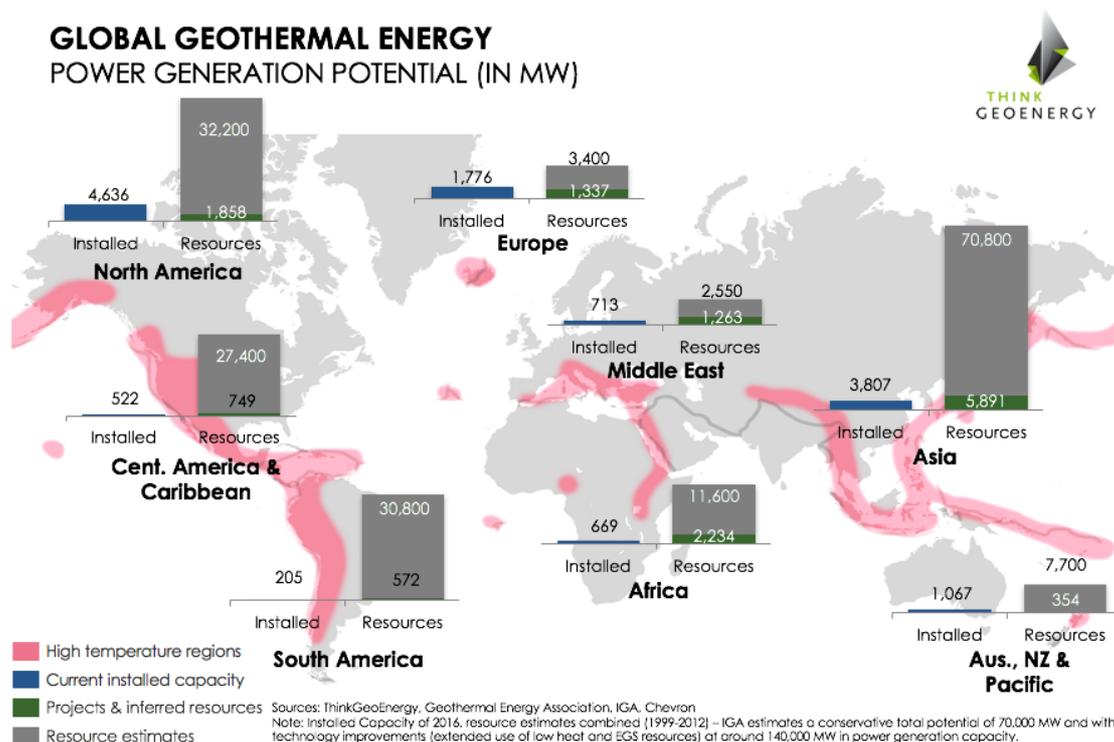


Source: TGE Research (2016), GEA (2016), IGA (2015), Enerji Atlası (2016)

However, there is a shift happening. While countries such as New Zealand and Iceland have seen large development activities in the first decade of this century, development has now stalled in both countries, as well as in the United States. The absolute newcomer in the top 10 of the geothermal power generating countries is Turkey, which expanded its geothermal power generation capacity by more than 600 MW in the past 7 years.

Key markets for the near future are expected to be Southeast Asia (predominantly Indonesia and the Philippines), Eastern Africa (predominantly Kenya and Ethiopia), Latin America (here mostly Mexico and Central American countries), but also – while on a smaller scale the Caribbean and Turkey. European activities in the power generation sector will see some growth supported by favourable subsidies schemes, e.g. in France, Italy and Germany.

There is though a large untapped potential for geothermal energy development globally.



The largest untapped potential for geothermal lies though in the utilisation for heating purposes and related direct-use industrial applications that require heat. With increasing efforts for energy security and independence from energy imports, and the fight against climate change heating has become a key concern in the energy debate in the European Union (EU). In February 2016 the EU published its first ever strategy on heating and cooling. The strategy can be seen as an integral part of EU’s Energy Union strategy, heating and cooling represents half of EU’s energy consumption and 75% of the energy used for heating and cooling buildings is supplied by fossil fuels.⁷

This is also the trend globally, even though in many places around the world there is demand for heating only around 3 to 6 months of the year. Current heating is mostly fueled by fossil fuels with connected emissions and air quality problems. There is increased focus on renewable district heating and energy efficiency. District heating has become one of the keys to solving the growing climate and environmental challenges the world is facing.

In the overall energy debate, the focus is on cities. Cities hold a central role in the transition of the energy market towards clean and sustainable energy. Today, cities represent more than 70% of the global energy demand and how they respond, e.g. in the form of adapted energy policies are crucial to meeting future renewable energy and climate related targets. In this context, utility companies and related services are uniquely placed to develop modern district energy systems. This was acknowledged at the COP21 climate conference in Paris, France in December 2015 with the launch

⁷ EU Commission, Communication on “An EU Strategy on Heating and Cooling” (February 2016) retrieved from https://ec.europa.eu/energy/sites/ener/files/documents/1_EN_ACT_part1_v14.pdf on March 22, 2016.

of the European Union supported Covenant of Mayors initiative on a global scale. The United Nations Environmental Program, (UNEP) also acknowledges this with its initiative District Energy in Cities.

Geothermal Energy Sector in Iceland

The Iceland Geothermal Cluster has published a graphic overview of the “Geothermal Value Chain” that defines the key stakeholders of the geothermal energy industry based on the different roles they play.

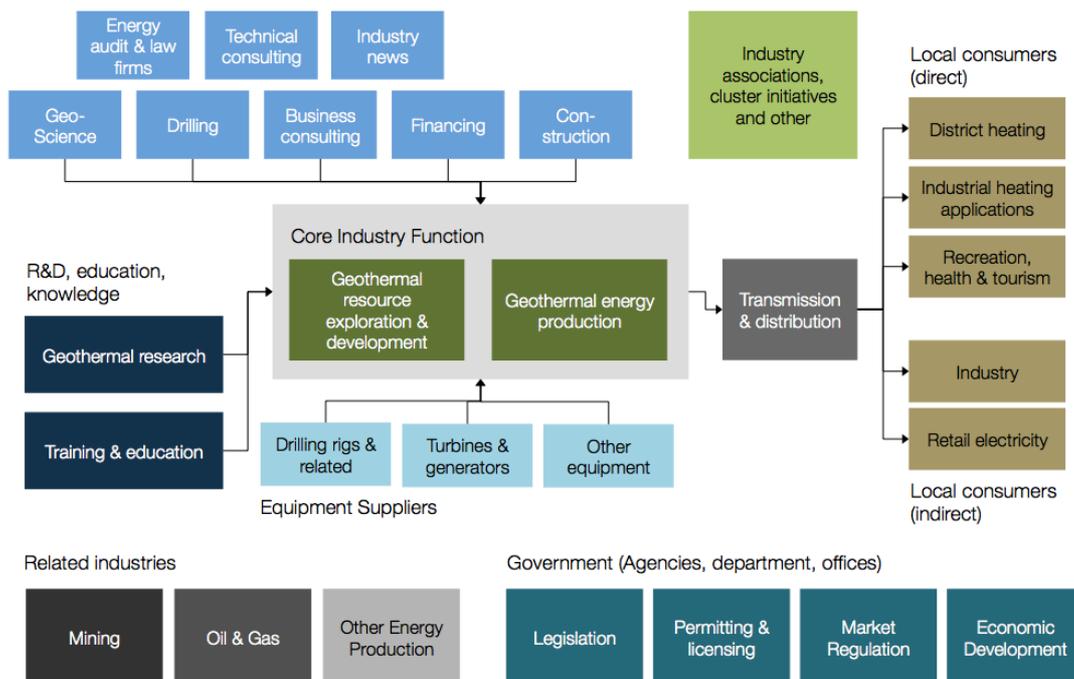


Chart: Iceland Geothermal Cluster (2010)⁸

It highlights the different roles for industry actors, such as service providers, equipment suppliers and the core functions of development and operation, including research and education, government functions, related industries, and the actual direct and indirect customers for the energy generated.

At the end of the document we provide short summaries of the companies, organizations and entities that represent the Icelandic geothermal sector. They include private companies, non-profit entities, government offices, state and privately owned utilities and operators and international firms with an Icelandic presence or operations.

There are two organisations, which represent most of the sector and need to be named specifically and this is Iceland Geothermal, the industry cluster with majority of the companies of the sector as members, and GEORG, the Geothermal Research Group, a research focused collaboration by companies, schools and universities, both Icelandic and international.

⁸ Iceland Geothermal, The Iceland Geothermal Cluster: Mapping and Mobilisation , “The Geothermal Value Chain” (2011)

Positioning of the Icelandic Geothermal Sector

In this section, it is discussed how the Icelandic geothermal sector has been represented so far and what role government and government agencies, as well as the private sector have played. Iceland has a proud heritage of geothermal utilisation and its know-how and expertise is recognized around the world. Looking at how the sector, its experience, know-how and offerings is being represented, in this chapter the analyses of the public and private sector are done separately.

Energy Companies

While the energy companies are either state-owned, like in the case of Landsvirkjun (National Power Company) and Rarik, municipality-owned (Orkuveita Reykjavíkur), privately owned (HS Orka, HS Veita), they have played a crucial role in the international positioning of the Icelandic geothermal sector.

Through the development of projects, they essentially helped to create the geothermal industry of Iceland as it exists today. They played a crucial role also in the promotion of the geothermal sector, be it through participation in international research projects, the presentation of their work at conferences, but also in some international projects. Through the company Enex, a company set up by the various companies of the sector to participate in international development, the various companies not only participated in projects in a consulting function, but also developed own projects.

The energy companies have been going to great lengths to promote geothermal energy often in partnership with government activities, but also private sector initiatives and business development efforts internationally. This was paired with ambitious development and development plans in Iceland.

Those activities slowed down significantly with the financial crisis of 2008 and a clear focus on the Icelandic market and attracting energy buyers to Iceland. While still supporting some promotion, e.g. in the support of the Iceland Geothermal Cluster and welcoming delegations showcasing geothermal facilities, e.g. at the geothermal plants of Hellisheidi and Svartsengi, the companies don't see themselves in a role to promote the geothermal sector as such for business development internationally. At the same time, they are though promoting themselves to international markets as suppliers of electricity to international buyers with the goal of attracting them to invest and buy electricity in Iceland.

The energy companies source most of their equipment from international vendors, with limited use of components manufactured in Iceland. While using Icelandic engineers and contractors, the energy companies have cooperated only on a limited basis on technology development with potential suppliers and manufacturers in Iceland.

The private sector

Service Companies & Developers

The service firms of the geothermal sector, such as engineering firms and consultancies were facing huge challenges following the financial crisis of 2008. With the sudden stop of development in Iceland, the companies had focus on finding work internationally. This also increased the competition among the companies that often found themselves bidding for the same projects abroad.

Some of the companies partnered up on specific projects or markets, but there have been limited concrete cooperation efforts to possibly offer more complete packages of services that would cover a larger part of the development of geothermal projects. Overall there are limited concerted efforts being made to go after specific regions or markets to offer the capabilities of the Icelandic geothermal sector as a package. Furthermore, presenting themselves internationally, service companies such as the engineering firms, often present the same reference projects in Iceland. The role of ÍSOR in this

context, as state-owned service firm, is special, but the company is often a crucial partner for the private service firms to originate business abroad.

As indicated above, development while continuing in Iceland has slowed down and there are today only a limited number of Icelandic companies developing projects abroad. These companies are though predominantly in foreign ownership.

The Iceland Geothermal Cluster Initiative, started in 2010, was set up as a tool to strengthen the cooperation of its members in Iceland. In 2013, an organization was set up around the cluster. Today, the cluster represents most of the companies of the geothermal sector in Iceland. The cluster plays a supporting role to initiatives such as Startup Energy Reykjavík and the Iceland Geothermal Conference that is organised by the consulting firm Gekon.

The Iceland Geothermal Conference is a promotion tool for the industry and its representatives. Apart from the opportunity to present themselves through exhibiting and a presentation, the companies further engage in a variety of side events with international organisations and partners. The conference therefore plays an important role in bringing the Icelandic industry and the global geothermal community together, showing showing Iceland's leadership in geothermal while opening up for a conversation with the international industry. In many ways it is a cooperation between the public and private sector.

Suppliers

There is little technical development taking place in Iceland with the majority of plant components being sourced internationally. There are though R&D efforts by both the energy firms, but also private sector companies. With the startup accelerator program, Startup Energy Reykjavik, an incentive is given for some innovation and development of actual products for the energy market, and this also applies to possible components and products being used in the geothermal sector.

There are though a variety of companies, both larger, but also small firms focusing on specific components. While all on a very small scale, there are large opportunities for these firms to apply their products and know-how on opportunities internationally. But so far the efforts of these companies are mostly underestimated and unknown with little visibility.

Government and government agencies

Internationally, Iceland is represented through Government Ministries and its Ministers, the Icelandic President and Orkustofnun, the National Energy Authority.

Ministry of Industries & Innovation

The ministry covers all sectors of ordinary business and economy activity, represented by two ministers, one for Fisheries and Agriculture and one for Industry & Commerce. The Ministry was formed in 2012, merging previously separate ministries of Industry, Energy and Tourism, Ministry of Fisheries and Aquaculture and the Ministry of Economic Affairs.

Matters related to energy are represented by the Minister for Industry & Commerce and the Department of Industry and Energy within the Ministry.

Agencies related to energy matters that are affiliated with the Ministry are the Innovation Center Iceland (Nýsköpunarmiðstöð Íslands) and the National Energy Authority (Orkustofnun).

In its activities, the current Minister and Ministers of previous governments have been supporting the sector by presenting the Icelandic geothermal success story in presentations, official visits abroad and in meetings in Iceland. This includes business delegations, representation at international events, such as the World Geothermal Congress, and related events.

Throughout the years, the Ministry and Ministers have been supportive of the sector and individual companies, e.g. through connecting official visits with business delegations to countries of interest for the geothermal sector. This includes bilateral cooperation agreements, such as MOUs. Among the countries with which MOUs have been signed are: Djibouti, Dominica, Ecuador, India, Indonesia, Mexico, Nicaragua, Poland, Rwanda, Slovenia and Serbia.

The Iceland Geothermal Cluster is seen as partner for the Ministry on issues related to the representation of the Icelandic geothermal sector and is being consulted on matters related to promoting the activities of the geothermal sector internationally and in Iceland.

The Ministry consults with the National Energy Authority (NEA) on energy related issues and most of its activities related to geothermal energy are handled by it. NEA also hosts and manages the United Nations University Geothermal Training Program (UNU-GTP), as a separate unit, an important element in the promotion of Iceland's geothermal capabilities. Management and hosting is based on a contract with Iceland's Ministry for Foreign Affairs and the United Nations University in Tokyo, Japan. It is funded by Icelandic Ministry for Foreign Affairs as a part of Iceland's development aid.

Many events have been organized by the Ministry in cooperation with the National Energy Authority to promote Iceland and its geothermal activities and companies, e.g. through international cooperation and projects.

Ministry for Foreign Affairs

The Ministry for Foreign Affairs of Iceland has traditionally played an important role in promoting Iceland, as well as the geothermal sector.

On international visits, all ministers so far have been praising the role geothermal energy has played in Iceland, particularly in the development of its economy. This includes among others speeches and presentations at the United Nations and other international opportunities, such as state visits, representation at international events and more.

Given the size of the country, Iceland maintains a limited number of embassies and consular offices internationally. Representation in business affairs is often limited, but supported wherever possible, by connecting Icelandic companies with Ministries, agencies and private sector players in the respective countries. Before the establishment of Promote Iceland in 2010, the Ministry had the responsibility to organise business delegations, and the Trade Council of Iceland played a crucial role in this context. Today Promote Iceland is responsible for that important task.

The Icelandic International Development Agency (ICEIDA) has also played an important part in promoting the geothermal sector. ICEIDA has supported a large number of geothermal projects throughout its existence. These include, among others, a joint Geothermal Exploration Project with the Nordic Development Fund (NDF) and the World Bank (WB), which assists countries in East Africa to enhance geothermal knowledge and capacity. Out of ICEIDA's total budget in 2014, about 13% went to geothermal projects⁹. As of 1 January 2016, all projects of ICEIDA have been transferred to the Ministry of Foreign Affairs.

Through its Department of Natural Resources and Environmental Affairs, the Ministry has played an instrumental part in the creation of the Global Geothermal Alliance (GGA) in 2015, an initiative by the International Renewable Energy Agency (IRENA) that "acts as a platform [of currently 38 nations] for enhanced dialogue and knowledge-sharing within the constituency as well as for coordinated action to increase the share of installed geothermal electricity and heat generation worldwide, with a focus on efforts towards realizing geothermal energy potential to achieve a five-fold growth in the global installed capacity for geothermal power generation and two-fold growth for geothermal heating by

⁹ ICEIDA, Financial Statement 2014, at: <http://www.iceida.is/english/about-iceida/Statistics/>, retrieved March 22, 2016.

2030.”¹⁰ Another important role is the support and engagement on various geothermal programs by the World Bank, among them the Utility Scale Renewable Energy Program and the Global Geothermal Development Plan launched in Iceland in 2013.¹¹ The GGA can act as an umbrella for funding from international financial institutions that wish to go to a new market area.

In relation to Europe and the foreseen expansion of renewable district heating, the ministry plays a very important role in ensuring access to finance and education through the EEA Financial Mechanism. The negotiations for the next period are expected to start during 2Q 2016. During the funding period Iceland will contribute 7 billion ISK. The EEA Financial Mechanism could therefore provide an important access for the Icelandic geothermal sectors to markets in Central and Eastern Europe.

These programs play an important part in highlighting and promoting the Icelandic geothermal sector, while also creating indirectly business opportunities internationally.

Ministry of Finance & Economic Affairs

The Ministry of Finance can also play an important role in the promotion of Iceland’s geothermal sector. Through the membership in development banks, countries and their private sector companies get access to funding for renewable energy development in countries served by the development banks. The ministry also manages relations with the Nordic Investment Bank (NIB), the International Monetary fund (IMF), European Investment Bank (EIB), the European Bank for Reconstruction and Development (EBRD) and the Asian Infrastructure and Investment Bank (AIIB).

There are multilateral development banks and regional development banks. Over the past few years these financial institutions have been the predominant donors and funders for renewable energy development internationally, including geothermal development. Most of the development banks support projects either in the countries of their shareholder/ member or with a specific focus on companies from those countries. This – as seen by the companies in the geothermal sector in Iceland – puts Icelandic companies in a disadvantage to other companies from countries that have access to that kind of funding.

This applies particularly in the growth markets for the global geothermal energy sector, e.g. in Asia, East Africa, Latin America and the Caribbean. The banks of interest there are the Asian Development Bank (ADB), the African Development Bank (AfDB), Interamerican Development Bank (IDB), Central American Bank for Economic Integration (CABEI), and the Development Bank of Latin America (CAF).

Banks that Iceland is a member of are: the World Bank, European Bank for Reconstruction and Development (EBRD, 1991), Nordic Investment Bank (NIB 1976), the Green Climate Fund (GCF 2010), and the Asian Infrastructure Investment Bank (AIIB, 2015). Furthermore under the EEA/ EFTA umbrella, Iceland has had access to loans from the European Investment Bank since 1994. (EIB, 1994).

Office of the Icelandic President – the President of Iceland

As the head of state, the President of Iceland, has a predominantly representative role. The current President, whose term is running out in August 2016, has been a strong advocate for geothermal energy. He has given numerous speeches and presentations on the subject, promoting the Icelandic geothermal heritage and know-how. He has been a tremendous asset to Iceland’s geothermal sector. Throughout his terms in office he has visited countless countries and often made geothermal

- IRENA, Joint Communiqué on the Global Geothermal Alliance, at: http://www.irena.org/News/Description.aspx?NType=A&mnu=cat&PriMenuID=16&CatID=84&News_ID=438 retrieved March 22, 2016

- World Bank, New Funding Boost International Support for Geothermal Energy, at: <http://www.worldbank.org/en/news/feature/2013/12/18/new-funding-to-boost-international-support-for-geothermal-energy>, retrieved March 22, 2016.

energy and its utilisation one of the key topics, e.g. in the United States, China, at the United Nations, Vietnam and many others.

With having been in office for about 20 years, he has built a strong network, through which he has been supporting various Icelandic businesses in their quest for international business opportunities, which includes geothermal.

Promote Iceland (Íslandsstofa)

Promote Iceland (Íslandsstofa) is a public-private partnership under the Ministry for Foreign Affairs. The agency promotes and assists individual companies to gain a foothold in foreign markets.

Promote Iceland has played a crucial role in promoting Iceland as a tourist destination and to promote Icelandic products and culture abroad. One of its key role is to promote various sectors to key players in selected markets in cooperation with the companies.

Promote Iceland has worked with the geothermal sector through the organisation of business delegations and seminars in the Geothermal and engineering sector to Croatia, Poland, Nicaragua, Vietnam as well as organizing the Icelandic exhibition stands at different World Geothermal Congresses, in Bali/ Indonesia in 2010 and Melbourne/ Australia in 2015.

Invest in Iceland, which is part of the Promote Iceland, is focused on attracting investment to Iceland in various sectors including the energy sector. The agency acts as an umbrella organisation for series of promotional events and activities in energy related opportunities with participation of the power companies. The agency thus actively promotes the utilization of geothermal energy in order to attract foreign investors/companies to locate in Iceland.

Here geothermal energy is displayed as the most unique and cost competitive value proposition for number of industrial processes in need of electricity, hot water, CO₂, sea brine and steam. Data centers, fish farming, green chemicals and production of micro algae are examples of processes being established in Iceland based on the joint marketing effort and the competitive edge of the geothermal energy.”

National Energy Authority (Orkustofnun)

As Agency under the Ministry of Industries and Innovation, “it advises the government on energy issues and related topics, licenses and monitors the development of energy and mineral resources, regulates the operation of the electrical transmission and distribution system and promotes energy research.”

In the promotion of Iceland’s geothermal sector, it plays an important role. It provides extensive information on past and current geothermal development and the energy sector in general, hosts the UNU-GTP and represents Iceland in various international organizations and collaborations. Among them are geothermal associations, but also international research efforts such as the International Partnership for Geothermal Technology (IPGT), the International Energy Agency Geothermal Implementing Agreement (IEA-GIA), and runs the EU funded Geothermal ERA-net. The NEA is a donor programme partner for renewable energy programmes under the EEA Grants program.

Through these activities NEA represents the Icelandic geothermal know-how internationally and helps promote geothermal energy research in Iceland and internationally.

NEA works closely with Iceland’s energy companies and regularly organizes events in Iceland and participates in international events. NEA also serves as a consulting body to Icelandic companies in foreign markets. Given its role, there is only limited collaboration with the private sector, but a general good will towards utilising opportunities on promoting Iceland and geothermal energy in general.

Iceland GeoSurvey/ ÍSOR

Iceland GeoSurvey, formerly part of the National Energy Authority, is a government-owned non-profit company and has played an important role in the exploration and development of geothermal in Iceland. It has not only provided consultancy work, but has also been much focused on R&D work. The company has also been working closely with international initiatives by the Icelandic government, e.g. through Orkustofnun or the Ministry for Foreign Affairs.

Internationally the company has supported governments, private sector companies, but also Icelandic companies that have been involved in developing projects internationally. With its specific activities, experience, know-how, track record and size, it represents only one of few players in the sector providing these complete services related to sub-surface, monitoring, steam quality and management as well as drilling related services.

Often, Icelandic companies are seeking to partner with ÍSOR in the bid for projects internationally.

International Situation

Today, there are a limited number of geothermal markets which are showing exponential growth. As mentioned earlier in the report and in line with the current international project pipeline, the following regions and countries can be described as key markets for geothermal activities presenting business opportunities. The key markets are: Southeast Asia (particularly Indonesia, the Philippines), East Africa (Kenya, Ethiopia and other), the Caribbean (smaller projects but with large impact for the respective nations), Latin America (various countries, including Nicaragua, El Salvador, Costa Rica and others), Europe (here mostly Eastern European countries and with focus on district heating), and Turkey. There are unexplored opportunities in Iran, which recently re-opened after international trade sanctions have been lifted.

Other countries that have a history of geothermal development and a strong geothermal sector have been experiencing a similar stand still in development in their home countries. Therefore, competition in the international markets is becoming difficult. The geothermal industry in New Zealand has focused its promotional activities in Indonesia, the Pacific, South America and the Caribbean. The geothermal companies in the U.S. have been active globally. While there are other nations actively competing for business in geothermal development in the sector's growth markets, New Zealand and the United States are exemplary on the competition faced by the Icelandic geothermal sector. The sector in both countries is backed by their governments both in-kind and with direct financial contributions and through diplomatic channels. As a result, the companies from these countries often are at least one step ahead when it comes to making the sale.

The geothermal market is though not limited to the power sector and in particular the opportunities presented by the heating sector are vastly underestimated. A market that is particularly interesting in this context is in Europe. With heating representing about 50% of the overall energy market and a current dependency on fossil fuel imports to fuel demand, there is a strong emphasis on energy security looking at national and clean energy resources that could fuel demand. Geothermal energy and its heating capacity is therefore of particular interest. With the unique experience in developing, building and operating geothermal district heating systems and successful financial schemes, Iceland is well positioned to offer its geothermal sector's capabilities and offerings.

The geothermal associations, both national and international have - in this context – only a limited role and are mostly focused on education and research and not on business development for its members.

The availability of funding plays an increasingly important role not only for the development of projects, but also for companies wanting to provide either services or products. For suppliers, the availability of vendor financing is often a requirement to be able to sell products at all, this is often

supported by export credits and similar schemes, but also through development banks and development aid programs that often tie in national companies.

With limited financial capabilities and availability of funding, Icelandic firms are thereby at a disadvantage when compared to their international peers. To enable the companies to follow growth markets, start-up funding is needed. Follow the example of Innovation Norway that provides support to companies for establishment in international markets.

Most of the start-up capital for geothermal development comes from international finance institutions. Representing the Icelandic geothermal sector as a whole will support its competence vis-à-vis these institutions. Since Icelandic resources for participating in these institutions are limited it is very important to consult the industry on where to participate.

In the past there have been delegations from international finance institutions in Iceland, such as the EBRD. The representation of the Icelandic industry vis-à-vis these delegations needs to be organized in more inclusive manner.

Industry Survey

Introduction on survey and question

The companies and entities chosen for the survey include companies that work solely in the geothermal sector, or are serving the sector both directly and indirectly. Companies include members of the Iceland Geothermal Cluster, but also educational and government institutions, and other entities that are not part of the cluster.

For the purpose of this study, we identified and engaged with 56 companies/ organizations/ entities. Companies were interviewed either in person, by phone or provided information electronically for the purpose of this document.

Despite all efforts, some entities have not provided their answers, but were included through information that has been publicly available.

The survey was structured into individual parts that looked at companies and their capabilities, export & sales strategies, the competitiveness of the Icelandic geothermal sector, collaboration and related efforts.

In the following sections we are providing a summary of the answers by the companies for the purpose of this survey.

Companies & Capabilities

In the survey and interviews, companies provided background on their companies, core capabilities, operations, markets, projects and more. The following tables provide an overview on the companies. For a more detailed overview of the companies/ entities and their activities, see the Companies/ entities description at the end of this document. Data is provided based on willingness of companies to share, or the public availability of data.

Activities & main lines of business

To define the different activities in the geothermal sector, one can look at governmental activities, business services, technical supply, development and operations. For the purpose of this document we established 16 categories with companies often working across different categories.

The categories include:

- Education (schools and other educational programs),
- Geoscience (sub-surface geo-scientific work and related activities),
- Engineering (this includes among others design of plants and related activities),
- Environmental (these are activities related to environmental impact analysis and related activities),
- Drilling (the actual drilling activity, but also drilling services),
- R&D (research and development activities, which can go beyond technical development),
- Equipment/ maintenance (equipment suppliers and companies providing services in the maintenance of power plants),
- Business consulting (consulting activities that are not of technical nature and can include strategic and business development work),
- Finance/ insurance (activities related to financing of project grant, brokerage, fund-raising, but also insurance activities),
- Legal/ policy (activities related to legal advise, on contractual issues, permitting, policy consulting and related),
- Construction (activities related to the construction of plants, including civil work),
- Transmission & related (among others design, construction and operation of transmission infrastructure),
- Development (direct project development activities of both power and heating projects), operation (companies that are operating plants),
- Government & related (government offices and entities),
- Other (activities that don't fit in any of the aforementioned categories).

| Company | Education | Geoscience | Engineering | Environmental | Drilling | R&D | Equipment/ maint. | Business Consult. | Finance/ Insurance | Legal/ policy | Construction | Transmission & rel. | Development | Operation | Government & rel. | Other |
|---------------------------------------|-----------|------------|-------------|---------------|----------|-----|-------------------|-------------------|--------------------|---------------|--------------|---------------------|-------------|-----------|-------------------|-------|
| Áhættulausnir | | | | | | | | | ■ | | | | | | | |
| Arctic Green Energy Corp. | | | | | | | | | | | | | ■ | | | |
| Arion Banki | | | | | | | | | ■ | | | | | | | |
| BBA Legal | | | | | | | | | | ■ | | | | | | |
| Centra | | | | | | | | | ■ | | | | | | | |
| Deilir | | | | | | ■ | ■ | | | | | | | | | |
| DMM Lausnir | | | | | | | | | | | | | | | | |
| Efla | | | ■ | ■ | | | | | | | | | | | | |
| Foreign Ministry | | | | | | | | | | | | | | | ■ | |
| Framtak (Stálsmiðjan) | | | | | | | ■ | | | | | | | | ■ | |
| GEORG/ DEEP EGS project | | | | | | ■ | ■ | | | | | | | | | |
| Gerosion | | | | | | ■ | | | | | | | | | | |
| Green Energy Geothermal | | | | | | | ■ | | | | | | | | | |
| Háskóli Íslands/University of Iceland | ■ | | | | | ■ | | | | | | | | | | |
| HS Orka/ GeoResources Park | | | | | | | | | | | | | ■ | ■ | | |
| Iceland Drilling | | | | | ■ | | | | | | | | | | | |
| Iceland Geothermal Cluster | | | | | | | | | | | | | | | | ■ |
| Islandsbanki | | | | | | | | | ■ | | | | | | | |
| Íslenskt Jarðhítatækni | | | | | | | ■ | | | | | | | | | |
| ISOR | ■ | | ■ | | | ■ | | | | | | | | | | |
| ÍSTAK | | | | | | | | | | | ■ | | | | | |
| Keilir Institute of Technology | ■ | | | | | | | | | | | | | | | |
| KPMG | | | | | | | | ■ | ■ | | | | | | | |
| KS Orka/ Hugar Orka ehf | | | | | | | | | | | | | ■ | | | |
| Kvika | | | | | | | | | ■ | | | | | | | |
| Landsbanki | | | | | | | | | ■ | | | | | | | |
| Landsvirkjun/ Landsvirkjun Power | | | ■ | | | | | | | | | | ■ | ■ | | |
| Lex | | | | | | | | | | ■ | | | | | | |
| LNS Saga | | | | | | | | | | | ■ | | | | | |
| Loki Geothermal | | | | | | ■ | ■ | | | | | | | | | |
| Lota (formerly VJI) | | | ■ | | | | | | | | | | | | | |
| Mannvit | | ■ | ■ | ■ | | | | | | | | | ■ | | | |
| Ministry of Industry & Innovation | | | | | | | | | | | | | | | ■ | |
| Navigo | | | | | | | | ■ | | | | | | | | |
| North Tech Energy | | | | | ■ | | | ■ | | | | | | | | |
| Innovation Center Iceland (NMÍ) | | | | | | | | | | | | | | | | ■ |
| Orkustofnun | | | | | | | | | | ■ | | | | | ■ | |
| Orkuveita Reykjavíkur | | | | | | | | | | | | | ■ | | ■ | |

Overview on companies, employees and international activities

There have been 56 companies defined working either solely or partly on geothermal business in Iceland and/ or internationally. With information available and provided by companies, we estimate that around 900 to 1,400 people work either directly or indirectly in geothermal energy. This does not include customer of the sector, such as energy buyers (e.g. Blue Lagoon, aluminium smelters and similar)

In the context of this table overview, international operations for geothermal refers to offices or companies founded that have been founded with a specific geothermal focus, while international projects refer to countries in which companies are working on geothermal projects.

| Company/ entity | Founded | Employees | | Intl. op. for geoth. | Intl. projects |
|--------------------------------|------------|-----------|-----------|--------------------------------------|--|
| | | # | # geoth. | | |
| Áhættulausnir | 2012 | 1 | n/a | | |
| Arctic Green Energy Corp. | 2012 | * | * | China | China |
| Arion Banki | 2008/ | 900 | n/a | | |
| BBA Legal | 1998 | 24 | 1-2 | Vietnam | |
| Centra | 2009 | 8 | 1-2 | | Various |
| Deilir | 2008 | 20 | 20 | | |
| DMM Lausnir | 1997 | 4 | * | | |
| EFLA | 1973 | 300 | 15 | Turkey | Turkey, Indonesia, Croatia, Kenya, U.S., Chile |
| Framtak (Stálsmiðjan) | 2001 | * | * | | |
| GEORG/ DEEP EGS project | 2009 | 2 | 2 | | |
| Gerosion | 2014 | 1 | 1 (10 PT) | | |
| Green Energy Geothermal | 2008/ 2010 | 140 (30) | 140 (30) | UK, Kenya, Indonesia | Kenya |
| HS Orka/ GeoResources Park | 1975/2014 | 65 | 65 | | |
| Iceland Drilling/ Jarðboranir | 1986/ 1969 | 200 | 200 | Indonesia | Various |
| Iceland Geothermal Cluster | 2013 | 1 | 1 | | Various |
| Iceland School of Energy (RU) | /2005 | 3 | * | | |
| Íslandsbanki | 2008/ 1989 | 919 | n/a | | |
| Íslandsstofa | 2010 | 37 | 0 | | |
| Íslenskt Jarðhítatækni | 1996 | * | * | Romania | Romania |
| ISOR | 2003 | 80 | 80 | Chile | Various |
| ÍSTAK | /2014 | 200 | * | | |
| Keilir Institute of Technology | 2007/ | * | * | | |
| KPMG | 1975 | 240 | n/a | | Various |
| KS Orka/ Hugur Orka ehf | 2015 | 350 | 58 | Singapore, Shanghai, Jakarta, Manila | |
| Kvíka | 2009/ 2011 | 80 | n/a | | |
| Landsbanki | 2008/ | 1063 | n/a | | |
| Landsvirkjun | 1969 | 250 | 26 | | |
| Landsvirkjun Power | 2007 | 7 | 1 | | Ethiopia, Chile, Turkey |
| Lex | 1997 | 45 | * | | |
| LNS Saga | 2013 | 400 | 150 | | |
| Loki Geothermal | 2014 | 2 | 2 | | |
| Lota (formerly VJL) | 1960 | 49 | 2-3 | | Africa, Turkey, Germany, Philippines, Dominica |

| Company | Founded | Employees | | Intl. op. for geo. | Intl. projects |
|--|------------|-----------|---------------|----------------------------------|--|
| | | | | | |
| Mannvit | 1972 | 300 | 80-100 | Hungary, Chile, Germany | Hungary, Germany, Romania, Croatia, Ukraine, Kenya, Chile. |
| Ministry for Foreign Affairs | n/a | n/a | 2 | | |
| Ministry of Industry & Innovation | n/a | n/a | n/a | | |
| Navigo | 2014 | 3 | 1 | | Various |
| North Tech Energy | * | * | * | | |
| Innovation Centre Iceland (NMI) | 2007/ | * | * | | |
| National Energy Authority/ Orkustofnun – incl. UNU-GTP) | 1969 | 42 | 10 (5 at UNU) | | Various |
| Reykjavik Energy (Orkuveita Reykjavíkur) | 1930/ 1998 | 450 | 200 | | |
| Rafal | 1983 | 37 | 10-20 | | |
| Rarik/ RED | 2006/ 1947 | 200 | 1 | | |
| Reykjavik Geothermal | 2008 | 25 | 25 | U.S., Ethiopia, Emirates | Africa, Caribbean, various other |
| SET | 1978 | 19 | * | Germany | Germany |
| Startup Energy Reykjavik | 2014 | n/a | n/a | | |
| TBL Architects | 2004 | n/a | n/a | | |
| ThinkGeoEnergy | 2008 | 3 | 3 | | Various |
| UNU-GTP/ (part of Orkustofnun) | 1979 | n/a | n/a | | Africa, Latin America, Asia |
| University of Iceland | 1911 | * | * | | |
| Vatnaskil | 1982 | 12 | 7 | | China, Costa Rica, Guatemala, Hungary, Indonesia, Kenya, Romania, Slovakia, United States |
| Vélvík | 1994 | 24-25 | 4-5 | | |
| Verkís | 1976 | 320 | 30 | Bulgaria, Poland, Ukraine, Chile | Turkey, China, Kenya, Ethiopia, Djibouti Caribbean, Azores, Chile, El Salvador, Dominica, Guadeloupe and St Vincent. |
| VHE | 1995 | * | * | | |
| VSO Consulting | 1972 | 70 | 3-5 PT | | Africa, Europe, Abu Dhabi, Ruanda, Ethiopia, |
| XRG Power | 2015 | 2 | | | |

- * - No information was available or was not provided
- PT = part time
- FT = full time
- Intl. op. for geo = International operations (offices) set up for the purpose of geothermal operations/ business.

International activities of Icelandic companies

Icelandic companies and institutions have worked on geothermal projects worldwide. In 2015, the Iceland Geothermal Cluster created the map shown below. It shows in which countries Icelandic companies have worked on geothermal projects. The map was created for the World Geothermal Congress 2015 in Melbourne, Australia.



The companies of the Icelandic geothermal sector have been working on a global scale providing mostly consulting services, drilling services, but have also been involved in the development and financing of projects.

The companies agree that ISOR and the National Energy Authority play an important supporting role. Through government channels, direct or indirect involvement, Iceland's National Energy Authority and Iceland Geo Survey ÍSOR have been involved in supporting countries to explore their geothermal potential and support the creation of the necessary legal framework, this includes capacity building in the form of education. The United Nations University Geothermal Training Program, part of the National Energy Authority has educated more than 600 scientists and engineers from 59 countries, with a the potential to develop an active alumni network and access globally.

Directly or indirectly, Icelandic firms have been involved in the development of geothermal projects in Central America, Asia, North America, Caribbean, but also Europe and the Middle East. There are further Iceland-based firms in mostly foreign ownership involved in development of projects in North America, Africa, the Caribbean, Asia and Europe. These projects include power generation and heating projects.

Responses from the Icelandic engineering firms show, that they have been very active internationally working on a variety of projects, in various roles and different capacities, ranging from structural administration and evaluation of grant programs, financial and technical due-diligence work, providing geoscience consultancy, engineering and design work, but also services related to drilling.

Iceland Drilling is the only company at this point providing drilling services with own drilling rigs; the company has been involved in projects globally with projects in Germany, Portugal, New Zealand, the Philippines, Nicaragua, and the Caribbean.

According to the survey, only a handful of Icelandic companies of the geothermal sector have actual offices or daughter companies set up for their geothermal activities internationally.

There are only a limited number of suppliers of products to the geothermal sector in Iceland, most of them focusing currently on the Icelandic market. One company has manufacturing facilities in Germany. Another – with majority in foreign ownership – sources parts of own-design and turnkey

power plants in Iceland. There are several small start-up-scale companies currently developing products for the Icelandic and international markets.

Future markets

Looking at what new markets companies in the Icelandic geothermal sector are considering for business opportunities, answers vary greatly. By evaluating future markets for the Icelandic geothermal sector, it is useful to follow the flow of funds to geothermal, and the access the Icelandic companies and institutions have to these funds.

1. Europe: Primarily direct use, heating and cooling. Funds provided by EEA Financial Mechanism, EU Structural and Investment funds, EIB and EBRD.
2. Europe: Research funding through Horizon 2020, EGS and deep drilling has been the primary focus. Funding for technology and industrial solutions and heating and cooling for low enthalpy and high enthalpy.
3. East-Africa: Nordic Development Fund (NDF), Green Climate Fund, EU – GRMF, (Geothermal Risk Mitigation Facility), World Bank (various).
4. Indonesia: Green Climate Fund,
5. Latin America: Green Climate Fund, EU Latin America Geothermal Risk Mitigation Facility, Horizon 2020 research funding for Mexico.
6. Southeast Asia: Green Climate Fund, Asian Infrastructure Investment Bank, EBRD
7. China: Green Climate Fund, EBRD
8. Caribbean: Green Climate Fund
9. Specific countries of interest: Turkey (EBRD funding), Mexico

The Icelandic geothermal service sector, including geoscience, engineering, drilling and related services has always been working internationally beside its activities in Iceland. The financial collapse of Iceland in 2008/ 2009 changed things dramatically. Expansion projects by the Icelandic energy companies in Iceland were put on hold. The same applied to all international projects and stakes, with most of them sold to international partners, or to Icelandic companies that had secured international funding.

Since 2009, due to the lack of development in Iceland, the companies of the sector had to increasingly look for work abroad. Most of the activities took place in countries that saw an increase in geothermal development, particularly in South America, the Caribbean, China, Central America and East Africa. The potentially big growth market of Southeast Asia has not seen much interest or activities apart from a selected few of the Icelandic companies. The service has been provided to government, private companies/developers as well as international institutions.

Most of the equipment and components for geothermal installations in Iceland has come from international vendors. In servicing existing plants and developing a skill set tailored towards maintenance and operation of geothermal plants, there are now a number of interesting smaller players. They have not only created themselves a role in servicing customers in Iceland, but have gained great know-how and experience and developed their own solutions.

Asked about potential new markets for the geothermal sector answers vary widely, but focus is mostly on the current growth markets of the geothermal sector, namely East Africa, Southeast Asia, Latin America and the Caribbean. At the same time there are great business opportunities seen in the development of geothermal district heating projects in Europe and continued development in Turkey.

Internationally recognized, Iceland is among the leading nations in the utilisation of geothermal energy. To maintain its international standing and perception, on-going development and the promotion of its geothermal sector is crucial. The largest geothermal project of recent years, the 90 MW Theistareykir project plays an important role in supporting this image. The same can be said

about the Reykjanes Geothermal Resource Park, a showcase of a multiple use of geothermal resources, as well as the participation of Iceland and Icelandic companies in international research projects. Cooperation on promoting the Icelandic Geothermal sector internationally can be strengthened.

It is very important for the Icelandic industry to maintain its image as a leader in geothermal development globally.

Research & Development, staff education

With most of the companies of the sector providing consultancy services and little to no manufacturing, R&D efforts are mostly limited to the energy companies and related to the operation and maintenance of current plants in Iceland. There has however been a recent increase in participation in international research projects funded through the EU's Horizon 2020. ISOR has driven the Icelandic participation in four of these projects that have received grants.

Cooperation with the energy companies has been a crucial factor for the innovation companies developing equipment and services; these companies have typically been founded under a start-up accelerator program.

Some of the engineering firms are working on R&D projects either for clients, or indirectly on projects funded through grants from the EU and other sources, on the DEEP EGS project funded by Horizon 2020, which was recently launched, and the South Hungarian EGS project funded by the NER300 program.

The objective of the DEEP EGS project is to prove that energy can be produced from deep enhanced geothermal systems with the aim of increasing the permeability of the rock from depth of 4-5 km. Three sites will be examined, the Reykjanes geothermal area and the geothermal areas in Valence and Vistrenque in France.

The South-Hungarian EGS project, objective is to produce geothermal energy from a hot dry rock in a compressional stress field. An enhanced geothermal system (EGS) will be created by drilling a 4 km deep production well and two re-injection well and hydraulic fracturing of the reservoir under a compressional stress field.

The educational level varies greatly depending on the activities of the companies, while engineering and related firms prefer hiring individuals with Master degrees and PhDs, service firms and related also hire people with technical backgrounds. Most of the experts are educated both in Iceland and abroad.

The sector as a whole should be more active when it comes to EU funded research. There has especially been a lack of participation of the Icelandic sector in research and EU funded initiatives focused on heating and cooling (district heating). Here there are several opportunities for the Universities, the public utilities and the private companies to participate. As an example the Danish district-heating sector has been very active when it comes to participation in research in Europe and has managed to create a brand name. The work on the Heat Roadmap for Europe was lead by Aalborg University.

The Icelandic companies and Universities have been more focused on research related to the use of high enthalpy geothermal resources for power production under special conditions. Icelandic companies have received funding and participated in international projects funded by the EU's Research and Innovation Program (FP7 and Horizon 2020) as well as from the NER300 Program.

Overall the staff working in the geothermal sector is highly educated and experienced. Compared to other countries there is also a more diversified age of employees, despite a large number of the most experienced staff being close to retirement age, which is a great concern for the global geothermal work force.

In the engineering, geoscience and consulting sector, staff mostly has Master degrees from either Icelandic, but also well regarded international schools and universities. There is a large number of people in the sector with PhDs in various scientific fields related to geothermal energy.

Furthermore, there is a large pool of highly experienced and capable technicians with various backgrounds working both for energy companies, in construction, drilling, manufacturing and related fields.

Export & Sales Strategy

The export & sales strategy of the Icelandic geothermal sector has been more re-active than pro-active. The majority of the sector is offering services and thus are not project developers. The re-active nature of the service industry is that the companies respond to international opportunities, call for tenders, grants etc.

There are companies that have opened offices in international markets, often in cooperation with local partners. These companies are project developers, equipment suppliers, or service suppliers. The companies in the two first categories have cooperated with the Icelandic geothermal industry service sector (private and government companies) and opened up opportunities for other Icelandic companies to participate in international projects. The companies confirm that the image of the Icelandic sector as a leader in geothermal development has helped these companies to succeed internationally. Icelandic engineering companies (service suppliers) have opened offices abroad providing engineering services for the energy sector. The offices have not specifically been opened to support their geothermal activities. There are however an exception, Mannvit's Hungarian office has a specific focus on geothermal development in the region. The focus has been on geothermal district heating as well as Enhanced Geothermal Systems. Mannvit also owns a subsidiary in Germany – GTN Geothermie Neubrandenburg and an office in Chile. Isor and Verkis run a joint office in Chile named, GeoThermHydro, which focuses on geothermal and other renewables.

All of the companies agree that ÍSOR has played a very important role for the international efforts of the Icelandic geothermal sector. ÍSOR has been very active when it comes to participation in international projects, and as a result kept the name of the Icelandic sector alive. Moreover, ÍSOR has on many instances partnered with the service sector, providing support on geoscience in many cases enabling the sector participation in international projects.

Both ÍSOR and Orkustofnun have worked with the project developers in their international efforts. In the past there have been several companies set up as either a cooperation effort to get involved in geothermal projects internationally, one was ENEX that was owned by energy companies and engineering firms, the other companies were Geysir Green Energy and Reykjavik Energy Invest. While one was set up as an equity company with shareholdings in a variety of companies, including an energy company and developers, the other was set up as a project developing company.

With these companies, the sector has been trying to directly work in the geothermal sector as project developers, beyond simple consultancy to guarantee better connections and revenue streams for the sector and the companies involved. Some elements of these companies have since been run as separate entities, or have been bought by foreign entities.

Overall, companies promote themselves over their websites with different levels of descriptions of their services, products and experience. Companies generally see the need to create marketing materials, in the form of concise company presentations and brochures.

All companies see official tender and bidding processes as a crucial tool to get access to business opportunities and use various tools available to participate in tenders, either alone, or in partnership with both Icelandic and/ or international partners.

Icelandic companies and institutions participate in a variety of geothermal, and other energy related events internationally. This applies though predominantly to consulting firms, such as the engineering firms. They present papers, posters or exhibit. Only on selected occasions, such as the World Geothermal Congress held every five years, there are efforts made to present a joint Icelandic booth.

Several companies are joining forces to go after certain markets, such as East Africa or South America and create joint promotional materials, but these are limited efforts. There are also companies that join forces with international partners to either bid for projects or develop them together. There is though no clear preference recognizable for hiring local agents.

Overall, the export and sales strategy of the Icelandic geothermal sector can be seen as a rather direct approach to business development and tapping into business opportunities. Relationships and direct networking are seen as absolutely crucial. Longtime strategic planning, taking into account policy and funding available is limited.

Companies in the sector confirmed that the Icelandic geothermal sector competes internationally with various countries, companies and entities. The geothermal sectors of other countries, such as New Zealand and the United States face a similar situation as its Icelandic counterpart, with limited development in their countries, the companies are looking for international opportunities. With strong government support, companies from New Zealand have joined forces in the promotion and targeting of international markets, such as the Caribbean and Indonesia. This puts the Icelandic sector at a disadvantage given its size of the economy and the available level of support.

On the company level, there is strong international competition that is fought on a project-by-project basis with concrete competitors named by the Icelandic companies.

Competitiveness

Looking at the competitiveness of the geothermal sector, one can look at the internal elements, such as strengths and weaknesses as seen by the companies, but also the elements outside of Iceland as they relate to opportunities and threats.

Looking first of the internal elements, the following are points raised by the entities interviewed.

Strengths

- Geoscience and related expertise
- Geological capabilities
- Geophysics
- Engineering
- Long history of geothermal utilisation
- Success stories and experience in cascaded use
- Education and in particular the network created by the UNT-GTP
- Relative share of geothermal activities in firms high

Weaknesses

- Distance to growth markets
- Currency/ capital controls
- Lack of funding
- Experience built on government-funded support
- Not competitive (price, size, capabilities)
- Business Model
- Lack of international promotion of the sector
- Lack of cooperation
- No manufacturing
- Too little and irregular development, not maintaining/ replacing expertise regularly and constantly
- Uncoordinated government promotion

Looking at the external elements of the competitiveness of the Icelandic geothermal sector, entities interviewed raised the following points.

Opportunities

- Increasing global geothermal development
- Specific markets with significant growth (Turkey, Mexico, Eastern Africa)
- District heating (Eastern & Central Europe)
- EU funded R&D
- Direct use – resource parks
- Increased demand for services offered by the Icelandic sector in geoscience, geology and geochemistry
- Operation and maintenance services
- Financing of geothermal projects
- UNU-GTP fellows in management positions in their countries.

Threats

- Knowledge lies with people in retirement age
- Increasing competition from financially stronger countries and national initiatives (New Zealand, U.S. and others)
- Price competitiveness, Icelandic sector often too expensive
- Size: often Icelandic firms are too small to provide some of the consultancy needed
- Educational programs run by other nations or in the growth markets of the geothermal sector
- No funding from Iceland for development internationally.
- No access to funding from development banks

Collaboration

In the interviews with the companies we asked about the various collaboration elements as they relate to marketing of the geothermal sector in Iceland.

Generally, all participants stressed the need for collaboration on business development and marketing, while at the same time highlighting the fact that several companies see themselves in a competitive situation in Iceland and internationally when it comes to geothermal projects.

The role of government entities, such as the Ministry for Foreign Affairs, the Ministry of Industry and Innovation, the President's office, as well as government agencies and offices, such as the National Energy Authority (Orkustofnun), the Iceland Development Aid program (ICEIDA, now part of the Ministry for Foreign Affairs), and Promote Iceland are mostly described as important and necessary by the companies.

At the same time, it was described that there could be better information flow between both the government sector and the private sector. The government sector wants to know what companies are doing and where their interests lie, while the private sector needs to be aware of initiatives that it can get involved in.

With inter-government relations between Iceland and other nations, there are often opportunities for cooperation, e.g. on support for capacity building programs, policy support or technical support in the form of assistance in exploring the geothermal potential of a country. The private sector, often being directly involved in specific countries and being interested in certain growth markets of the geothermal world, could provide details on what countries and markets are of interest and what government initiatives could help to get access to these markets. The government and affiliated offices can provide details on their activities and focus, with access to funding and projects that in return the private sector could tap into.

According to the survey results the organisation of business delegations to countries with a business interest for companies of the sector is seen as important, while often the timeframe for organisation is seen as too short. So while some companies raised the need for a better structure and organisation for these trips, others actually stressed out the need to themselves make sure they make the most out of trips like this, e.g. by organising meetings with local players and potential partners ahead of the visit.

With regards to delegations visiting Iceland, there seems to be a general interest in hosting or meeting delegations, particularly from countries that provide business opportunities for the private sector companies. The timeframe to organise and react on invitations is seen as often too short and sometimes not all companies that could be interested are aware of delegations coming. Another point raised was that international delegations often are being taken to the same points of interest, e.g. geothermal power plants. This often represents additional work for the operators, which can become too much if not coordinated and planned correctly.

The efforts of the Iceland Geothermal Cluster in presenting the Icelandic geothermal sector are generally described as positive and needed. For government bodies, the cluster also provides for the opportunity to having one focus point to connect to, which makes communication easier.

The Iceland Geothermal Conference, which took place April 2016, is an important date on the agenda for the Icelandic geothermal sector and is generally described as a major opportunity to showcase the capabilities of the Icelandic sector, but also connect with international companies, suppliers and individuals. This important networking opportunity is often described as a major marketing tool for the sector.

Education & other

Throughout all answers, the importance of the United Nations University Geothermal Training Program (UNU-GTP) has been emphasized. Funded by the Ministry for Foreign Affairs of Iceland, it is operated by the National Energy Authority (Orkustofnun) with lecturers coming from industry, government and universities in Iceland, with regular guest lectures by foreign individuals as well.

With the long and proud history of the program and the large number of graduates of the program, the companies see it as a major element and contributor to the Icelandic geothermal brand and perception of the Icelandic geothermal sector internationally.

Graduates from the program regularly find themselves in exponent roles and position in companies driving geothermal development in their home countries, e.g. in Kenya, Ethiopia, China and other countries.

Companies surveyed for the report all emphasize the great role, but also stress out the opportunities for a closer cooperation between the school and industry. At the same time there are several networking opportunities, like lecture series by UNU-GTP that are open to the public and have maybe not been used by companies

Beyond the UNU program, there have been efforts on creating sustainable energy focused programs. The University of Akureyri had established the School for Renewable Energy Science (RES), which started in 2008, but was discontinued in 2011. Reykjavik University, a private university, started a similar program around the same time, named Reykjavík Energy Graduate School of Sustainable Systems (REYST), which was renamed to Iceland School of Energy and is jointly owned by Reykjavik Energy (Orkuveita Reykjavíkur), Reykjavik University and Iceland GeoSurvey (ÍSOR). The school offers Master programs, PhD programs and short programmes, such as summer schools and professional development courses. The school has been able to attract a large number of foreign students for its programs.

In 2014, the University of Iceland established a Renewable Energy Graduate programme, one of the aims of the programme is to strengthen the University's ties to Icelandic industry in order to create knowledge, discover novel solutions and opportunities in the creation of wealth for the Icelandic community. Two of the program's offered focus specifically on geothermal.

Another undergraduate program with a focus on energy and related technologies is run by the School of Energy and Technology at Keilir – Atlantic Center of Excellence. The multidisciplinary program in energy technology has a particular focus on geothermal energy technology tapping into the know-how of Icelandic companies.

Overall, there is a common understanding of the importance of education and the programs offered, both for students from Iceland and programs attracting foreign students to Iceland. Particularly a close relationship and collaboration of industry with the programs run in Iceland is seen as crucial to attract students to the sector. The companies see the programs and teaching as a business development opportunity.

The role of internship programs, such as with the Iceland School of Energy, social activities and joint industry/ school events was also mentioned.

In that context, the role of the Iceland Geothermal Conference is considered as important, not only to showcase and promote the Icelandic geothermal know-how, but also to provide a platform for networking for the sector, students, foreign and national company representatives, legislators, donors, investors, international multilateral funders etc.

Recommendations

Iceland has an opportunity to be the leader of geothermal development in the world. To be able to use the image of Iceland as the leader of geothermal government and the industry as a whole, needs to step up and cooperate and create a strategy for international promotion and an action plan.

In 2020 Iceland will host the World Geothermal Congress. It has been forecasted that the global geothermal market will increase exponentially by 2020, both for power and heat sectors. This is due to favourable policies worldwide as well as the continuously increased funding available for geothermal development.

We recommend starting immediately planning for and create a strategy and an action plan for the international efforts of the Icelandic geothermal sector. The plan should be created for the coming four years, with the aim of having established Iceland as a leader in geothermal development and utilisation by the WGC in 2020. This should include a brand and visual identity.

The government also needs to play a role and e.g. help provide an umbrella for the industry within Iceland – the umbrella ensures consultation on all government levels with the industry, the cluster here could play an important role in the share of information between government and the sector.

Given its experience and role, Promote Iceland could play an important role in helping to combine and facilitate efforts in the positioning of the sector for international business development. This should be efforts both inward and outward focused. This could involve facilitating partnerships with international players, the organization of business delegations, the creation of workshops and presentations, but also the creation of a specific toolbox that could help promote the sector and what it has to offer internationally.

Activate international efforts of the direct use market. Here geothermal district heating is crucial, how the utilities can play an important role by participating in international projects such as the UNEP District Energy in Cities as well as policy work funded by the EU and other international institutions. Instigate cooperation with the Covenant of Mayors, which initiative will become global this year.

The holding of the Iceland-EU Roundtable on geothermal should actually be considered as annual event.

Look into how to use the tools available such as the global geothermal development plan and the global geothermal alliance to create opportunities for geothermal development.

Focus on low hanging fruits; increase the cooperation with the beneficiary states of the EEA Financial Mechanism when it comes to education, research, development and funding of geothermal district heating in Europe.

Increase the cooperation with the EU, establish a strategic alliance in providing support for development of geothermal district heating in Europe. Consider funding a national expert at DG Energy.

Cluster: Focus on suppliers and technological development in Iceland and other programs that could help facilitate for increased cooperation between the companies within the cluster.

Increased research and development, Iceland has the potential of being a test facility for the world in the use of geothermal both when it comes to power production as well as direct use applications.

Support to research and development, provide funding for companies to participate and build alliances for participation in international research and development. Both when it comes to geosciences and equipment. Through, e.g. the Startup Energy Reykjavik program, entrepreneurship and technology innovation could be fostered better, which also would provide the opportunity for increased industry involvement and plug-in.

The energy firms need to provide platform for development, research and innovation as well as international marketing. At the end of the day they are financially stronger and are also serving international markets through their international clients.

Financial sector / banks, can provide support to international finance institutions in evaluation of and funding of geothermal projects.

Last but not least is on-going development in Iceland crucial to maintain the current experience level and know-how within the geothermal sector.

Companies of the Icelandic geothermal sector

Energy Companies

HS Orka/ Auðlindagarðurinn - Reykjanes Resource Park

HS Orka owns and operates the Reykjanes Resource Park. The park has been developed in the vicinity of HS Orka's geothermal plants in the Suðurnes region. It provides for an innovative use of geothermal waters and encourages further and more efficient development of the products of geothermal plants.

HS Orka power plants resource streams have been used by an incredibly varied range of businesses, such as the Blue Lagoon, cosmetics manufacturers, biotechnology companies and aquaculture. More than 500 jobs can be directly attributed to HS Orka's Resource Park, in addition to other derived jobs.

Each of the companies of the Resource Park directly utilises two or more resource streams from the geothermal plants of HS Orka. The operation of the Resource Park has been developed on the basis of joint interests, such as the effluent (gas and fluid) from one company being raw material for another; their proximity and close interdisciplinary co-operation.

HS Orka uses the Resource Park to open people's eyes about the valuable resources the company sustainably manages.

The objective of the Resource Park is to foster a "society without waste" and to ensure that all resource streams that flow to and from the companies in the Park are utilised to the fullest extent possible, in as responsible a manner as possible, for the benefit and further development of the community. Currently there are seven companies operating within the resource park, the Blue Lagoon, Haustak, Háteigur, Norther Light Inn, Orf Genetics, Carbon Recycling International (CRI) and Stolt Sea Farm.

HS Veitur

- Founded: 2008
- Website: <http://www.hsveitur.is/default.aspx>
- Category: Utility

HS Veitur was established in 2008 after unbundling of Hitaveita Suðurnesja as required by EEA law. The company is a classic utility company. The company produces and sells hot water and electricity. It also provides fresh water for the Suðurnes and Vestmannaeyjar area, as well as selling earth sea to industrial users in the Reykjavik Resource Park.

Landsvirkjun (The National Power Company of Iceland)

- Founded: 1965
- Website: <https://www.lv.is>
- Category: power company

Landsvirkjun is state owned and by far the largest power producer in Iceland processing 75% of all energy generated in Iceland. The company builds, runs and refurbishes hydroelectric and geothermal projects in Iceland. It now owns and operates 13 hydroelectric and 2 geothermal power stations in Iceland with an installed capacity of around 2,000 MW.

Landsvirkjun owns and operates two geothermal power stations in the Mývatn, area, the Krafla and Bjarnarflag stations. In addition the company's Theistareykir project is under development in the same area.

Landsvirkjun conducts extensive research on the utilisation of geothermal energy in these areas. This includes research on current utilisation, potential future utilisation in the Hágöngur and Bjarnarflag area and research pertaining to the expansion of the Krafla Geothermal Station.

Orkuveita Reykjavíkur (Reykjavik Energy)

- Founded: 1999
- Website: <http://www.or.is>
- Category: utility – power production

Orkuveita Reykjavíkur has recently completed the unbundling of Orkuveita Reykjavíkur's operations in line with EEA law. Orkuveita Reykjavíkur serves as an umbrella for the three subsidiaries: Veitur-Utilities, ON Power and Reykjavik Fibre Network. Today, Orkuveita Reykjavíkur main function is to support its subsidiaries in providing quality services in a sustainable manner.

Orkuveita Reykjavíkur/ Reykjavik Energy (OR) is an energy and utility company that provides electricity, geothermal water for heating, and cold water for consumption. It also operates a data-utility network and waste-treatment facilities. The company's service area extends to 20 communities in the south-west part of Iceland. Orkuveita Reykjavíkur is owned by the City of Reykjavík (93.5%) and the Municipalities of Akranes (5.5%) and Borgarbyggð (1%).

Reykjavik Energy is the largest utility in Iceland, covering 67% of the Icelandic population. The company owns and operates the largest combined Heat and Power plant in the world at Hellisheidi and Nesjavellir where high-pressure geothermal steam is used to produce electricity. For district heating, hot water is harnessed from geothermal wells in Reykjavik and at Hellisheidi and Nesjavellir where groundwater is heated and distributed to the district heating system in Reykjavik area.

Orkuveita Reykjavíkur has participated in numerous research projects. The largest one being the CarbFix project which objective is to imitate natural storage process of CO₂ already observed in basaltic rocks in Icelandic geothermal fields. The project's implications for the fight against global warming may be considerable, since basaltic bedrock susceptible of CO₂ injections are widely found on the planet

RARIK

- Founded: 2006/1997
- Website: <https://www.rarik.is>
- Category: power company

RARIK is fully owned by the government, it was established in 2006 when it took over the management of The State Electric Power Works. The company's main objective is to procure sufficient electrical power to the general public and industries in a favourable manner. The company has had an important role to play in procuring, distributing and selling electric power.

RARIK has worked on developing various power projects throughout Iceland, such as the electrification of rural areas and interconnecting districts with high voltage system. RARIK also laid extensive system of transmission lines between the country's various regions, constructing an integrated power grid stretching around all of Iceland. The company also operates six geothermal district heating systems across Iceland.

In 2008, RARIK established RED (RARIK Energy Development) a development and investment company in the field of renewable energy. The purpose of the company is to manage energy consultancy and development projects, both in Iceland and abroad. RED is owned 100% by the RARIK Ltd., its principle objective is to ensure continued growth and the creation of added value within the RARIK group and to provide a market for Icelandic expertise abroad.

RED holds a majority share of RARIK Turkison Energy (RTE) a company, which was founded in 2008, with the aim to manage projects in the field of geothermal energy in Turkey and Asia. The company's main focus is project development and technical assistance in geothermal, transmission, small and medium sized hydro and wind power. The company is owned 61,66% by RED and 38,34% by EFLA Consulting Engineers.

Private Sector/ For-Profit

Áhættulausnir

- Founded: 2012
- Website: <http://alausnir.is>
- Category: financial services

Company offers Insurance Consulting and Broking to the Geothermal Sector

Arion Banki

- Founded: 2009
- Website: <https://www.arionbanki.is>
- Category: financial services

Arion Bank was established as a state-owned bank on the ruins of the Icelandic based operations of the former Kaupthing Bank and placed in control of the old bank's domestic assets and liabilities. On 20 November 2009, New Kaupthing changed its name to Arion Banki.

Arion Bank has solely operations in Iceland. The Bank has an extensive branch network, there are 24 branches all over the country and over 100,000 customers. The bank provides corporate banking services to the domestic energy sector.

Arion Bank is one of the founders and a board member of IGC and one of the founders of Start-up Energy Reykjavik.

Arctic Green Energy

- Founded: 2012
- Website: <http://www.arcticgreencorp.com>
- Category: project development

Arctic Green Energy was founded with the mission of exporting the Icelandic know-how and success when it comes to develop, execute and operate geothermal projects to the emerging markets in Asia. In 2006 the company established a Joint Venture-Sinopec Green Energy, which has become the world's largest geothermal district heating company with 160 heat centrals across 20 cities/counties in China with 700 employees. The success of the project can be attributed to three factors. Secure funding from the local partner, policy supporting the geothermal development, cooperation with Icelandic companies, bringing Iceland's invaluable know-how and experience in geothermal district heating to China.

With the endeavour the parties have not only managed to create a successful business model for geothermal district heating development. More importantly over 1,5 million tons of CO₂ emissions have been saved, which is equal to planting of 7,1 million trees. The inhabitants of the cities where the projects have been implemented do not only benefit from cleaner air, but also lower energy prices than heating with fossil fuel

Since the first projects were established in Xianyang City of Shaanxi Province the company has expanded its operations into Hebei, Shandong and Jiangsu provinces. Today, SGE is the world's largest geothermal district heating company with a 35% market share in China – providing heating for over a million customers through its proven method of green, clean and sustainable energy utilization. Sinopec Green Energy currently has over 150 heat centrals, 3 waste heat projects and 1 geothermal heat pump project in operation, and has drilled close to 200 geothermal boreholes (third of which are re-injection boreholes). SGE's geothermal projects were the world's first to gain a United Nations Clean Development Mechanism registration and its district heating operations have saved close to 2 million tons of CO2 emissions to date.

The company does not operate in the Icelandic market but cooperates closely with Icelandic geothermal experts from ISOR and Verkis and Mannvit consulting engineers.

Among Arctic Green Energy's past projects is the development of a 50MW geothermal power station in Biliran Province in the Philippines which the company has already exited. A new venture is being launched in Vietnam in collaboration with a strong local company.

BBA Legal

- Founded: 1998
- Website: <http://www.bba.is/en>
- Category: legal services

BBA was the first law firm in Iceland to build its practice exclusively on servicing the business sector. This is and has always been the company's main focus.

As a result, BBA has in recent years been leading in the field of mergers and acquisitions, capital markets, banking and corporate finance, bankruptcy law, PFI projects and general corporate and commercial law on the Icelandic market. This is confirmed by the firm's top tier ranking in the respective fields by all the major ranking companies.

Due to our level of expertise and good reputation BBA Legal has been trusted by local and international clients to provide advice on many of Iceland's biggest and most complicated financing and M&A deals, as well as the country's most important PFI projects.

BBA Legal has been active within the Geothermal sector and has specialised in regulatory risk and licencing when developing geothermal projects. The company has signed a cooperation agreement with the Vietnamese based law firms of Baker & McKenzie and BNWN International on geothermal regulatory reform and funding in Vietnam.

Centra

- Founded: 2009
- Website: <http://www.centra.is>
- Category: business consulting

Centra Corporate Finance provides advisory services in the field of corporate finance in Icelandic firms. The company is owned by the partners and is independent of banks and other financial services firms.

Centra has worked extensively within the energy sector in Iceland. The company has provided advisory to all the major energy producers in Iceland as well as expert advice to utilities, the transmission operator and geothermal developers. This includes advice on financing, valuation, profitability assessments, and regulatory compliance. Its partners have also been actively involved in the financing of renewable energy projects outside of Iceland.

Centra is licensed as a brokerage firm in accordance with law no. 161/2002 and is as such under the supervision of FME.

Deilir

- Founded: 2008
- Website: <http://deilir.com>
- Category: service provider - maintenance

The Company specialises in maintenance, repairs and services for geothermal power plants, with strong focus on steam turbines. The company works with owners of power plants in regard to rotor overhaul, equipment assessments and spare part supply. The team specialises in turbine rotor repairs and related equipment such as vacuum and well pumps, condensers, cooling towers and associated equipment. The company's main service categories are as follows:

- Steam turbine outage services & overhaul
- Rotors assessment and recommendation of scope of repairs
- Rotor repairs and spare parts supply
- Reverse engineering & 3D scanning
- 3D engineering design
- Operation and maintenance partner for geothermal power plants
- Engineering and consulting services
- Training and onsite field services

DMM Solutions

- Founded: 1997
- Website: <http://www.dmm.is/en>
- Category: software

DMM Solutions is the developer and vendor of the Dynamic Maintenance Management System software solution. The system was originally designed for the CHP at Svartsengi.

DMM Solutions Ltd is the vendor of DMM. Development of DMM, Dynamic Maintenance Management system dates back to 1992. The system was originally designed for the Combined Heat and Power plant located at Svartsengi in Iceland. The software solution is an overall management system for maintenance, project management, monitoring and quality. DMM clients include major power producers and distributors in Iceland as well as utilities.

DMM Solutions has a dedicated partnership with DMM Solutions Switzerland.

EFLA

- Founded: 1973
- Website: <http://www.efla-engineers.com>
- Category: Engineering

EFLA is a general engineering and consulting company based in Iceland with international activities and consultancy around the globe. EFLA comprises highly qualified and experienced professionals operating in a wide variety of fields whose common goal is to provide clients with the highest possible level of services and solutions, no matter the nature or scope of the project involved.

As an acknowledged leader in its field, EFLA places strong emphasis on innovation, cooperation, and regards its employees as its most valuable resource.

EFLA offers services in 6 marketing divisions – Energy, Industry, Buildings, Transportation, Environment and Project Management – which together are comprised of 31 service divisions, each with its own designated core activities. These are supported by the company's business development, research and innovation and personnel divisions. EFLA affiliated companies are in Norway, Sweden, France, Poland, Turkey and Dubai.

EFLA's main geothermal market has been in Turkey, through RARIK Turkison Enerji, which EFLA owns over 30% stake in. For EFLA future markets in geothermal include East-Africa and Southeast Asia (Indonesia).

Framtak Stálsmiðja

- Founded: 2001
- Website: <http://www.framtak.is>
- Category: metal industry

The company is one of the largest metal and heavy steel shops. The company has worked extensively for the domestic energy market, both geothermal and hydro. Framtak has undertaken and overseen some of the largest and most complicated geothermal power plant projects in Iceland in the recent years. Installing and fabricating equipment, turbines, generators, condenser units, wellhead houses and pipes. In addition to the company's specialized workshops Framtak also operates an engineering department.

GEKON

- Founded: 2009
- Website: <http://www.gekon.is>
- Category: consulting

Gekon is consultancy specializing in the management of clusters. The company initiated the mapping of the competences of the Icelandic Geothermal Industry in cooperation with Michael Porter from Harvard Business School. Until the establishment of Iceland Geothermal as a non-profit association Gekon was responsible for the running of the cluster. The company is the owner of the Icelandic Geothermal Conference.

Gerosion

- Founded: 2014
- Website: <http://gerosion.com>
- Category: service/ consulting

Gerosion provides consultation; material testing and specialized R&D work for entities in the geothermal and petroleum industry. The company specialises in material selection, testing and consultation regarding materials problems such as corrosion and scaling, specifically in geothermal industry. This includes failure analysis and guide in material selection in harsh and corrosive environments.

The company's aim is to provide customised solutions for each customer, both on site and in a simulated testing environment. The company is in the process of buying an autoclave; a pressure vessel that will enable the company to simulate the condition of supercritical wells and pre-test all materials.

The company received its original funding through startup accelerator, Startup Reykjavik Energy.

Green Energy Geothermal (GEG)

- Founded: 2008
- Website: <http://www.geg.co.uk>
- Category: equipment provider/ EPC

Green Energy Geothermal (GEG) is a supplier of flash condensing type, modular geothermal wellhead power plants, delivered on a turnkey basis.

Founded in Iceland in 2008, GEG has its headquarter in London/ UK and maintains offices in Reykjavik/ Iceland, Jakarta/ Indonesia, Singapore, Nairobi/ Kenya and Oslo/ Norway.

GEG has developed a unique power plant system that is prefabricated in ready modules and commissioned on site in a matter of months.

GEG currently delivers turnkey flash type modular geothermal wellhead power plants sizing from 3.5 MWe to 11 MWe per unit. The plants reduce capital expenses and project risk and allow for quicker payback on investment. They can be scaled through several modules for larger scale development or expansions.

The highly experienced executive team at GEG has assembled a team commanding a wealth of experience within the design, engineering, project management and operation of geothermal plants and is supported by a Board of Directors drawn from both investment banking and the engineering sector.

GEG has an engineering department in Reykjavik, Iceland, where the core technical, procurement/ logistics and R&D team is located.

Iceland Drilling

- Founded: 1986
- Website: <http://www.jardboranir.is>
- Category: service/ drilling

Iceland Drilling Ltd. is a leading high technical company in the field of high temperature geothermal drilling and has many decades of experience in both high and low temperature drilling. The company has extensive international operations experience, and has a record of drilling several hundreds of geothermal wells around the world. The company possesses a fleet of new hydraulic rigs and modern drilling equipment and specializes in onshore geothermal drilling projects as well as drilling services in other sectors.

IDC's service offering ranges from day rate drilling services to integrated project management on meter rates. IDC's focus is to conduct its operations in a safe and efficient manner for the benefit of all involved.

Íslandsbanki

- Founded: 2008
- Website: <https://www.islandsbanki.is>
- Category: financial services

Íslandsbanki established on 15 October 2008 being split from the bankrupt Glitnir and re-established into a new independent bank. The sole operations of the bank are to manage a branch network in Iceland, with a 20%-40% market share across all domestic franchise areas.

Íslandsbanki has positioned itself as experts in renewable energy. The bank has published a number of reports on the domestic energy market, including geothermal. A special energy team operates within the bank.

Íslandsbanki is one of the founders and board member of IGC.

Íslensk Jarðhitatækni – (Icelandic Geothermal Engineering)

- Founded: 1995
- Website:
- Category: engineering – equipment provider

Provides wellhead pumps for direct use of Geothermal Its main market is in Eastern-Europe, specifically in Romania.

KPMG

- Founded: 1975
- Website: <http://www.kpmg.com/is/is/pages/default.aspx>
- Category: service/ consultancy

The Icelandic KPMG is part of KPMG International, a global network of companies providing professional services with the aim of changing the value of knowledge for the benefit of its customers, staff and the community.

Worldwide employs more than 160 thousand people at KPMG in 160 countries. Cooperation of this large group is based on regular quality assurance and access to information that ensures professional knowledge in the world and the same service all over the world.

KPMG has about 240 employees with a diverse group of experts in all areas of business. There are 58 statutory auditors, 16 lawyers and people working on business administration and a large number of other professionals.

The main purpose of KPMG in Iceland is to provide companies and individuals in Iceland specialized services in the field of audit and consulting based on reliability, highest professionalism and safety. Well-trained staff is open to domestic and international trends and new knowledge-based all his work to the client is paramount. In 2010 KPMG Iceland published a report: "World Geothermal Market & Outlook" a comprehensive analysis of the global geothermal sector. KPMG Iceland cooperates with KPMG worldwide in providing services in providing analysis on geothermal projects.

Headquartered in Reykjavik, the company is tied into the global network of KPMG International.

KS Orka

- Founded: 2015
- Website: <http://www.ksorka.is>
- Category: power production

KS Orka is a joint venture between Hugar Orka ehf, an Icelandic company and Zhejiang Kaishan Compressor Co., Ltd (Kaishan), which is listed on the China Shenzhen stock exchange. KS Orka combines Hugar Orka's geothermal and project development expertise with Kaishan's power plant technology and manufacturing expertise to form vertically integrated geothermal and waste energy company. KS Orka acts as a project developer with a main focus on the development of geothermal power and heat projects as well as waste heat projects. KS Orka recently acquired the Sorik Merapi project, the second largest geothermal project under development in Asia and a geothermal project in Hungary. The KS ORKA team is currently involved in projects in the Philippines, Indonesia, Serbia, Hungary and Kenya.

Kvika

- Founded: 2011
- Website: <https://en.kvika.is>
- Category: financial services

Kvika banki hf. is a specialised bank focusing on asset management and capital markets. Kvika Asset Management has an established reputation and offers comprehensive solutions covering major asset classes, including fixed-income securities, equities, and real estate in both domestic and international markets.

Kvika's headquarters are in Reykjavík, Iceland. The Bank's goal is to be the first choice for individuals and institutional investors seeking quality services and consistent long-term results. The Bank offers investors comprehensive asset management and private banking solutions. As a broker-dealer of securities on domestic and international markets, Kvika provides all major services in the field of corporate finance. Kvika is a member of the Nasdaq Iceland stock exchange.

ISTAK

- Founded: 2014
- Website: <http://www.istak.is/en/>
- Category: contractors

ÍSTAK has been a leader in the Icelandic contracting industry for 40 years. In 2015 the company was acquired by the Danish contractor Per Aarsleff AS. Since its establishment ÍSTAK has been involved in most of Iceland hydro and geothermal power projects. The company's main competence is construction of buildings, power plants, aluminum smelters, harbor projects and bridge construction. ÍSTAKS main countries of operations are Iceland, Greenland and the Faroe Islands.

Landsbankinn

- Founded: 2008
- Website: <http://landsbankinn.is>
- Category: financial services

Landsbankinn is an Icelandic bank established in 2008 by the Icelandic government out of the domestic operations of its predecessor Landsbanki which failed during the 2008–2011 Icelandic financial crisis.

The bank has been state owned since its establishment and its current shareholders are the Icelandic State Financial Investments with 81.33% of the shares in the bank, while the remaining 18.67% of the shares are currently owned by the winding-up receivership (Landsskil) for the old bankrupt Landsbanki.

Landsvirkjun Power

- Founded: 2007
- Website: <http://www.lvpower.com>
- Category: engineering

Landsvirkjun Power is subsidiary of Landsvirkjun, its objective is to manage its international operations. The purpose of Landsvirkjun Power is primarily to provide the expertise needed in the development and operations of international power projects. The company has been involved as a consultant in a number of projects internationally, both in hydropower and geothermal

The activities cover all phases of project management, including site investigations, feasibility studies, tendering and detailed design, design review, specific engineering and operation services for owners and developers. Refurbishment and upgrades of existing power facilities are also an important mission. Landsvirkjun Power is seeking to expand its international activities, based on past experiences of the company.

LEX

- Founded: 1987
- Website: <http://www.lex.is>
- Category: legal services

LEX is one of Iceland's leading law firms, providing clients with comprehensive services over a wide range of financial, corporate and commercial issues, as well as most other aspects of Icelandic law.

LEX is one of Iceland's largest law firms comprised of 45 lawyers. Over the past decades, LEX has successfully acted on behalf of a large number of internationally respected corporations, organisations and private individuals both in Iceland and abroad.

LEX has a dedicated team of specialists that closely monitors all the developments in energy law, natural resources law and environmental law both locally and internationally. LEX's special focus in this field also includes its participation in the Energy Law Group and its active co-operation with Iceland's leading universities. LEX's clients in the field of energy law, natural resources law and environmental law include major Icelandic energy companies, major companies in energy intensive industries, financial institutions and municipalities.

The company's projects include PPAs, geothermal water and mining rights and licensing issues related to various uses of natural resources.

LNS Saga

- Founded: 2013
- Website: <http://www.lns.is>
- Category: contractors

LNS Saga is a subsidiary of LNS-Gruppen, which is one of the biggest contractors in Norway. LNS Saga was established in Iceland to fill a gap in the contractor market in Iceland. Since its establishment in Iceland the company has been selected to work on the extension of Hellisheiðavirkjun and the construction of Peystarreykir, the Landsvirkjun Geothermal project in the Mývatn area. The company is looking into establishing geothermal drilling operations.

LNS Saga aims at being a leading contractor in Iceland, Greenland and the Faroe Islands, offering first class services in construction.

Loki Geothermal

- Founded: 2014
- Website: <http://www.lokigeothermal.is>
- Category: geothermal equipment manufacturer

Loki Geothermal received its initial funding through Start-up Energy Reykjavik. Loki Geothermal specializes in the production and service of geothermal equipment and is currently developing wellhead valves for high-temperature geothermal wells.

The company's main objective is to develop equipment that is more reliable and easier to use than equipment that is currently available on the market. The company is currently developing expanding gate valves for high temperature geothermal wells. The valves are specifically designed to operate under severe conditions, including wellhead temperatures above 250°C and corrosive media, e.g. hydrogen sulphide, silica scaling etc.

Lota

- Founded: 1960
- Website: <http://www.vjiconsulting.com/>
- Category: engineering

Lota specializes in engineering-security and project management along with business support. Lota has more than 50 years of experience in consulting and design of every phase of power development, from pre-design and pre-feasibility studies, through to operation and maintenance.

Lota consulting has several years of experience in the development and design of geothermal energy projects, however on a smaller scale than the three leading Icelandic consultant engineers. The company has consulted and designed geothermal projects in Iceland, Germany, Turkey, and Kenya.

The company's recent geothermal projects in developing countries include projects in Kenya, the Philippines, and Dominica.

Mannvit

- Founded: 1963
- Website: <http://www.mannvit.com>
- Category: Engineering

Mannvit is an international engineering consultancy firm founded in 1963 in the fields of engineering, technical services and innovation. The company is employee-owned with headquarters in Reykjavik and branch offices or affiliates in Hungary, United Kingdom, Germany, Chile and the USA. The company employs a dynamic team of experienced engineers and technically trained employees with diverse experience in most disciplines relating to engineering services. Mannvit provides reliable and professional consultancy services based on a half century of knowledge and experience across a wide variety of projects and industries.

Mannvit provides services in the fields of engineering, geoscience, environmental studies, IT and construction material research. Mannvit offers complete project management and EPCM services. The company's services are divided into three core fields: renewable energy & transmission; industry and oil & gas and infrastructure.

Mannvit has offered geothermal development services for more than 50 years. The company employs more than 100 geothermal specialists, including engineers, scientists and technicians handling all aspects of geothermal development from start to finish. The company has been involved in projects in Iceland, Europe, Asia, the Americas and Africa. Mannvit's affiliated companies are in Britain, Chile, Greenland, Germany, Norway and Hungary.

Since 2010 Mannvit has operated an office in Hungary, Mannvit Kft, focusing on geothermal development in Eastern Europe. In Hungary the main projects have been in geothermal district heating and development of the South Hungarian Enhanced Geothermal System (EGS) Demonstration Project in cooperation with local partners. The project is supported by a grant from the NER300 EU funding program.

Mannvit's subsidiaries in the field of engineering are HRV Engineeringl, LWRC ltd. In the UK, GTN GmbH, Germany and GTN LA in Chile.

NAVIGO

- Founded: 2014
- Website: <http://www.navigo.is>
- Category: consultancy

Navigo specialises in EU and International affairs with a focus on EU Energy and Climate policy and financing of renewable energy and energy efficiency projects in international markets. NAVIGO specializes in energy, environment, and financial markets. Services include project and programme management and international finance in climate and energy related investments, structure of investment projects with the use of grants and loans from international institutions.

NAVIGO has worked extensively with the energy sector in Iceland advising on EU Energy policy as well as marketing of the Icelandic Geothermal Sector in Europe.

North Tech Energy

- Founded: 2014
- Website: <http://www.nte.is/>
- Category: Human Resources

North Tech Energy (NTE) specializes in supplying energy companies with proficient and flexible talent for geothermal drilling services around the world. With a team of geothermal drilling experts, the firm is focused on finding staff for geothermal drilling projects and for geothermal drilling projects to be completed on schedule and within budget.

RAFAL

- Founded: 1971
- Website: <http://www.rafal.is>
- Category: power and distribution transformers

Initially the company's purpose was to undertake various services for utilities and others and service agreements were made with some of the largest utilities in Iceland. In addition Rafal has also worked as a general electrical contractor.

Rafal provides services in high- and low voltage systems of production and distribution networks, and in the electrical and electronic industries, as well as in the telecommunication industry.

Rafal has been a supplier to a geothermal project in Kenya and has also worked for energy companies on projects in Iceland.

Reykjavík Geothermal

- Founded: 2008
- Website: <http://www.rg.is>
- Category: development, engineering

Reykjavik Geothermal Limited (RG) is a geothermal development company focused on the development of high enthalpy geothermal resources for utility scale power production. RG specifically identifies and targets locations where quality geothermal resources can be efficiently harnessed to meet the local demand for power and clean dependable energy. The company's strategy has been to develop international project in regions that offer significant but undeveloped geothermal resources such as Ethiopia, Mexico, Papua New Guinea, St. Vincent and the Grenadines. The projects are in different stages of development from feasibility study to pre-drilling stages.

RG was founded in Iceland by a proven team of experienced geothermal experts. RG management has been responsible for projects in over 30 countries including spearheading the development of one of the world's largest geothermal power plants in Hellisheidi, Iceland.

The Company's technical capability has been matched by an in-house group of expert and experienced multinational finance professionals. This team ensures the company's ability to navigate the complications of geothermal development and power plant finance.

These capabilities make RG the preferred entity for the development of geothermal resources anywhere around the world. The company is majority owned by USA based shareholders, this provides the company with access to development banks such as the African Development Banks

which Icelandic companies have no access to as Iceland is not a member. The company is headquartered in Iceland with offices in New York and Ethiopia.

SET

- Founded: 1978
- Website: <http://set.is>
- Category: pipe manufacturer

Steypuiðjan which later became SET, was founded in 1968 with the production of concrete sewer pipes and a decade later, insulated steel pipes for district heating. A wide range of other pipes and piping systems have followed, with all production taking place in 3 factories, SET in Selfoss SET in Mosfellsbær and Set Pipes Germany.

The last four decades have seen a very active and competitive market environment and circumstances call for vigilance and rapid response where the emphasis has been placed on a high level of technology, productivity and quality control. Great knowledge and experience has evolved in the field of manufacturing technology within the company. This also applies to knowledge in the field of marketing and services for pipeline industries.

The company's customers range from: municipalities, wholesalers, service providers within the construction field, hardware stores, contractors and the largest energy and telecommunications companies. All these parties have adopted purchasing formats governing open offer and price comparison in accordance with international agreements, ensuring SET's ability to meet international standards in price, product and service quality.

Startup Energy Reykjavik

- Founded: 2003
- Website: <http://www.startupenergyreykjavik.com/>
- Category: business support

Startup Energy Reykjavik is a mentorship-driven seed stage investment program with focus on energy related business ideas. The program was founded by Landsvirkjun, Arion Bank, GEORG and Innovation Center Iceland in December 2013.

The 10-week long program is run once each year. Selected companies or ideas get USD 40,000 in seed funding. Startup Energy Reykjavik founders also get a place to work at Reykjavik University, ten weeks of intensive mentorship, and the chance to pitch to angel investors and venture capitalists at the end of the program.

The program is facilitated by Icelandic Startups (formerly Klak Innovit) and Iceland Geothermal.

TBL Architects

- Founded: 1987
- Website: <http://tbl.is>
- Category: architects

TBL architects is a design team specializing in and committed to excellence in large-scale system integrated building projects.

TBL architects is an umbrella company of three leading Icelandic design firms, two in architecture and one in the field of landscape architecture. With a pooling capacity of over 70 designers and technicians and combined design experience of hundreds of projects, TBL is uniquely capable of taking on the most demanding of projects.

ThinkGeoEnergy

- Founded: 2008
- Website: <http://www.thinkgeoenergy.com>
- Category: media/ service/ consultancy

In 2008, ThinkGeoEnergy was launched as a website blogging about news from the global geothermal energy industry. It is today the leading geothermal news platform and network.

ThinkGeoEnergy provides industry news coverage, industry research, a global geothermal power plant map and weekly newsletters for subscribers.

The company is working on several additions, including industry research coverage, a company directory, a tender platform, educational elements and more.

ThinkGeoEnergy also acts as advisory firm working for international corporate clients on research, strategic, marketing and communication related activities.

Vatnaskil

- Founded: 1982
- Website: <http://vatnaskil.is>
- Category: engineering

Vatnaskil is a private consulting firm specializing in the fields of geothermal reservoir engineering, groundwater hydrology, river hydraulics, surface runoff, air pollution and environmental modelling. The company has provided specialized consultation for most of the major geothermal and hydroelectric projects in Iceland since its founding, as well as for numerous international projects.

Vatnaskil has participated in a wide variety of projects relating to geothermal resource development and management. Specific services provided by Vatnaskil have included defining and constructing field wide geothermal conceptual models, utilizing simple volumetric assessments methods, estimating reservoir generating capacity, implementing more complicated lumped parameter models, and utilizing fully dynamic three-dimensional multiphase exploitation models. Vatnaskil employees are also experienced in designing well tests and analyzing well tests results, analyzing tracer return curves and implementing general production management and injection strategies to help maximize production output over a fields's lifecycle.

Company specialists have years of experience teaching at the Engineering Department at the University of Iceland, the United Nations University Geothermal Training Programme (UNU-GTP) in Iceland, and at various seminars and courses around the world.

Velvik

- Founded: 1988
- Website: <http://www.velvik.is>
- Category: precision machining

Vélvík was established in 1988 and is one of the best-equipped companies in Iceland in the field of precision machining. At Vélvík, the skill of the craftsman meets state-of-the-art technology. (waiting for more info).

Verkís

- Founded: 1932
- Website: <http://www.verkis.com>
- Category: engineering

Verkís Consulting Engineers is one of the largest engineering firms in Iceland with around 300 employees. Verkís is a multidisciplinary consulting firm, providing services in all fields of engineering and related professional disciplines of consulting. Verkís offers engineering, consulting, management, operational and EPCM services. Core disciplines include geothermal and hydroelectric power. Verkís has participated in nearly all geothermal and hydroelectric projects in Iceland as well as in several projects abroad. Other core disciplines include geothermal district heating, power transmission, buildings, transport, infrastructure and industry.

Verkís geothermal power portfolio includes projects from high temperature fields with direct steam plants (dry steam and flash) to low temperature fields using binary cycle or Organic Rankine Cycle (ORC) together with combined heat and power projects. The company has participated in all of the Icelandic geothermal power projects and internationally in Turkey, Kenya, Ethiopia, El Salvador, Chile the Caribbean and Indonesia. The company has furthermore consulted on geothermal district heating projects in Iceland, China and Slovakia.

Verkís is headquartered in Iceland with foreign branch offices and subsidiaries in Norway, Greenland, Bulgaria, Poland Ukraine and Chile.

VHE

- Founded: 1971
- Website: <http://vhe.is>
- Category: machinery fabrication

Vélaverkstæði Hjalta Einarssonar ehf. (VHE) was established by Hjalti Einarsson in 1971. Initially, the focus was on the maintenance of diesel engines together with miscellaneous fabrication and maintenance. Today, forty years later, VHE is a strong company with a broad yet complimentary range of industrial goods and services. In total 15 companies belong to the VHE group increasing the companies abilities and expertise.

VHE's goal is to provide to its customers reliable and high quality services in the fields of machinery fabrication, maintenance and service. VHE now has the capability to provide total solutions for many industrial applications – analysis, conceptualisation, engineering design, fabrication, automation including software. The company has worked extensively for the aluminium and energy industry both in Iceland and internationally.

VSO Consulting

- Founded: 1958
- Website: <http://vso.is/english2/home.html>
- Category: engineering

VSO Consulting is one of the established engineering companies in Iceland. VSO Consulting provides its customers with comprehensive engineering and management consulting with the goals of ensuring them the most efficient solutions for each task that produce tangible results for them and an edge in their field.

Currently around 50 people work at VSO Consulting. About 85% of them have university and technical education in the field of, civil engineering, geotechnical engineering, environmental affairs, chemical engineering and economics.

Within the geothermal sector VSO has conducted environmental impact assessments, environmental and social impact analysis, health and safety and designed drilling platforms and buildings. Internationally VSO has worked in cooperation with other Icelandic companies in Southeast-Asia and Ethiopia.

XRG Power

- Founded: 2015
- Website: <http://www.xrgpower.com>
- Category: micro binary generators

The company received its initial funding through Startup Energy Reykjavik. The company is also supported by the Icelandic Innovation Centre and received a grant from the Technology Development fund (Frumherjastyrkur). XRG provides a personal micro binary generator solution that can produce electricity from low enthalpy geothermal resources.

Government

Iceland GeoSurvey/ ÍSOR

- Founded/ established: 2003
- Website: <http://www.geothermal.is>
- Category: engineering

Iceland GeoSurvey is a self-financing, state-owned, non-profit institution. It receives no direct funding from the government and operates on a project and contract basis like a private company.

Iceland GeoSurvey was established 2003, when the GeoScience Division of Orkustofnun, the National Energy Authority of Iceland, was spun off as a separate entity. It is based on seven decades of continuous experience in the field of geothermal and hydropower research and development. During this period Iceland GeoSurvey has provided consulting, training, and scientific services to the Icelandic power industry and the Icelandic government, and to numerous foreign companies and governments all over the world. Although our focus is on geothermal exploration, development, and utilization, our experience covers many other geoscience-related fields as well, including groundwater studies, marine geology, and environmental monitoring.

ISOR's has worked on geothermal projects all over the world, consulting on a broad range of issues related to geothermal exploration, geothermal development and environmental monitoring, both for the Icelandic and international geothermal industry. Together with Verkis, ISOR owns GeoThermHydro specializing in geothermal energy, hydropower, transmission and construction for the Latin American market. The company is located in Chile.

Recently ISOR has expanded its international research activities taking part in five Horizon 2020 grants. With a success rate of 80%, four out of the five projects received a grant. ISOR leads one of the projects and is a participant in three. The research projects will be implemented from 2016-2019. The projects bring together participants from 31 institutions, universities, private companies and energy research organizations from all over Europe. In addition to ISOR the Icelandic participants are: HS-Orka, Landsvirkjun and GEORG. The four research projects involve processing techniques such as

deep drilling, well design, well technique and well stimulation. Focus is on selection of materials and development of methods to deep well geothermal utilization.

Iceland GeoSurvey is committed to:

- Being in the forefront of geoscientific research, development, and service,
- Finding ways to enhance and augment geothermal resources,
- Enhancing the environment and contributing to the debate on environmental issues,
- Actively promoting geothermal development by increasing public and political awareness and understanding,
- Training scientists throughout the world in geothermal science and development,
- Participating in international geothermal development projects.

Innovation Centre Iceland (Nýsköpunarmiðstöð Íslands)

- Founded/ established: 2007 after merger of two related institutes
- Website: <http://www.nmi.is/english>
- Category: R&D, education

Innovation Centre Iceland encourages innovation and promotes the advancement of new ideas in Icelandic economy by providing active participation and support to entrepreneurs and businesses. Innovation is a prerequisite for diversity in the Icelandic economy and the basis of a strong competitive position of the economy. Innovation Centre Iceland belongs to the Ministry of Industry and Innovation.

The interplay of technological consulting and business support is the greatest strength of Innovation Centre Iceland. A group of specialists in different fields encourage innovation and support the advance of new ideas through research, development projects, business development and professional advice and consulting.

The Innovation Centre has supported the launch of several start-ups in the field of geothermal such as XRG-Power – provides micro binary solutions, Loki Geothermal that produces high-pressure high-temperature expanding geothermal gate-valves and Gerosion, that provides consultation, material testing and specialized R&D work for entities in the geothermal and petroleum industry.

Ministry for Foreign Affairs

- Website: <https://www.utanrikisraduneyti.is>
- Category: government

The Ministry is responsible for promoting Iceland's competences in Energy internationally. Geothermal plays a big role in that regard both when it comes to participation in international organisations such as the World Bank, Irena and other international finance institutions. The ministry works closely with ICEIDA (recently incorporated under the Ministry) in promoting and providing funding for geothermal development in developing countries. The UNU-GTP run by Orkustofnun has played a central role in that regard. The Ministry played a significant role in the establishment of the Global Geothermal Alliance. The Ministry is currently working on the promotion use of geothermal in Ukraine.

The Ministry is also responsible for the EEA Financial Mechanism. The fund has played a central role in providing funding for geothermal district heating in Eastern Europe.

Ministry of Industry and Innovation

- Website: <https://www.atvinnuvegaraduneyti.is>
- Category: government

Department of Energy and Industry provides a framework for new investments in energy and industry, this includes clear rules and policy. The office is responsible for all legal and policy matters in the field of energy and how energy related EEA regulations are incorporated into the EEA Agreement and transposed into national law. The Ministry participates in the EEA EFTA working group on energy and follows developments on energy matters within the EU and all contact with the EU in the field of energy, the embassy in Brussels plays an important role in that regard.

In 2014 the ministry organized the Iceland – EU geothermal roundtable in Brussels in. The Ministry is also responsible for Nordic Energy Cooperation and serves on the working group for renewable energy, Nordic committee of senior officials for energy policy and working group of energy efficiency.

Orkustofnun is an agency directly under the ministry. Close cooperation is between the Ministry and Orkustofnun in relation to foreign business delegations interested in energy matters.

The Ministry cooperates directly with companies in the Geothermal Industry as well as the Icelandic Geothermal Cluster in relation to furthering their interest abroad. The Ministry has signed several MoUs on energy cooperation with a number of countries.

Nordic Energy Cooperation. EEA Energy Cooperation – Energy law

Orkustofnun (National Energy Authority)

- Founded: 1967
- Website: <http://www.nea.is>
- Category: government

Orkustofnun is a government agency under the Ministry of Industries and Innovation. Its main responsibilities are to advise the Government of Iceland on energy issues and related topics, license and monitor the development and exploitation of energy and mineral resources, regulate the operation of the electrical transmission and distribution system and promote energy research.

The research facilities and the multidisciplinary research environment of Orkustofnun have given the institution a status for over three decades as one of the leading geothermal energy research institutions in the world. Orkustofnun has been instrumental in the execution of government policy regarding exploration and development of geothermal resources, and in advising communities, companies, individuals and foreign governments about their utilisation of these resources.

Orkustofnun also participates in international projects funded by the EU and the EEA Financial Mechanism. Orkustofnun manages the Geothermal ERA-net project funded by the EU Seventh Framework Programme. Orkustofnun is also a Donor Programme Partner in geothermal programs supported by the EEA Financial Mechanism in Hungary, Romania and the Azores (Portugal).

Orkustofnun also provides consulting services to both the Icelandic and foreign energy sector in relation to projects abroad. Currently Orkustofnun is consulting on projects in Ukraine and China.

Promote Iceland (Íslandsstofa)

- Founded: 2010
- Website: <http://www.islandsstofa.is>
- Category: organisation - support

Promote Iceland, former Trade Council of Iceland, is a public-private partnership established to improve the competitiveness of Icelandic companies in foreign markets and to stimulate economic growth through increased export. The goals of Promote Iceland are promoting Iceland as a tourism destination, assisting in the promotion of Icelandic products and culture abroad, and introducing Iceland as an attractive option for foreign direct investment.

Promote Iceland also assists Icelandic companies seeking to grow internationally through competence building programs as well as international events, such as trade fairs, press trips, and trade delegations. This is done in close cooperation with Icelandic embassies and consulates abroad, as well as bilateral chambers of commerce.“

Education

Iceland School of Energy (Reykjavik University)

- Founded: 2008
- Website: <http://en.ru.is/ise>
- Category: education

Iceland School of Energy (ISE) is a school jointly owned by Reykjavik Energy, Reykjavik University, and Iceland GeoSurvey, delivering education in the field of sustainable energy, accredited in the School of Science and Engineering at Reykjavik University. In addition to providing MSc and PhD studies the ISE also offers short programs, professional development courses and a summer school. In April 2007, Reykjavik Energy, Reykjavik University and the University of Iceland signed an agreement to establish an international graduate program for sustainable energy studies called the Reykjavik Energy Graduate School for Sustainable Systems. REYST's inaugural class began studies in August 2008 and graduated its first class on 1 February 2010. In early 2013, the REYST program was reorganized into the Iceland School of Energy to include a new partner, Iceland GeoSurvey (ÍSOR). In addition to the permanent partners, Reykjavik Energy and ÍSOR, ISE has active collaborations with institutions both domestically and internationally including Landsvirkjun, Landsnet, Orkustofnun Arctic Circle (organization), Tufts University's Fletcher School and the GREEN Program.

Keilir Institute of Technology (KIT, Ásbrú)

- Founded: 2007
- Website: <http://www.keilir.net/technology>
- Category: education

Founded in 2007, Keilir Institute of Technology aims to advance energy engineering sciences in Iceland and to educate and train young people in the field of energy engineering sciences and technology. KIT operates both the School of Energy and Technology and state-of-the-art research laboratories in applied energy engineering.

The program in green energy technology has a strong focus on geothermal energy technology, capitalizing on the extensive expertise of leading Icelandic energy companies in this field. Recognizing that solutions to the energy challenges of the 21st century need to be global, the program also provides a solid background in other forms of renewable energy technology.

University of Iceland

- Founded: 1911
- Website: <http://english.hi.is>
- Category: education

The University of Iceland (Háskóli Íslands) is a public research university in Reykjavík, Iceland, and the country's oldest and largest institution of higher education. Founded in 1911, it has grown steadily from a small civil servants' school to a modern comprehensive university, providing instruction for about 14,000 students in twenty-five facilities. Teaching and research is conducted within social sciences, humanities, medicine, natural sciences, engineering, and teacher education.

The University of Iceland offers the Renewable Energy Graduate Program. The program is open for students within engineering, science and economics of energy resources. The program focuses on hydropower, geothermal energy, electrical power and energy sustainability. The program is a two year MSc program offering six different directions of study within individual faculties: Geothermal Engineering, Hydropower Engineering, Electric Power Engineering, Geothermal Resources (Geology, Geochemistry, Geophysics), Energy Economics, Policy and Sustainability and Environmental Impact and Sustainability.

United Nations University Geothermal Training Program (Jarðhitaskóli Sameinuðþjóðanna)

- Founded: 1979
- Website: <http://www.unuotp.is>
- Category: education

The Geothermal Training Programme of the United Nations University (UNU-GTP) is a postgraduate training programme, aiming at assisting developing countries in capacity building within geothermal exploration and development. The programme consists of six months annual training for practicing professionals from developing and transitional countries with significant geothermal potential. Priority is given to countries where geothermal development is under way, in order to maximize technology transfer. Until today, more than 600 fellows from 59 countries have been trained, thus providing for a valuable network in these countries for the Icelandic Geothermal Sector.

The programme has operated in Iceland since 1979. It is a cooperation between the United Nations University and the Government of Iceland and is hosted by the National Energy Authority (Orkustofnun). The objective of the UNU-GTP is to provide university graduates intensive on-the-job training on geothermal utilisation. The trainees work side by side with Icelandic geothermal professionals. The aim is to assist developing countries with significant geothermal potential in building professional competences in geothermal exploration and development. More recently, the UNU-GTP also offers a few successful candidates the possibility of extending their studies to MSc or PhD degrees in geothermal sciences or engineering in cooperation with the University of Iceland.

Non-Profit

Geothermal Research Group (GEORG)

- Founded: 2009
- Website: <http://georg.hi.is>
- Category: R&D, education

The international Geothermal Research Group (GEORG) was founded with the aim of enhancing research of geothermal resources and their sustainable development. Geothermal has the potential of playing a significant role in reducing the world dependence on carbon-based energy sources, and increase significantly the number of qualified experts in geothermal research, engineering, design and technical exploitation of the resource in Iceland. This has been achieved with awarding grants to 22 research projects on geothermal as well as supporting numerous masters and PhD students in their research and awarded 49 students travel grant to attend international geothermal events.

GEORG plans to achieve its ambitious objectives by increasing substantially research, education and distribution of knowledge in the field of geothermal energy resources and their sustainable utilization,

and to create an innovative way for education organizations, research institutions, companies and other stakeholders to work together.

GEORG is the founder and owner of the business accelerator program Start-up Energy Reykjavik (SER) together with Landsvirkjun, Arion bank and Innovation centre Iceland. Moreover, Georg is a shareholder in the start-ups that have been funded through the program through “SER eignarhaldsfélag ehf”, in total 14 start-ups have been funded through the accelerator.

Together with Orkustofnun, GEORG initiated the Geothermal ERA NET in May 2012 bringing together 8 European administrative bodies in geothermal development; the Netherlands, France, Switzerland, Germany, Italy, Hungary, Turkey, Slovakia, Slovenia and the Azores (Portugal). The project is supported by the EU's Seventh Framework program. One of the projects outcomes is to develop a geothermal information platform: www.geothermaleranet.is

GEORG also facilitates international research cooperation with the focus on creating consortiums receiving funding from the EU's Horizon 2020. One of these projects is the DEEPEGS (Deployment of deep enhanced geothermal systems for sustainable energy business), which received a EUR 20 million grant. The project's consortium consists of HS Orka, ISOR, Landsvirkjun, GEORG, BRGM France, Fonroche Geothermie France, Statoil Norway, Herrenknecht Vertical Germany, ENEL Green Power Italy and the Technical University of Karlsruhe Germany. The project's objective is to demonstrate in real environment the feasibility of enhanced geothermal systems (EGS) for delivering energy from renewable resources in Europe.

Iceland Geothermal Cluster

- Founded/ established: 2013
- Website: <http://www.icelandgeothermal.is>
- Category: education

Iceland Geothermal is a non-profit organisation that was established in February 2013. IG is an industry driven cluster cooperation partnership, which focuses on the field of geothermal energy. The Iceland Geothermal Cluster Initiative was founded by 43 diverse members, including; companies, associations and institutions.